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ENDF/B-VIII versus ENDF/B-VII: What's Different?

Dermott E. Cullen

National Nuclear Data Center, BNL, alumnus
Nuclear Data Section, IAEA, Vienna, alumnus
University of California, LLNL, retired

1466 Hudson Way
Livermore, CA 94550

E.Mail: RedCullen1@comcast.net
Website: <http://home.comcast.net/~redcullen1>

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Nuclear Data Section
International Atomic Energy Agency
Vienna International Centre
PO Box 100
1400 Vienna
Austria

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ABSTRACT

Recently the new ENDF/B-VIII library was released; this completely replaces the earlier ENDF/B-VII library. One of the first questions we ask about a new library is: **What's Different?** Here I attempt to at least partially answer this question. I present results in both tabulated form (so you can quickly determine if any evaluations of interest to you have changed), and graphic form (so that you can see how much evaluations have changed and in what energy ranges).

May 2018

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Vienna, April 2018

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Overview

Recently the new ENDF/B-VIII library [1, 2] was released; this completely replaces the earlier ENDF/B-VII library [3]. One of the first questions we ask about a new library is: **What's Different?** Here I attempt to at least partially answer this question. I present results in both tabulated form (so you can quickly determine if any evaluations of interest to you have changed), and graphic form (so that you can see how much evaluations have changed and in what energy ranges).

Here is a quick summary of ENDF/B-VIII and VII

	Evaluations
ENDF/B-VIII	557
ENDF/B-VII	423 (422 as also in VIII)
MF=1 to 6, neutron data different	137
MT=1, total cross section different	70

This report is designed to show the reader where ENDF/B-VIII and VII differ, so that the reader can easily determine if there have been any important changes in evaluations that they are interested in.

For the tables I have compared what I refer to as the ENDF neutron data, namely MF=1 through 6. Here I did a character-by-character comparison of the same sections (MF/MT) of the original data, referred to as ENDF2C, that appear in both ENDF/B-VIII [1] and VII [3]; here I found differences in 137 evaluations.

For the plots I have only compared the total cross sections at room temperature (293.6 K) for all evaluations that are common to both libraries. I found that of the 423 evaluations in ENDF/B-VII, 70 of these have total cross sections that differ by 1% or more from the evaluation of the same isotope in ENDF/B-VIII. Plots of all 70 appear later in this report.

WARNING: This should be considered only a preliminary comparison; obviously there can be more subtle important differences that do not ~~eaffect ofthe~~ total cross sections. However, my experience is that it is difficult to make any substantial changes in neutron cross sections without ~~effectingimpacting~~ the total cross section.

Below I present plots comparing the total cross section of these 70 isotopes. The plots are only broad overviews of the total cross sections over their entire energy range. If you have interest in more detailed plots for specific evaluations, you can download the POINT2018 [4] and POINT2015 [5] and the PREPRO [6, 7] code that I used to prepare and view the data. This is all I needed to do my comparisons, and is all you should need to do any more detailed comparisons to meet your individual needs.

What I present in the plots is the original ENDF/B-VII.0 and VII.1 data after it has been processed by my PREPRO2018 codes [7]; these codes linearized the data, added the resonance contributions and Doppler broadened to room temperature (293.6 K) the cross sections.

Availability of ENDF/B-VIII Final and POINT2018

ENDF/B-VIII Final [1, 2] data library is now freely available through the National Nuclear Data Center (NNDC), Brookhaven National Laboratory. **POINT2018** [4] and **POINT2015** [5] are FREELY available on-line; see the links listed with references.

Periodic Table

ENDF/B-VII and VIII both span the periodic table of elements from $Z = 1$ to 100, but not all elements are represented. The below table summarizes the number of evaluations included for each elements (Z) in ENDF/B-VII (7) and VIII (8). **0*** indicates no data for this element, e.g., ENDF/B-VIII does not include any data for $Z = 85, 86,$ and 87 .

z	7	8	z	7	8	z	7	8	z	7	8	z	7	8
1	3	3	21	1	1	41	3	3	61	5	10	81	2	3
2	2	2	22	5	5	42	8	9	62	9	11	82	4	5
3	2	2	23	2	3	43	1	2	63	7	7	83	1	2
4	2	2	24	4	5	44	10	11	64	8	9	84	0*	3
5	2	2	25	1	2	45	2	3	65	2	4	85	0*	0*
6	1	2	26	4	5	46	7	9	66	7	11	86	0*	0*
7	2	2	27	3	3	47	4	12	67	2	2	87	0*	0*
8	2	3	28	6	7	48	9	11	68	6	9	88	4	4
9	1	1	29	2	3	49	2	3	69	3	4	89	3	3
10	0*	3	30	6	7	50	14	15	70	0*	9	90	8	8
11	2	2	31	2	3	51	5	6	71	2	2	91	5	5
12	3	3	32	5	7	52	11	15	72	6	9	92	12	12
13	1	2	33	2	3	53	5	10	73	3	3	93	6	7
14	3	5	34	7	9	54	12	14	74	5	7	94	10	11
15	1	1	35	2	3	55	5	5	75	2	3	95	7	7
16	4	5	36	7	9	56	9	11	76	0*	9	96	11	11
17	2	3	37	3	3	57	3	3	77	2	4	97	6	6
18	3	6	38	6	7	58	8	10	78	0*	9	98	8	9
19	3	3	39	3	3	59	3	3	79	1	1	99	6	6
20	6	9	40	7	7	60	8	9	80	7	10	100	1	1

What's New and Old: ENDF/B-VIII vs. VII

ENDF/B-VIII (POINT2018) includes **557** evaluations, compared to **423** evaluations in ENDF/B-VII (POINT2015). There are **135** new evaluations included in VIII which were not included in VII. **422** of the **423** evaluations from VII are included in VIII; the only one not included is **6-C-Nat**, which has been replaced by its isotopes. Note, that with **6-C-Nat** replaced by its isotopes, **VIII does not include any elemental mixtures**.

135 New Evaluations in POINT2018 (ENDF/B-VIII)

Neutron	18-Ar-41	33-As-73	47-Ag-112	52-Te-131	61-Pm-143	68-Er-163	72-Hf-181	77-Ir-192	81-Tl-204
6-C -12	20-Ca-41	34-Se-75	47-Ag-113	52-Te-131m	61-Pm-144	68-Er-165	72-Hf-182	77-Ir-194m	82-Pb-205
6-C -13	20-Ca-45	34-Se-81	47-Ag-114	53-I -128	61-Pm-145	68-Er-169	74-W -181	78-Pt-190	83-Bi-210m
8-O -18	20-Ca-47	35-Br-80	47-Ag-115	53-I -132	61-Pm-146	69-Tm-171	74-W -185	78-Pt-191	84-Po-208
10-Ne-20	23-V -49	36-Kr-79	47-Ag-116	53-I -132m	61-Pm-150	70-Yb-168	75-Re-186m	78-Pt-192	84-Po-209
10-Ne-21	24-Cr-51	36-Kr-81	47-Ag-117	53-I -133	62-Sm-145	70-Yb-169	76-Os-184	78-Pt-193	84-Po-210
10-Ne-22	25-Mn-54	38-Sr-85	47-Ag-118m	53-I -134	62-Sm-146	70-Yb-170	76-Os-185	78-Pt-194	93-Np-236m
13-Al-26m	26-Fe-55	42-Mo-93	48-Cd-107	54-Xe-125	64-Gd-159	70-Yb-171	76-Os-186	78-Pt-195	94-Pu-245
14-Si-31	28-Ni-63	43-Tc-98	48-Cd-109	54-Xe-127	65-Tb-158	70-Yb-172	76-Os-187	78-Pt-196	98-Cf-247
14-Si-32	29-Cu-64	44-Ru-97	49-In-114	56-Ba-131	65-Tb-161	70-Yb-173	76-Os-188	78-Pt-197	
16-S -35	30-Zn-69	45-Rh-104	50-Sn-121m	56-Ba-139	66-Dy-154	70-Yb-174	76-Os-189	78-Pt-198	
17-Cl-36	31-Ga-70	46-Pd-103	51-Sb-122	58-Ce-137	66-Dy-155	70-Yb-175	76-Os-190	80-Hg-197	
18-Ar-37	32-Ge-71	46-Pd-109	52-Te-121	58-Ce-137m	66-Dy-157	70-Yb-176	76-Os-191	80-Hg-197m	
18-Ar-39	32-Ge-75	47-Ag-108	52-Te-121m	60-Nd-149	66-Dy-159	72-Hf-175	76-Os-192	80-Hg-203	

423 Evaluations in POINT2015 (ENDF/B-VII)
(422 in VIII; 6-C-Nat is NOT included in VIII)

1-H -1	20-Ca-44	32-Ge-74	42-Mo-92	49-In-115	54-Xe-131	61-Pm-147	68-Er-166	88-Ra-224	94-Pu-242
1-H -2	20-Ca-46	32-Ge-76	42-Mo-94	50-Sn-112	54-Xe-132	61-Pm-148	68-Er-167	88-Ra-225	94-Pu-243
1-H -3	20-Ca-48	33-As-74	42-Mo-95	50-Sn-113	54-Xe-133	61-Pm-148m	68-Er-168	88-Ra-226	94-Pu-244
2-He-3	21-Sc-45	33-As-75	42-Mo-96	50-Sn-114	54-Xe-134	61-Pm-149	68-Er-170	89-Ac-225	94-Pu-246
2-He-4	22-Ti-46	34-Se-74	42-Mo-97	50-Sn-115	54-Xe-135	61-Pm-151	69-Tm-168	89-Ac-226	95-Am-240
3-Li-6	22-Ti-47	34-Se-76	42-Mo-98	50-Sn-116	54-Xe-136	62-Sm-144	69-Tm-169	89-Ac-227	95-Am-241
3-Li-7	22-Ti-48	34-Se-77	42-Mo-99	50-Sn-117	55-Cs-133	62-Sm-147	69-Tm-170	90-Th-227	95-Am-242
4-Be-7	22-Ti-49	34-Se-78	42-Mo-100	50-Sn-118	55-Cs-134	62-Sm-148	71-Lu-175	90-Th-228	95-Am-242m
4-Be-9	22-Ti-50	34-Se-79	43-Tc-99	50-Sn-119	55-Cs-135	62-Sm-149	71-Lu-176	90-Th-229	95-Am-243
5-B -10	23-V -50	34-Se-80	44-Ru-96	50-Sn-120	55-Cs-136	62-Sm-150	72-Hf-174	90-Th-230	95-Am-244
5-B -11	23-V -51	34-Se-82	44-Ru-98	50-Sn-122	55-Cs-137	62-Sm-151	72-Hf-176	90-Th-231	95-Am-244m
6-C -Nat	24-Cr-50	35-Br-79	44-Ru-99	50-Sn-123	56-Ba-130	62-Sm-152	72-Hf-177	90-Th-232	96-Cm-240
7-N -14	24-Cr-52	35-Br-81	44-Ru-100	50-Sn-124	56-Ba-132	62-Sm-153	72-Hf-178	90-Th-233	96-Cm-241
7-N -15	24-Cr-53	36-Kr-78	44-Ru-101	50-Sn-125	56-Ba-133	62-Sm-154	72-Hf-179	90-Th-234	96-Cm-242
8-O -16	24-Cr-54	36-Kr-80	44-Ru-102	50-Sn-126	56-Ba-134	63-Eu-151	72-Hf-180	91-Pa-229	96-Cm-243
8-O -17	25-Mn-55	36-Kr-82	44-Ru-103	51-Sb-121	56-Ba-135	63-Eu-152	73-Ta-180	91-Pa-230	96-Cm-244
9-F -19	26-Fe-54	36-Kr-83	44-Ru-104	51-Sb-123	56-Ba-136	63-Eu-153	73-Ta-181	91-Pa-231	96-Cm-245
11-Na-22	26-Fe-56	36-Kr-84	44-Ru-105	51-Sb-124	56-Ba-137	63-Eu-154	73-Ta-182	91-Pa-232	96-Cm-246
11-Na-23	26-Fe-57	36-Kr-85	44-Ru-106	51-Sb-125	56-Ba-138	63-Eu-155	74-W -180	91-Pa-233	96-Cm-247
12-Mg-24	26-Fe-58	36-Kr-86	45-Rh-103	51-Sb-126	56-Ba-140	63-Eu-156	74-W -182	92-U -230	96-Cm-248
12-Mg-25	27-Co-58	37-Rb-85	45-Rh-105	52-Te-120	57-La-138	63-Eu-157	74-W -183	92-U -231	96-Cm-249
12-Mg-26	27-Co-58m	37-Rb-86	46-Pd-102	52-Te-122	57-La-139	64-Gd-152	74-W -184	92-U -232	96-Cm-250
13-Al-27	27-Co-59	37-Rb-87	46-Pd-104	52-Te-123	57-La-140	64-Gd-153	74-W -186	92-U -233	97-Bk-245
14-Si-28	28-Ni-58	38-Sr-84	46-Pd-105	52-Te-124	58-Ce-136	64-Gd-154	75-Re-185	92-U -234	97-Bk-246
14-Si-29	28-Ni-59	38-Sr-86	46-Pd-106	52-Te-125	58-Ce-138	64-Gd-155	75-Re-187	92-U -235	97-Bk-247
14-Si-30	28-Ni-60	38-Sr-87	46-Pd-107	52-Te-126	58-Ce-139	64-Gd-156	77-Ir-191	92-U -236	97-Bk-248
15-P -31	28-Ni-61	38-Sr-88	46-Pd-108	52-Te-127m	58-Ce-140	64-Gd-157	77-Ir-193	92-U -237	97-Bk-249
16-S -32	28-Ni-62	38-Sr-89	46-Pd-110	52-Te-128	58-Ce-141	64-Gd-158	79-Au-197	92-U -238	97-Bk-250
16-S -33	28-Ni-64	38-Sr-90	47-Ag-107	52-Te-129m	58-Ce-142	64-Gd-160	80-Hg-196	92-U -239	98-Cf-246
16-S -34	29-Cu-63	39-Y -89	47-Ag-109	52-Te-130	58-Ce-143	65-Tb-159	80-Hg-198	92-U -240	98-Cf-248
16-S -36	29-Cu-65	39-Y -90	47-Ag-110m	52-Te-132	58-Ce-144	65-Tb-160	80-Hg-199	92-U -241	98-Cf-249
17-Cl-35	30-Zn-64	39-Y -91	47-Ag-111	53-I -127	59-Pr-141	66-Dy-156	80-Hg-200	93-Np-234	98-Cf-250
17-Cl-37	30-Zn-65	40-Zr-90	48-Cd-106	53-I -129	59-Pr-142	66-Dy-158	80-Hg-201	93-Np-235	98-Cf-251
18-Ar-36	30-Zn-66	40-Zr-91	48-Cd-108	53-I -130	59-Pr-143	66-Dy-160	80-Hg-202	93-Np-236	98-Cf-252
18-Ar-38	30-Zn-67	40-Zr-92	48-Cd-110	53-I -131	60-Nd-142	66-Dy-161	80-Hg-204	93-Np-237	98-Cf-253
18-Ar-40	30-Zn-68	40-Zr-93	48-Cd-111	53-I -135	60-Nd-143	66-Dy-162	81-Tl-203	93-Np-238	98-Cf-254
19-K -39	30-Zn-70	40-Zr-94	48-Cd-112	54-Xe-123	60-Nd-144	66-Dy-163	81-Tl-205	93-Np-239	99-Es-251
19-K -40	31-Ga-69	40-Zr-95	48-Cd-113	54-Xe-124	60-Nd-145	66-Dy-164	82-Pb-204	94-Pu-236	99-Es-252
19-K -41	31-Ga-71	40-Zr-96	48-Cd-114	54-Xe-126	60-Nd-146	67-Ho-165	82-Pb-206	94-Pu-237	99-Es-253
20-Ca-40	32-Ge-70	41-Nb-93	48-Cd-115m	54-Xe-128	60-Nd-147	67-Ho-166m	82-Pb-207	94-Pu-238	99-Es-254
20-Ca-42	32-Ge-72	41-Nb-94	48-Cd-116	54-Xe-129	60-Nd-148	68-Er-162	82-Pb-208	94-Pu-239	99-Es-254m
20-Ca-43	32-Ge-73	41-Nb-95	49-In-113	54-Xe-130	60-Nd-150	68-Er-164	83-Bi-209	94-Pu-240	99-Es-255
							88-Ra-223	94-Pu-241	100-Fm-255

Detailed Differences

I have compared in more detail the original evaluations, exactly as distributed by the National Nuclear data Center (NNDC), Brookhaven. For this comparison I have not changed the original evaluations except to put them all into standard FORTRAN, C, C++, form; these are what are identified at the on-line POINT libraries as ENDF2C [4, 5].

Of the 423 evaluations in VII, 422 were also included in VIII. I have checked what I will call the “neutron” ENDF files, MF=1 through 6, and major reactions (MT=2, 102, 18, 4 and 16), character by character for differences between the evaluations in VII and VIII. I have found differences in 137 of these evaluations, i.e., the remaining 285 evaluations are character by character identical in both libraries.

The below table summarizes my results. I have only listed results for the 137 evaluations where I found differences. **An “X” in any position indicates that both VII and VIII include the same section (the same MF/MT), but these sections are NOT IDENTICAL in VII and VIII.**

What I have checked and listed in the below table, reading left to right,

- 1) The evaluation identification
- 2) MF=1/MT=452 = total neutrons per fission
- 3) MF=2 = resonance parameters

Beyond this point the organization of the table switches to array results by MT, including MT=2 (elastic), MT=102 (capture), MF=18 (fission), MT=4 (total inelastic), and MT=16 (n,2n). Under each of these 5 reactions I define whether or not I found differences in MF=3 through 6,

3 = cross sections

4 = angular distributions

5 = energy distributions

6 = double differential distributions

For example, if you look at the below table, for 17-Cl-35, you will see that I found differences for resonance parameters (MF=2), tabulated elastic cross sections (MT/MF=2/3), tabulated capture cross sections (MT/MF=102/3) and tabulated total inelastic (MF/MF=4/3). All of the other data is identical in ENDF/B-VII and VIII.

Evaluation MF(3,4,5,6)	MF=1		MF=2				MT=2				MT=102				MT=18				MT=4				MT=16			
	nu	res	3	4	5	6	3	4	5	6	3	4	5	6	3	4	5	6	3	4	5	6	3	4	5	6
1-H -1		X	X	X			X		X																	
1-H -2				X																						
3-Li-6		X	X	X			X								X											
3-Li-7							X								X					X	X					
4-Be-7		X	X	X																						
4-Be-9				X																					X	
5-B -10		X	X	X			X																			
5-B -11				X																						
7-N -15																					X					
8-O -16		X	X	X			X								X										X	
8-O -17							X								X											
11-Na-23				X			X								X											
17-Cl-35		X	X				X								X											
17-Cl-37				X			X								X											
18-Ar-38				X			X								X											
18-Ar-40				X	X		X								X					X						
20-Ca-40		X	X				X																			
21-Sc-45		X	X												X											
24-Cr-54				X			X								X											
26-Fe-54		X	X	X			X								X				X		X		X			
26-Fe-56		X	X	X			X								X				X		X		X			
26-Fe-57		X	X	X			X								X				X		X		X			
26-Fe-58		X	X	X			X								X				X		X		X			
27-Co-58				X			X																			
27-Co-58.M				X			X								X											
27-Co-59				X	X		X								X				X		X					
28-Ni-58				X	X		X								X				X		X		X			
28-Ni-59		X	X	X			X												X		X					
28-Ni-60				X	X		X								X				X		X		X			
28-Ni-61				X	X		X								X				X		X		X			
28-Ni-62				X	X		X								X				X		X		X			
28-Ni-64				X	X		X								X				X		X		X			
29-Cu-63		X	X	X			X								X				X		X		X			
29-Cu-65		X	X	X			X								X				X		X		X			
33-As-74		X	X	X			X		X										X		X		X			
36-Kr-78		X	X	X			X												X		X		X			
38-Sr-88		X																								
40-Zr-90		X	X				X												X		X		X			
40-Zr-91		X	X	X			X		X						X										X	
40-Zr-92		X	X	X			X																			
40-Zr-94		X	X				X																			
40-Zr-95				X			X								X											
40-Zr-96		X	X				X																			
41-Nb-93		X	X				X																			
42-Mo-95				X																						
44-Ru-105				X			X								X											
45-Rh-103		X																								
45-Rh-105		X	X	X			X								X				X		X	X	X			
50-Sn-120				X	X		X								X				X		X					

Evaluation	MF=1	MF=2	MT=2				MT=102				MT=18				MT=4				MT=16				
	MF(3,4,5,6)	nu	res	3	4	5	6	3	4	5	6	3	4	5	6	3	4	5	6	3	4	5	6
50-Sn-122			X	X	X		X								X				X	X	X		
50-Sn-124			X	X	X		X								X				X	X	X		
50-Sn-126			X	X			X								X								
52-Te-132				X	X		X	X							X				X			X	
54-Xe-123				X			X																
54-Xe-124			X	X	X		X												X			X	
54-Xe-135			X																				
58-Ce-136				X											X								
60-Nd-143				X			X								X								
61-Pm-148.M			X																				
62-Sm-144			X	X											X								
63-Eu-153					X			X														X	
63-Eu-154			X																				
64-Gd-152				X											X								
64-Gd-154			X																				
64-Gd-160				X			X								X								
66-Dy-160				X											X								
69-Tm-168							X	X							X								
69-Tm-169															X								
69-Tm-170				X			X								X								
72-Hf-174			X	X	X		X								X				X				
72-Hf-176				X	X		X								X				X				
72-Hf-177				X	X		X								X				X				
72-Hf-178				X	X		X								X				X				
72-Hf-179				X	X		X								X				X				
72-Hf-180				X	X		X								X				X				
73-Ta-180			X	X			X																
73-Ta-181				X																			
74-W -182			X	X			X																
74-W -183			X	X			X																
74-W -184			X	X			X																
74-W -186			X	X			X																
75-Re-185			X	X			X																
75-Re-187			X	X			X																
79-Au-197			X	X			X								X								
81-Tl-203				X			X								X								
82-Pb-204							X								X								
82-Pb-206				X			X								X								
90-Th-232														X									
92-U -230	X			X			X			X					X								
92-U -232	X			X			X			X					X								
92-U -233	X	X	X	X	X		X			X	X	X			X				X			X	
92-U -235	X	X	X	X	X		X			X	X	X			X				X			X	
92-U -238	X	X	X	X	X		X			X	X				X				X			X	
92-U -239	X	X	X	X	X		X			X	X				X				X			X	
92-U -240			X																				
92-U -241	X	X					X			X					X								
93-Np-236	X																						

Evaluation	MF=1		MF=2				MT=2				MT=102				MT=18				MT=4				MT=16			
	MF(3,4,5,6)	nu	res	3	4	5	6	3	4	5	6	3	4	5	6	3	4	5	6	3	4	5	6			
93-Np-238	X																									
94-Pu-239	X	X	X					X				X	X	X						X			X			
94-Pu-240	X	X	X					X				X					X									
94-Pu-243	X	X																								
94-Pu-244	X																									
94-Pu-246	X																									
95-Am-241				X	X			X					X			X				X			X			
95-Am-243		X											X													
95-Am-244					X																					
95-Am-244.M					X																					
96-Cm-241	X																									
96-Cm-242	X																									
96-Cm-243					X																					
96-Cm-244	X																									
96-Cm-246	X																									
96-Cm-247	X			X				X				X				X										
96-Cm-248	X				X																					
96-Cm-249	X																									
96-Cm-250	X																									
97-Bk-245	X																									
97-Bk-246	X																									
97-Bk-247	X																									
97-Bk-248	X																									
97-Bk-249	X																									
97-Bk-250	X																									
98-Cf-246	X																									
98-Cf-248	X																									
98-Cf-249	X																									
98-Cf-250	X																									
98-Cf-251	X																									
98-Cf-252	X																									
98-Cf-253	X																									
98-Cf-254	X																									
99-Es-251	X																									
99-Es-252	X																									
99-Es-253	X																									
99-Es-254	X																									
99-Es-255	X																									
100-Fm-255	X																									

70 Plots of Total with 1% or More Differences

The following plots only present an overview of the difference in the total cross section (MF/MT=3/1) for the 70 cases where I found differences of 1% or more between the ENDF/B-VIII and VII data. For each evaluation there is only one plot covering the entire energy range of each evaluation; for most ENDF/B evaluations this spans the energy range from 10^{-5} eV to 20 MeV, or more.

The 70 plots are grouped 4 per page, for a total of 18 pages; I judged 70 pages of plots to be excessive and larger plots add little additional information. For more detail full sized 70 plots are now available on-line at,

redcullen1.net/HOMEPAGE.NEW/ENDFB-VIII-Diff/ENDF-VIII-Diff.htm

70 Evaluations with 1% or more Total Differences

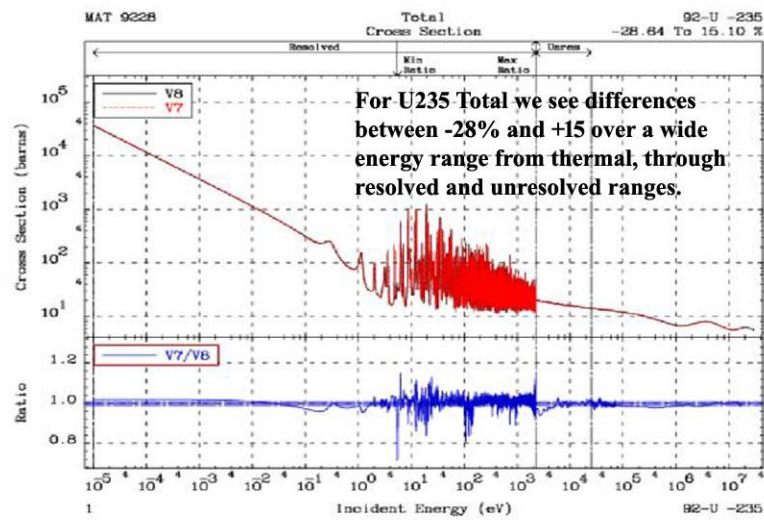
1-H -1	27-Co-58	40-Zr-96	72-Hf-174	79-Au-197
3-Li-6	27-Co-58.M	41-Nb-93	72-Hf-176	82-Pb-206
4-Be-7	27-Co-59	45-Rh-105	72-Hf-177	92-U -232
5-B -10	28-Ni-59	50-Sn-120	72-Hf-178	92-U -233
8-O -16	28-Ni-61	50-Sn-122	72-Hf-179	92-U -235
11-Na-23	29-Cu-63	50-Sn-124	72-Hf-180	92-U -238
18-Ar-38	29-Cu-65	52-Te-132	73-Ta-180	92-U -239
18-Ar-40	33-As-74	54-Xe-123	73-Ta-181	92-U -240
20-Ca-40	36-Kr-78	54-Xe-124	74-W -182	92-U -241
21-Sc-45	38-Sr-88	58-Ce-136	74-W -183	94-Pu-239
26-Fe-54	40-Zr-90	60-Nd-143	74-W -184	94-Pu-240
26-Fe-56	40-Zr-91	61-Pm-148.M	74-W -186	94-Pu-243
26-Fe-57	40-Zr-92	62-Sm-144	75-Re-185	95-Am-241
26-Fe-58	40-Zr-94	63-Eu-154	75-Re-187	95-Am-243

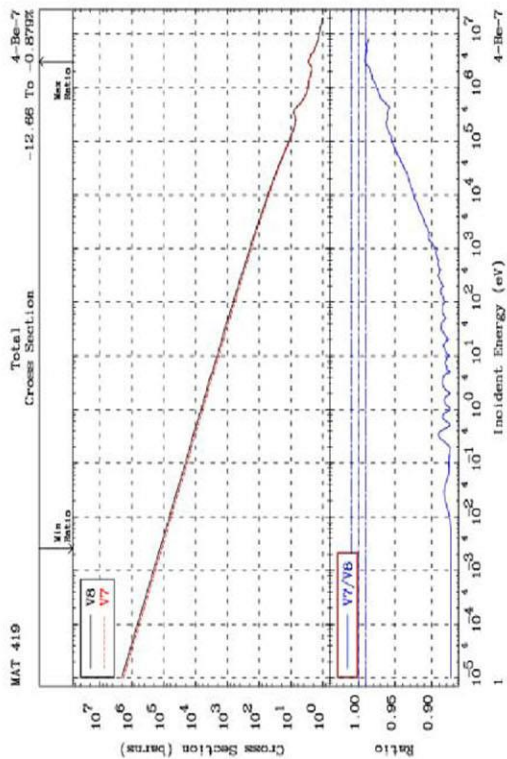
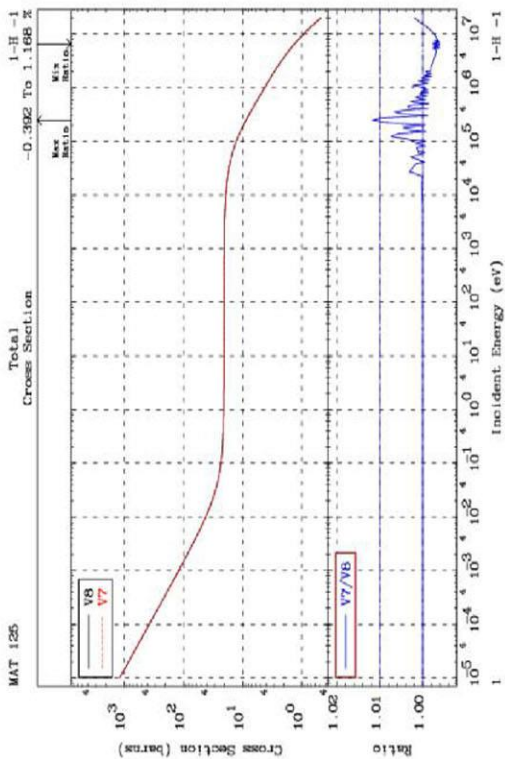
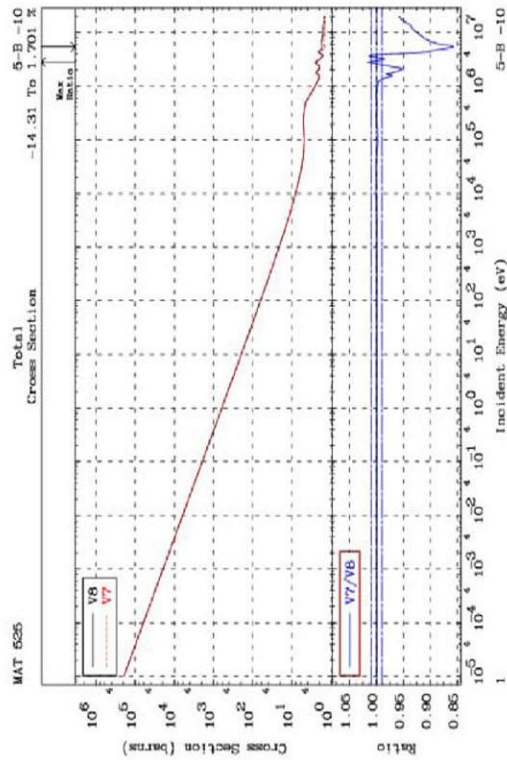
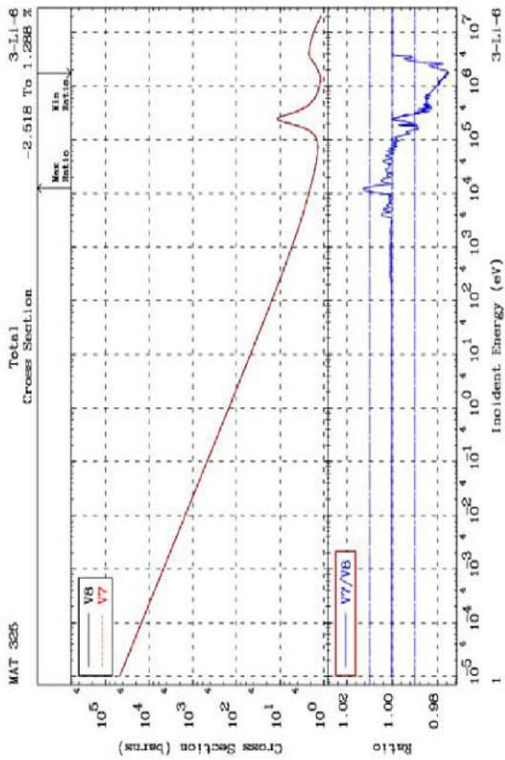
Each plot is divided into the upper two-thirds to show the total cross section for V8 (**black**) and V7 (**red**). The lower third of each plot shows the ratio of the V7 total divided by the V8 total.

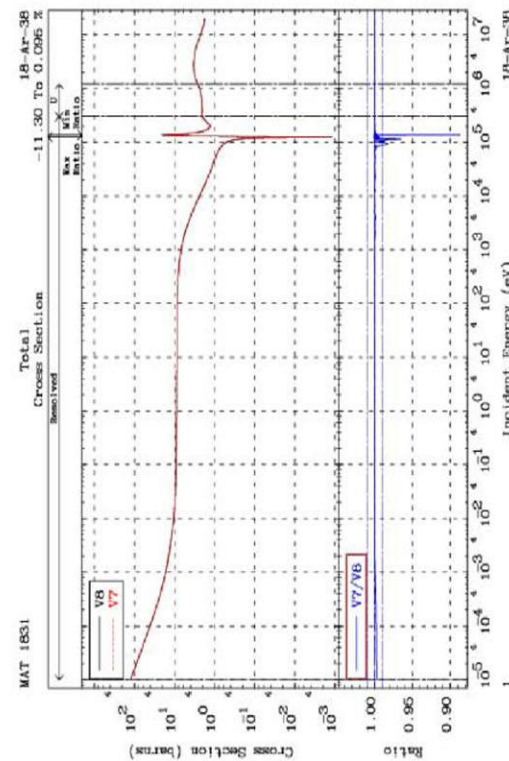
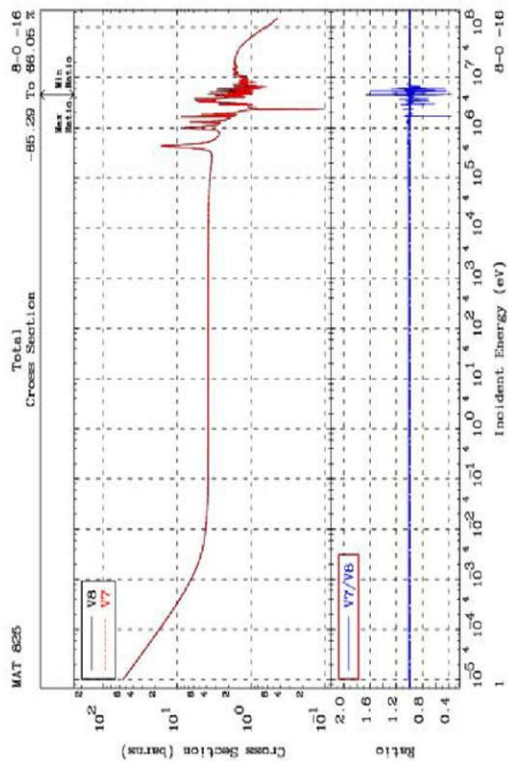
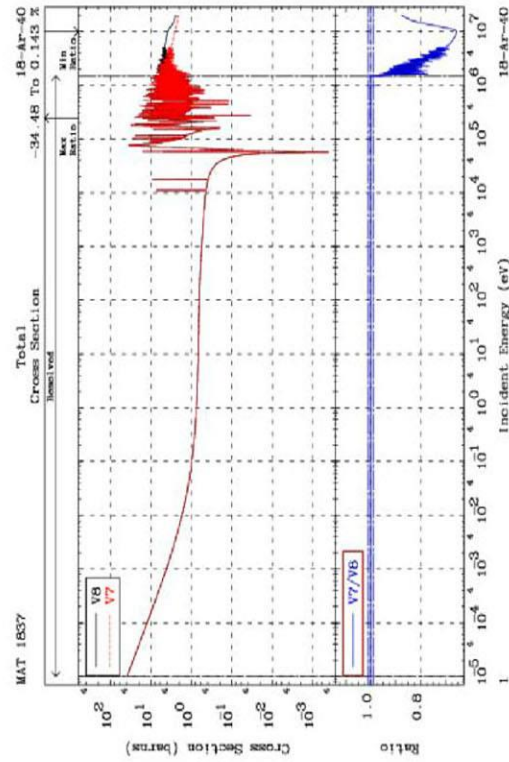
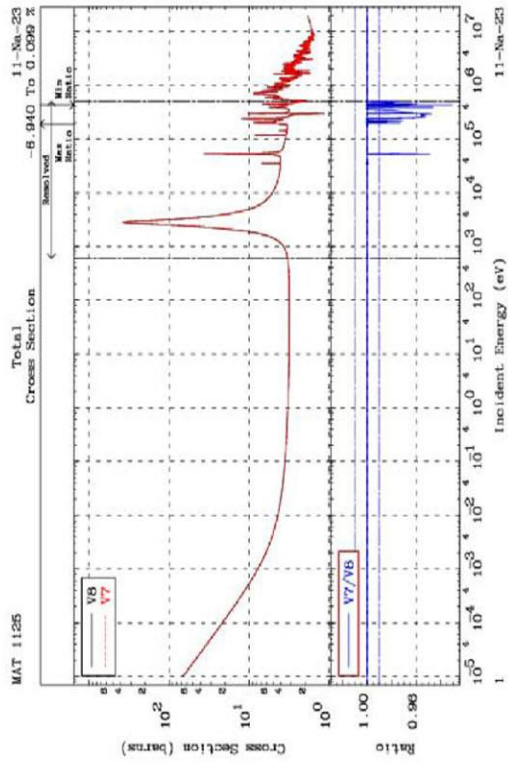
From each plot you can see,

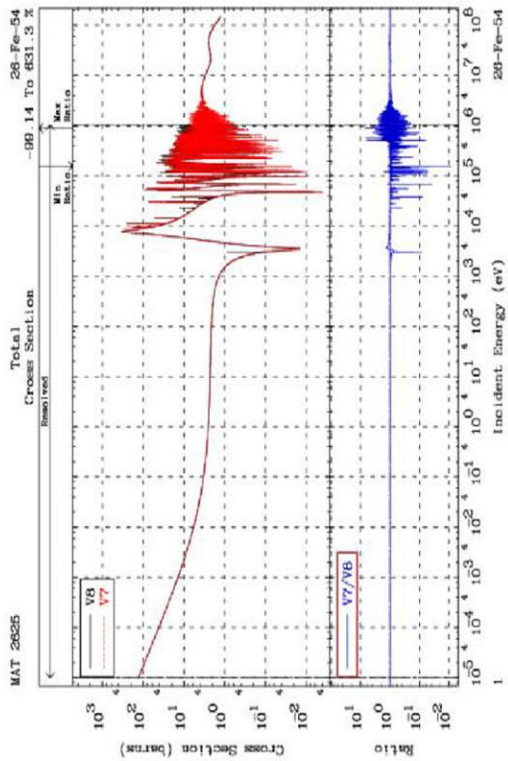
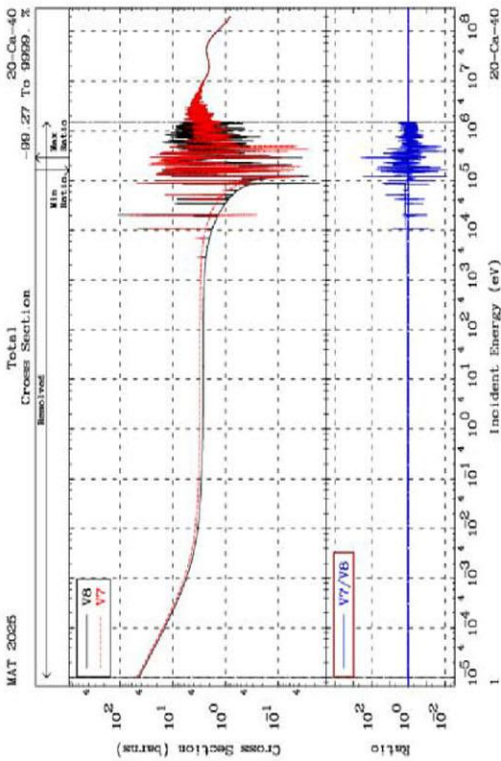
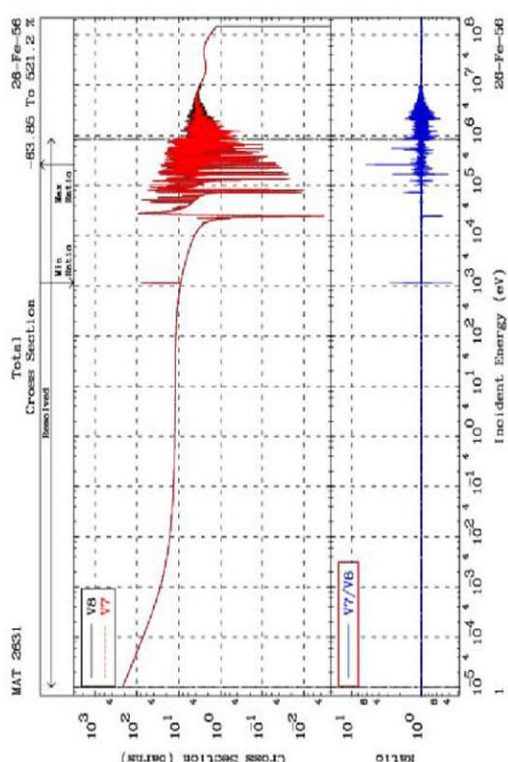
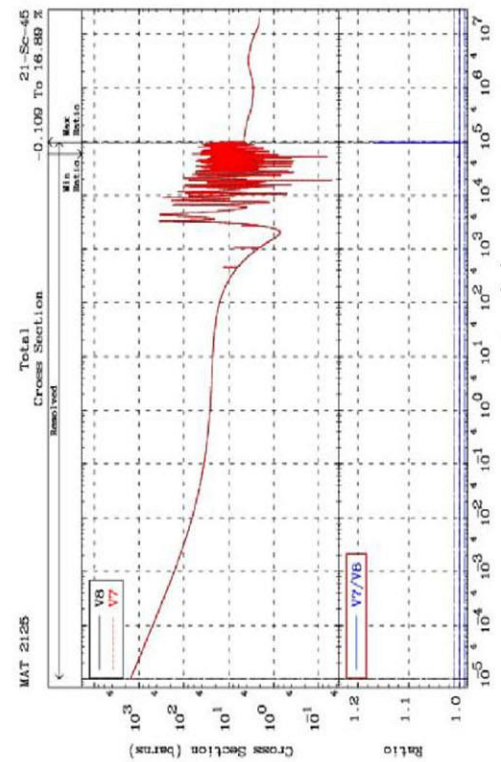
- 1) The isotope identification, in the upper right-hand corner
- 2) Maximum negative and positive % differences, below isotope id
- 3) The energy range of resolved and unresolved energy ranges, if any
- 4) Vertical arrows show the position of maximum differences
- 5) The energy and cross section scales.

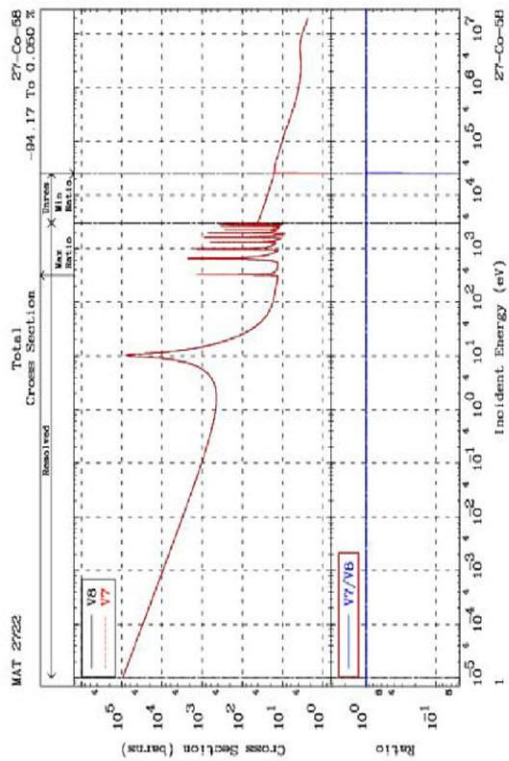
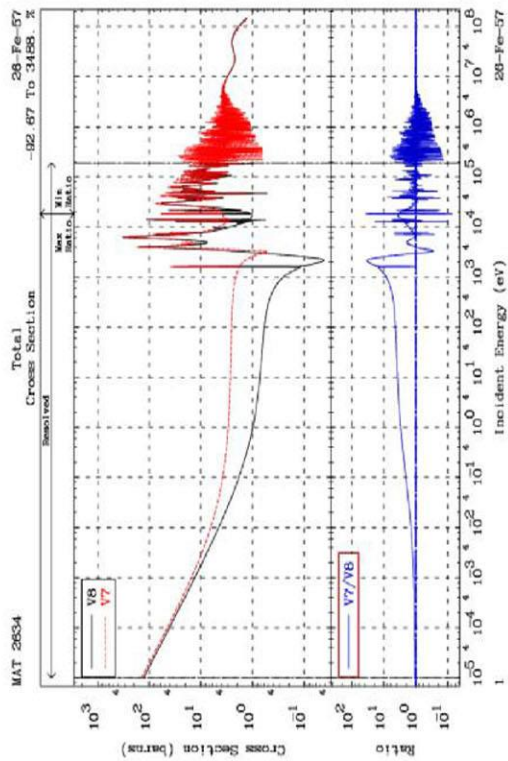
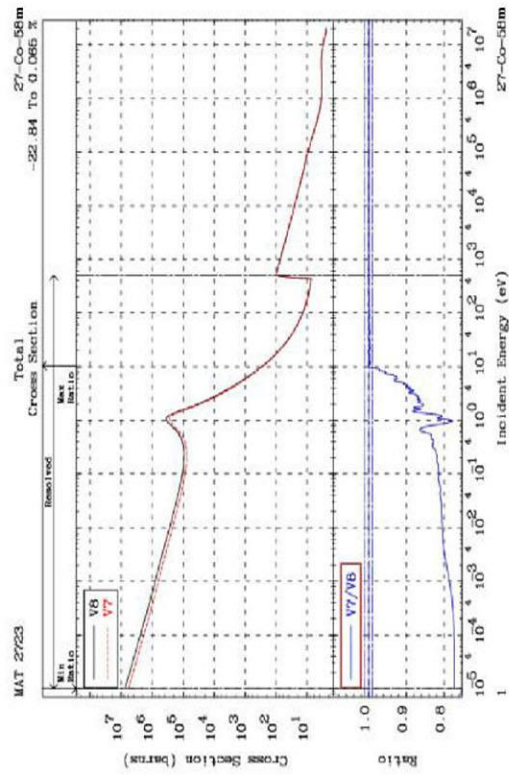
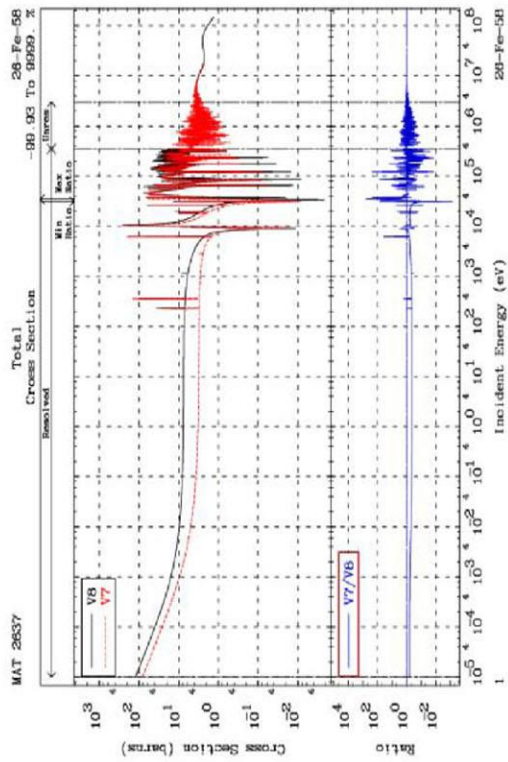
Below is an example to which I added an explanatory comment

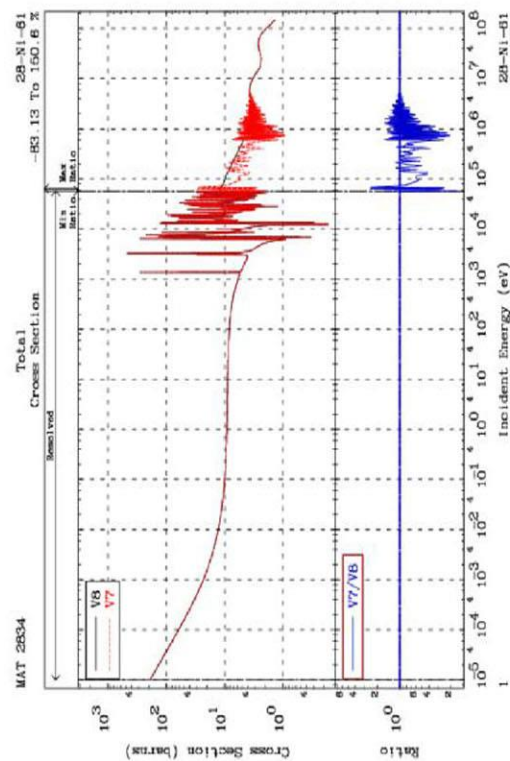
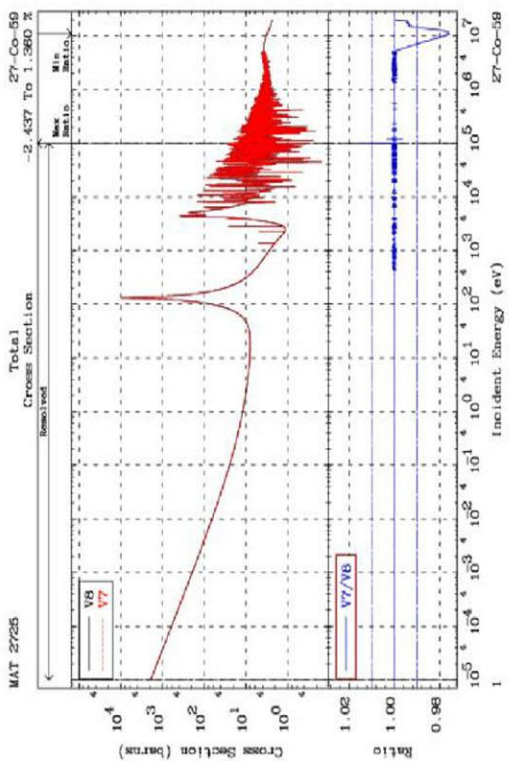
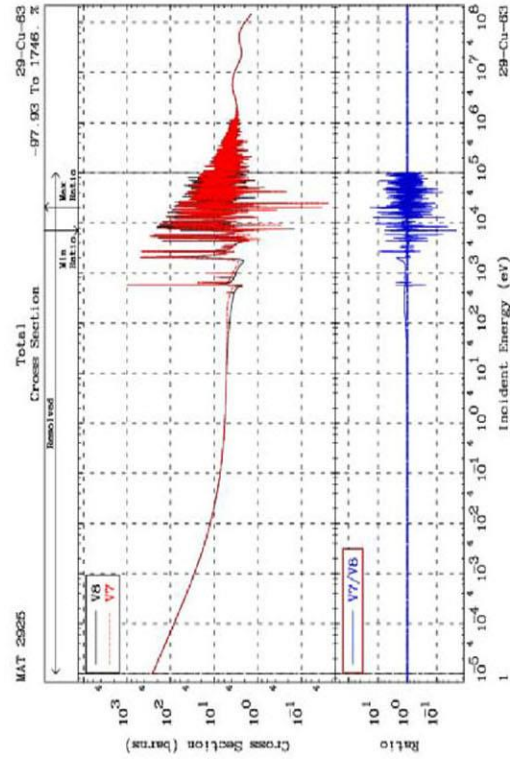
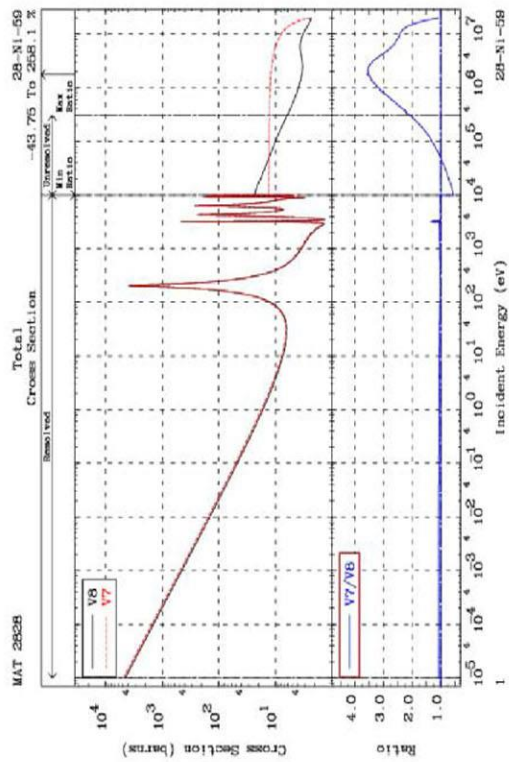


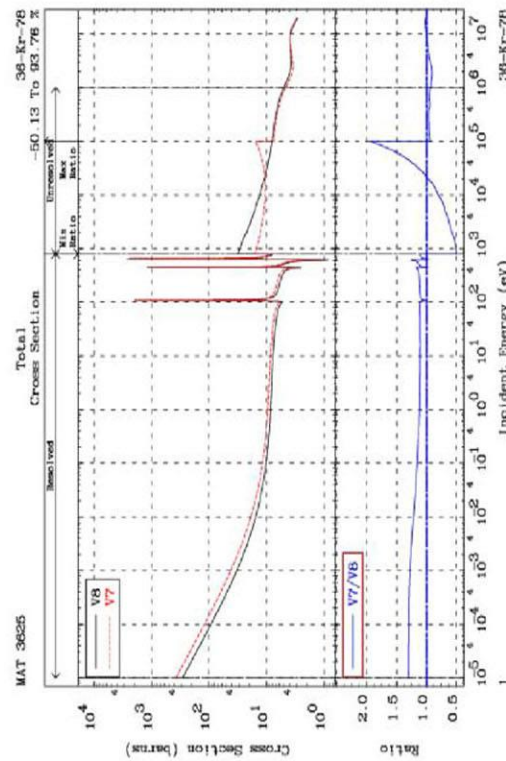
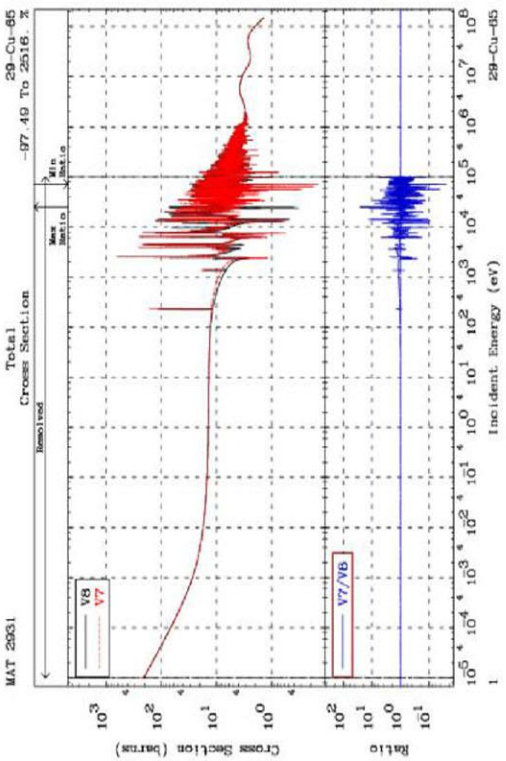
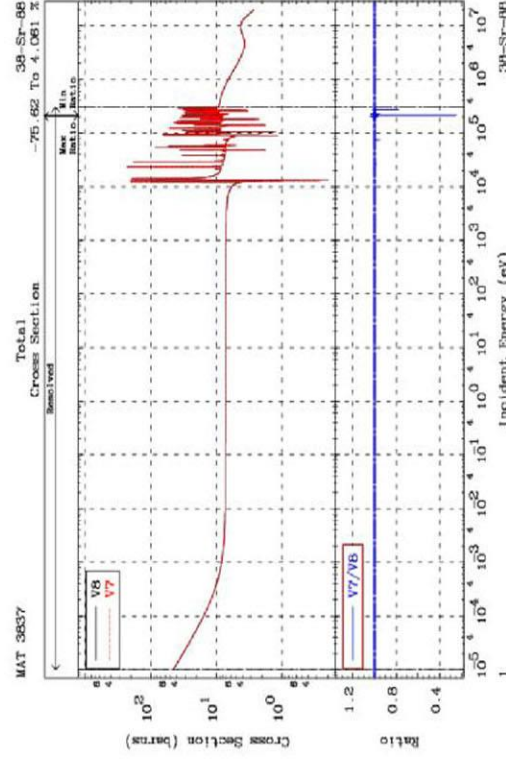
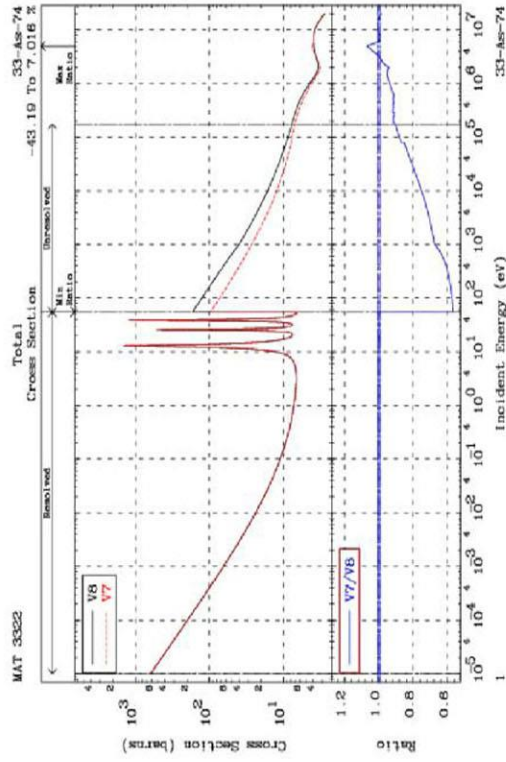


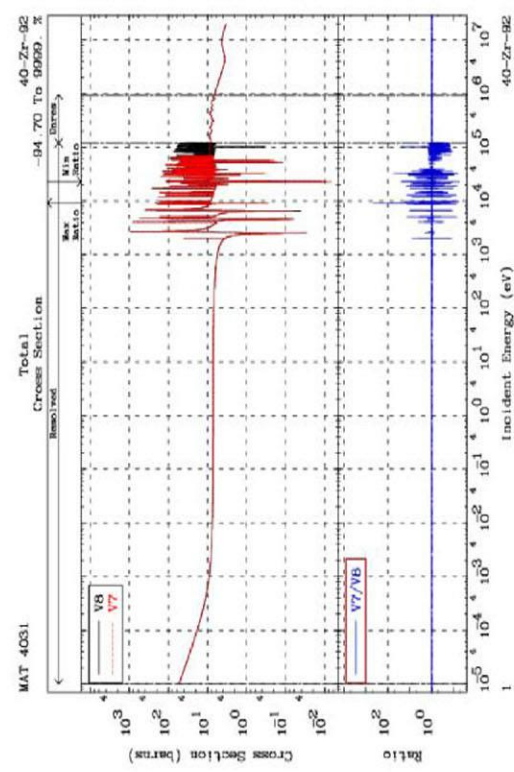
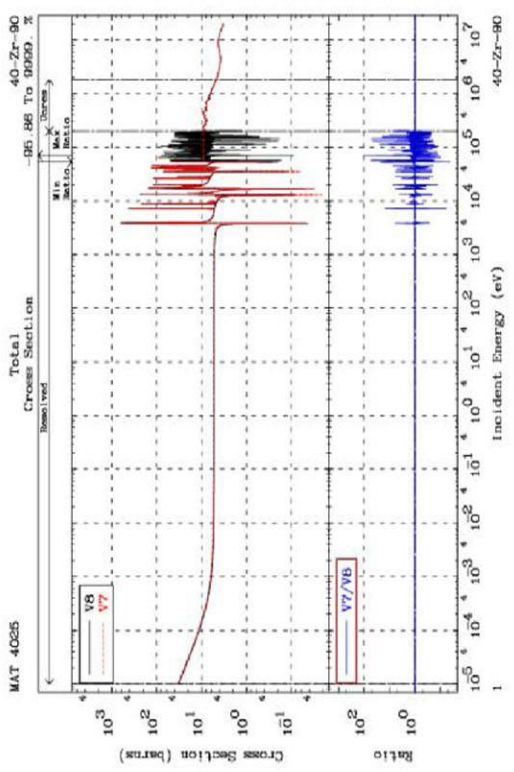
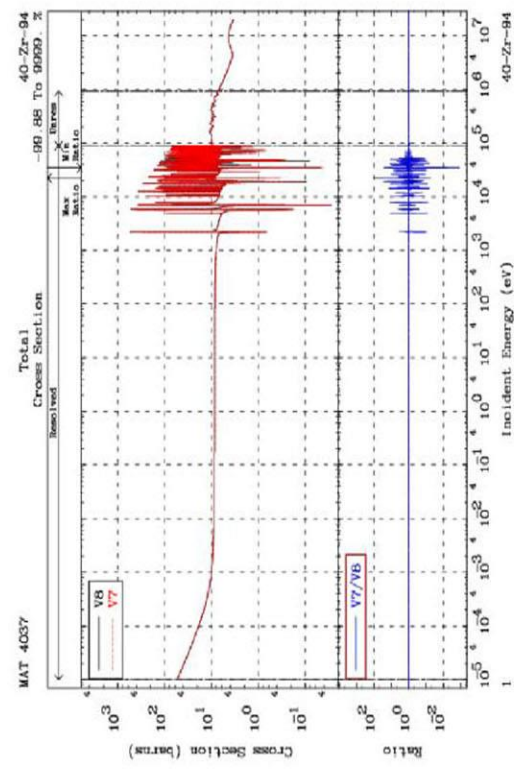
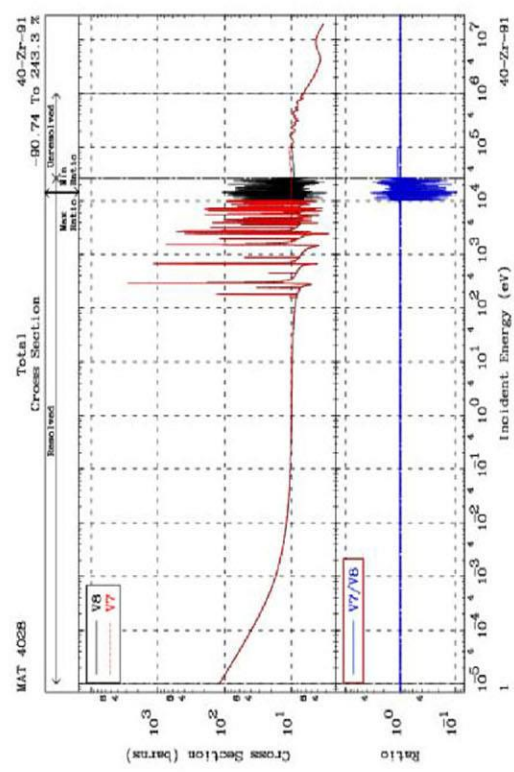


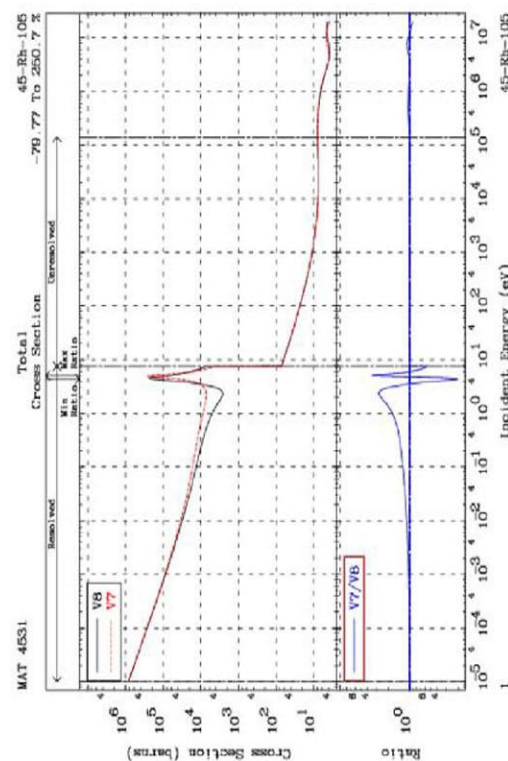
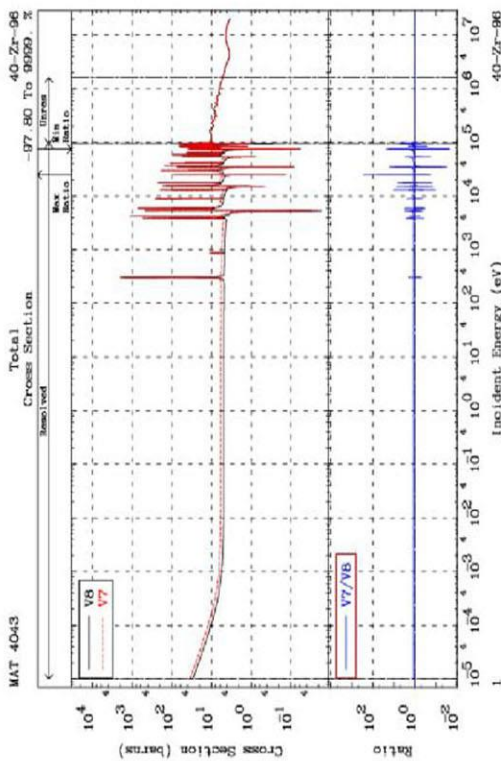
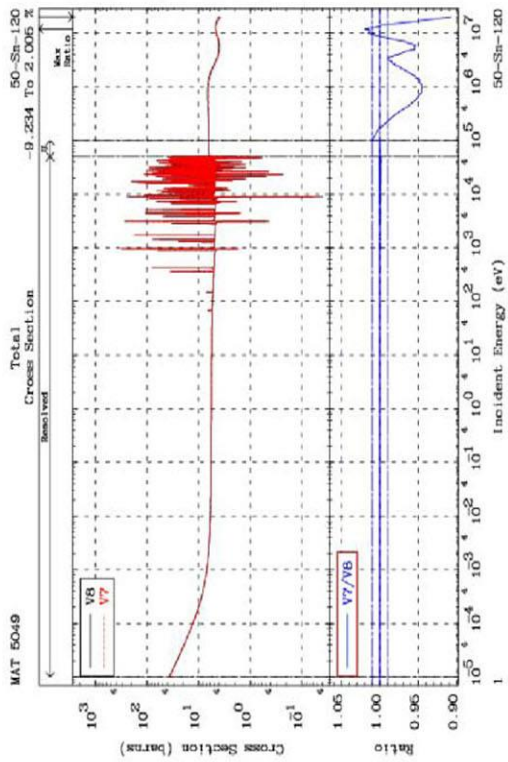
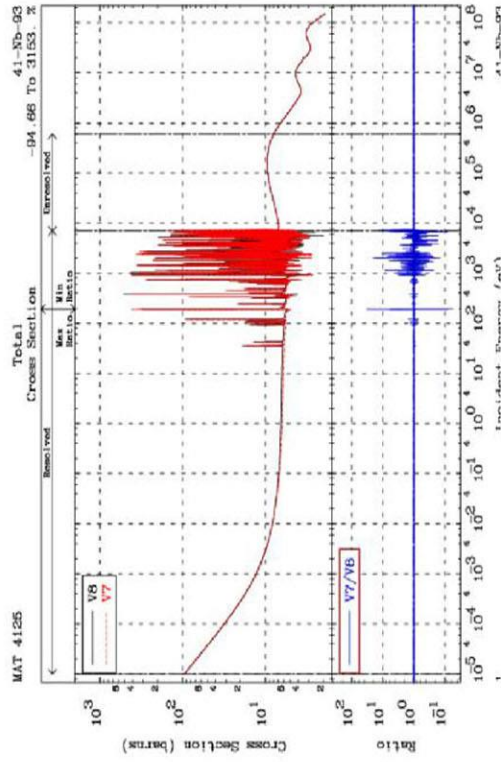


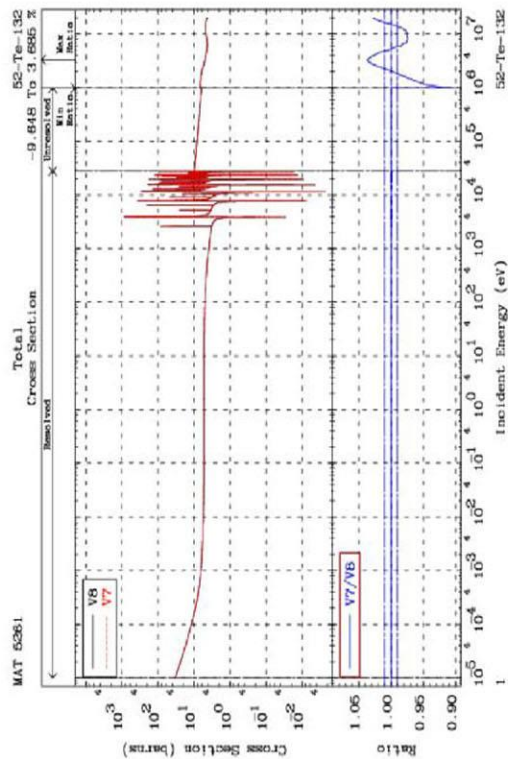
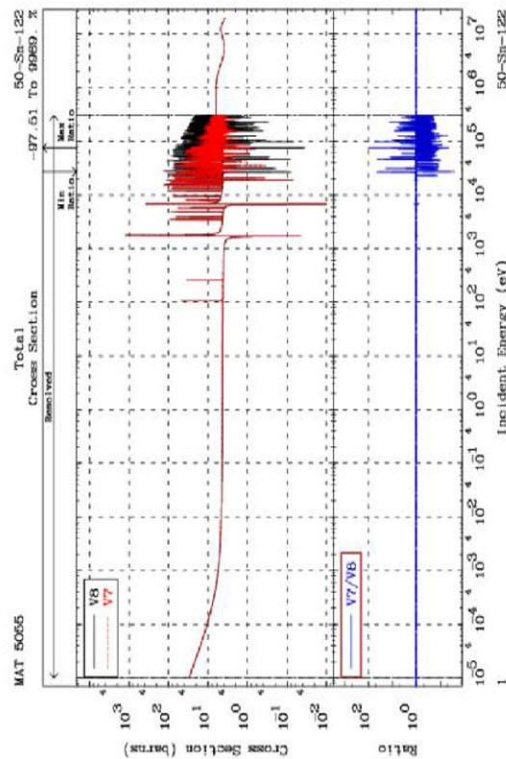
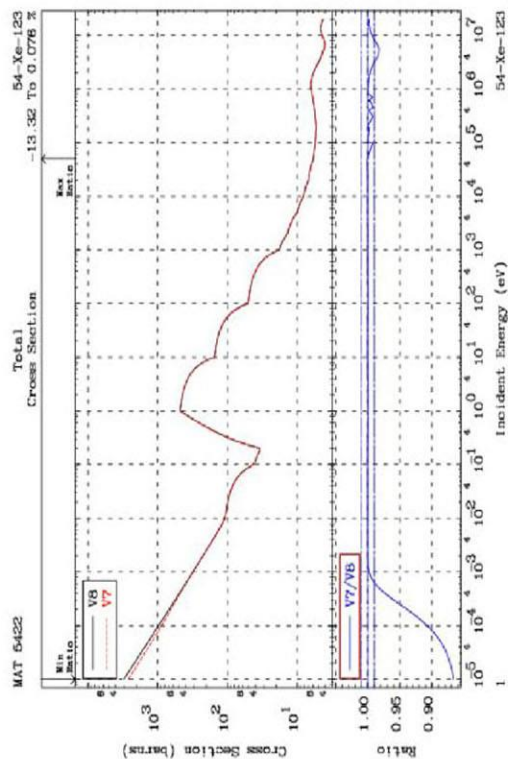
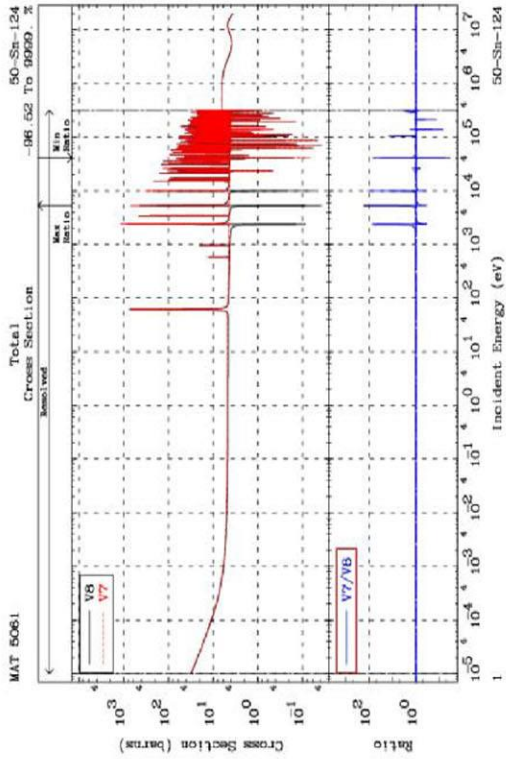


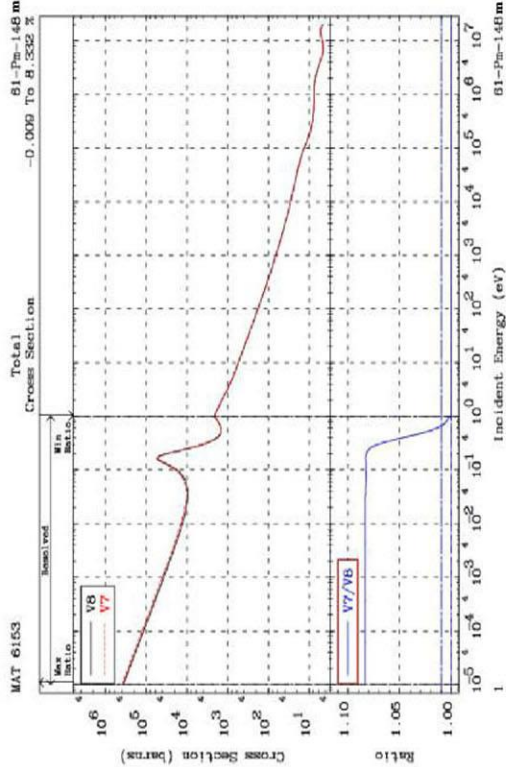
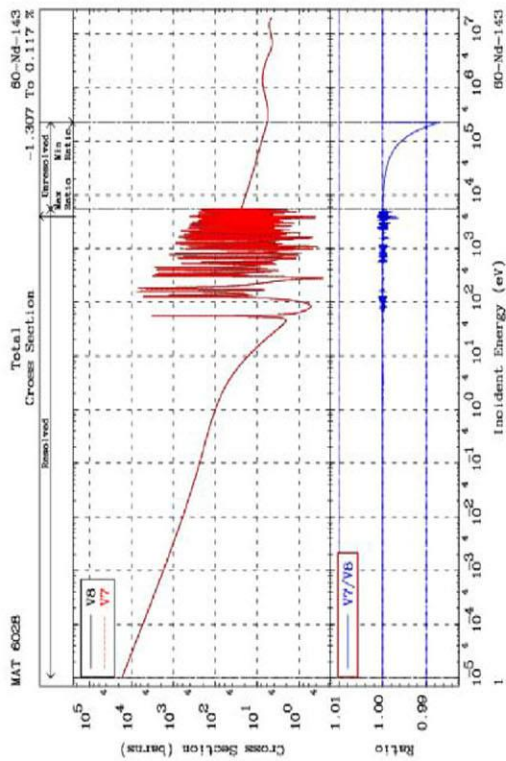
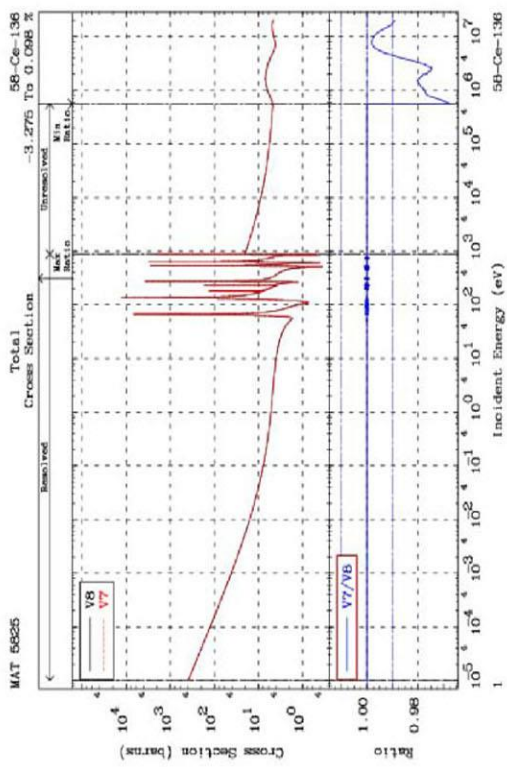
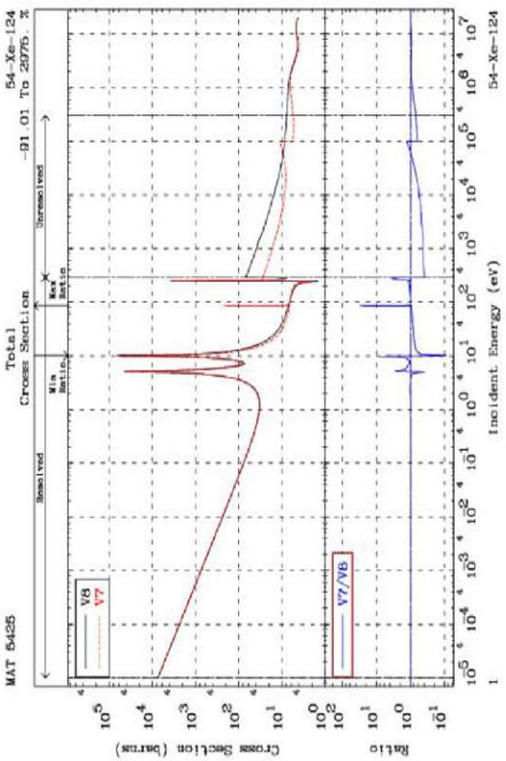


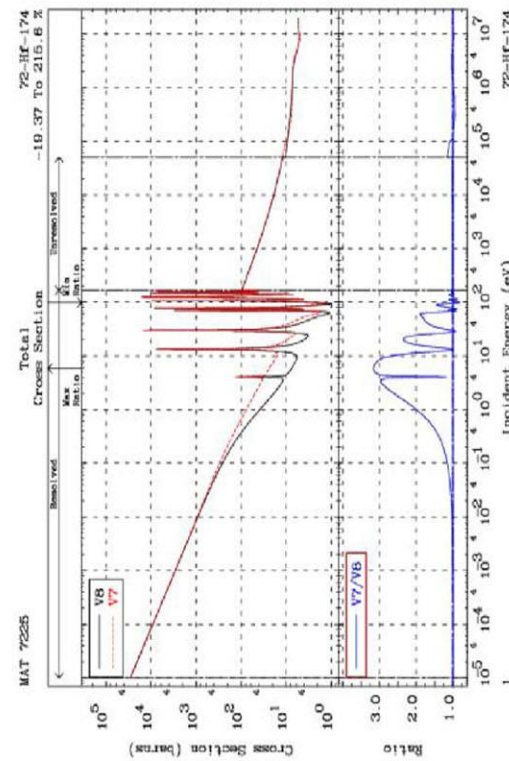
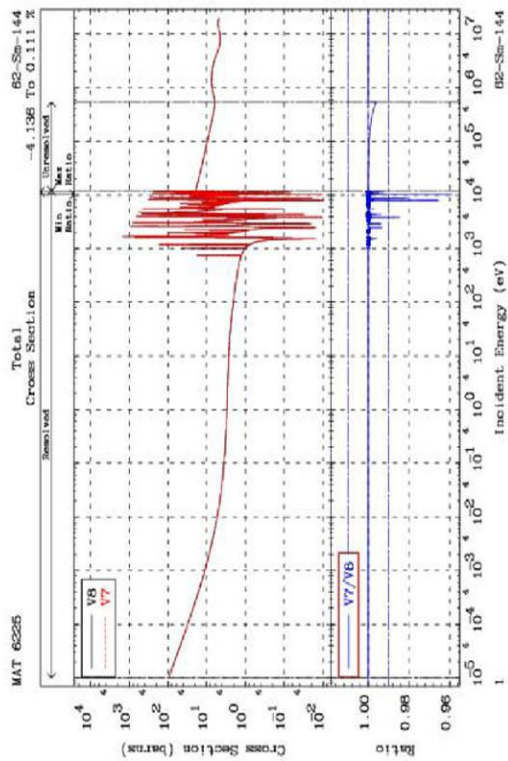
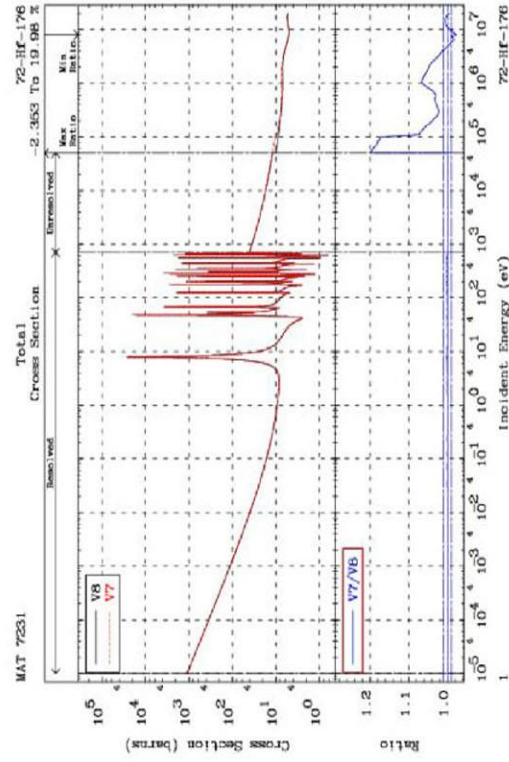
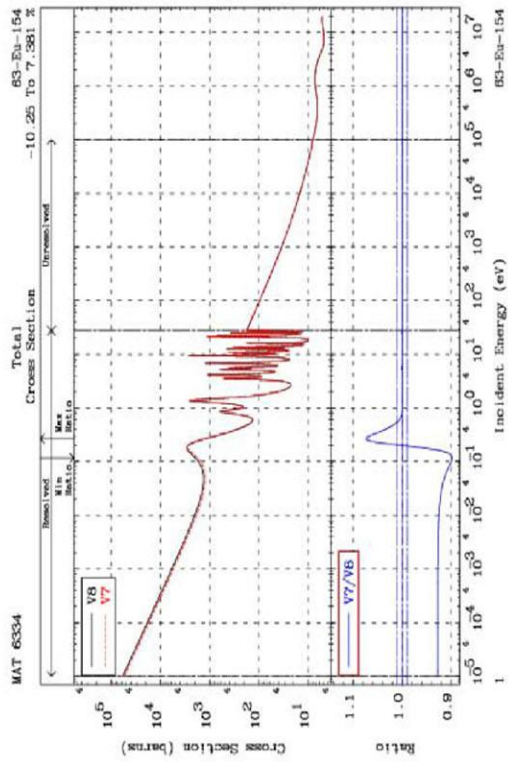


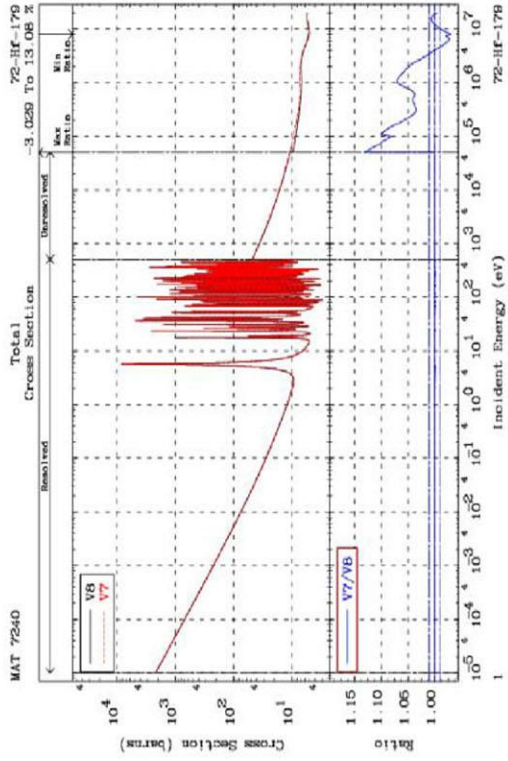
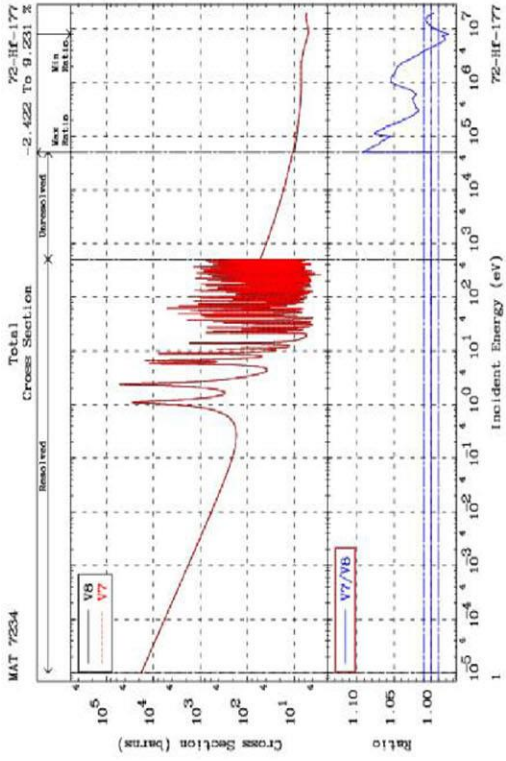
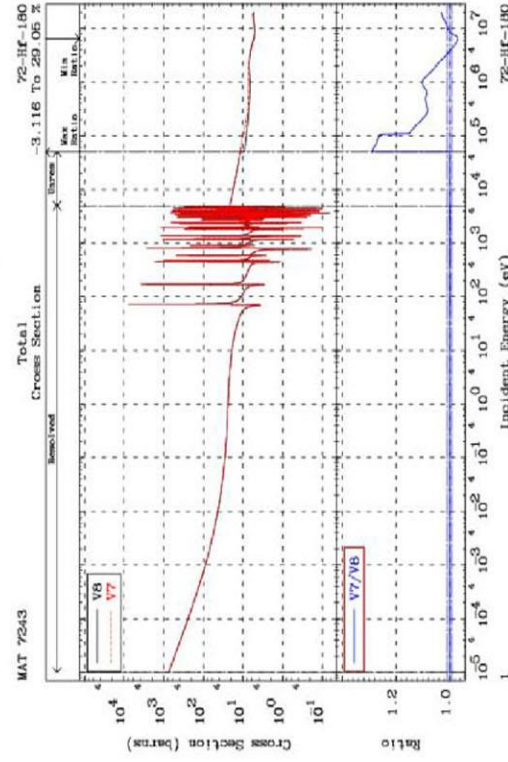
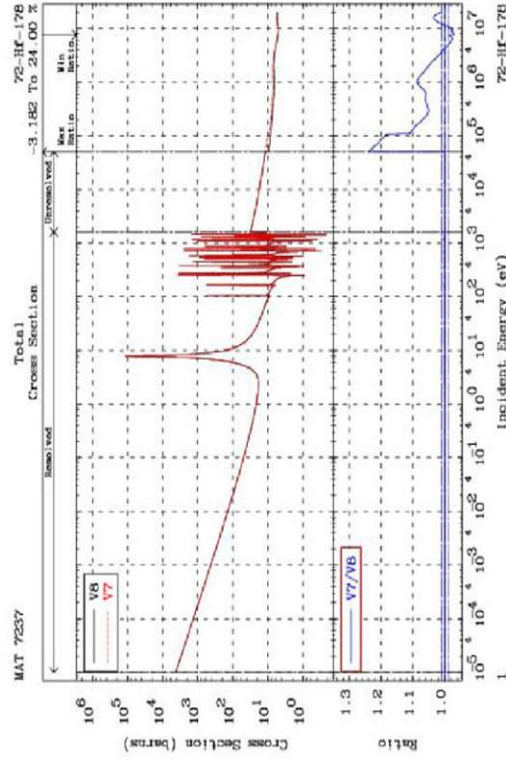


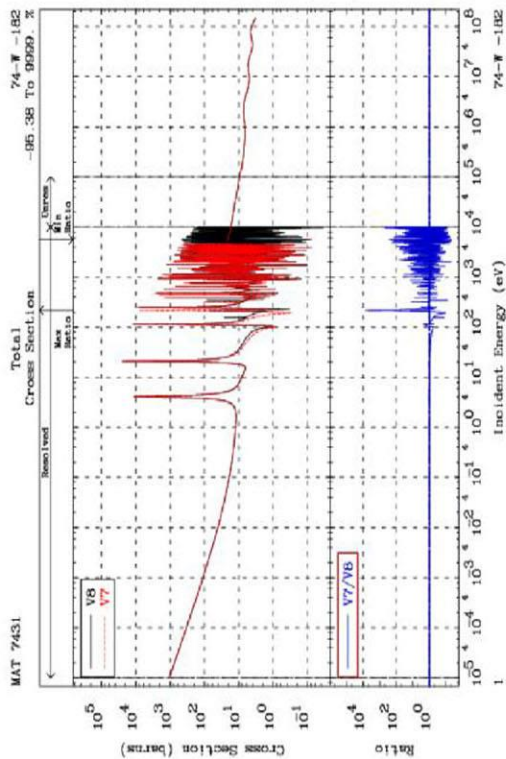
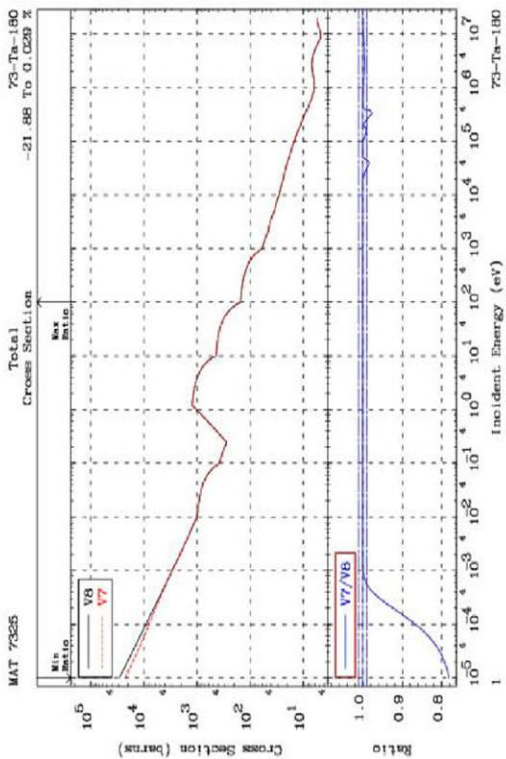
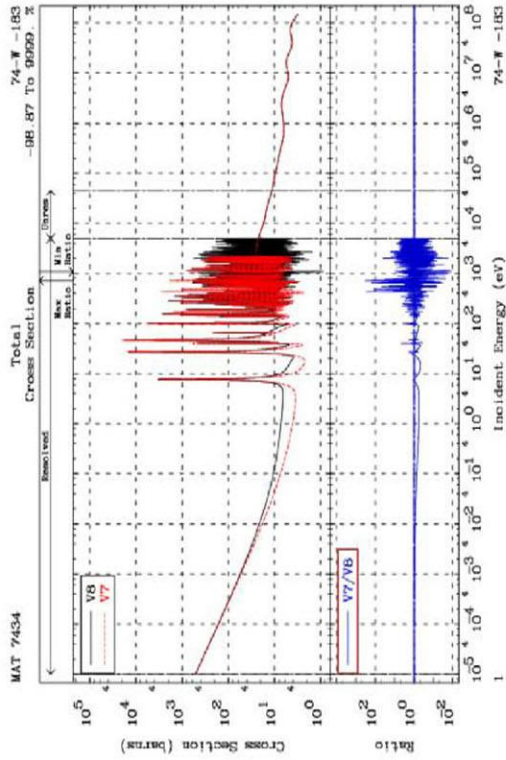
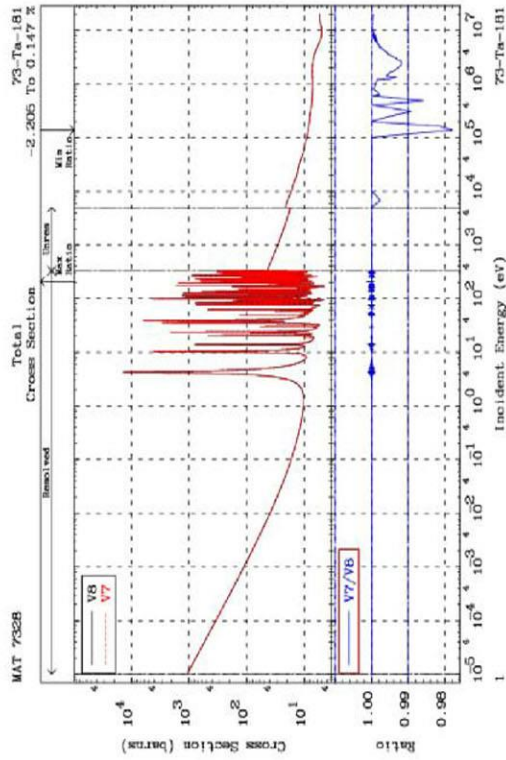


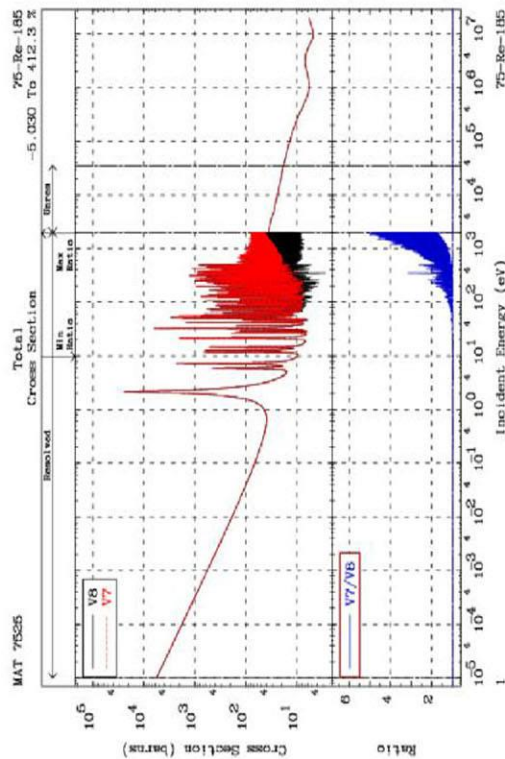
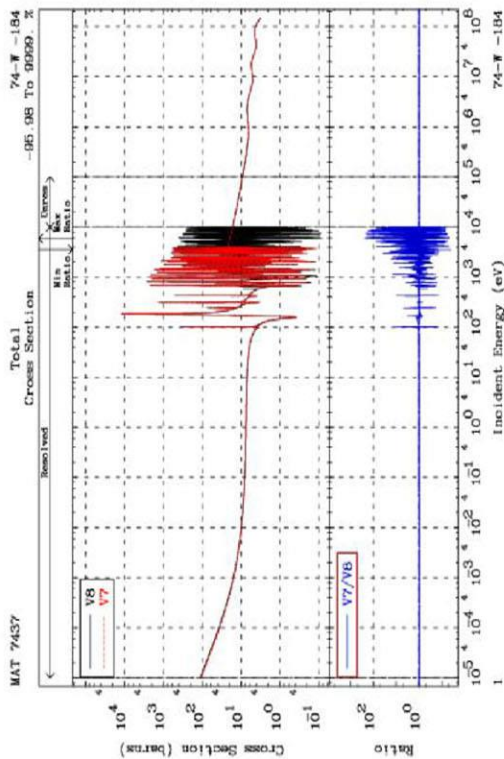
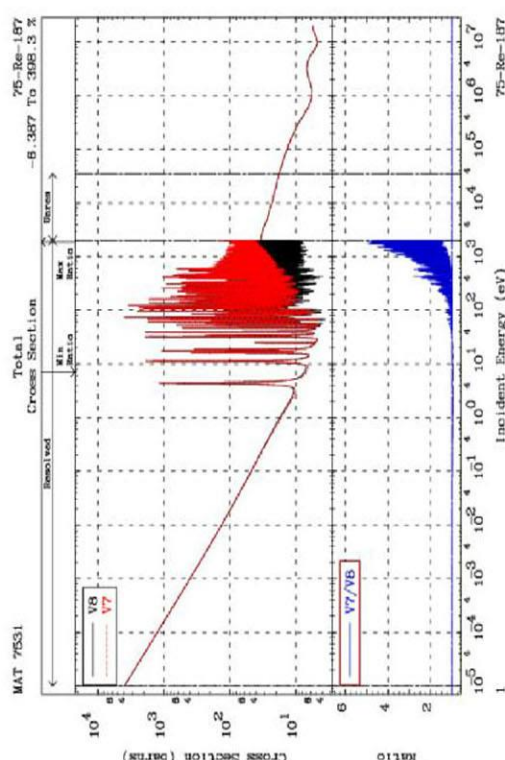
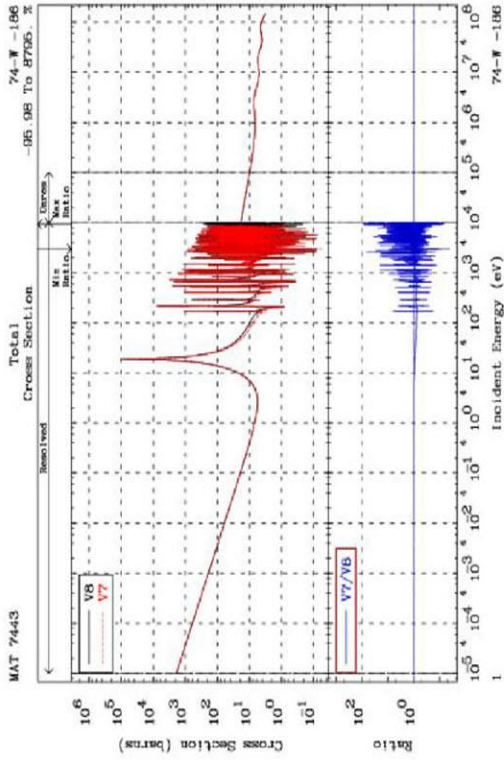


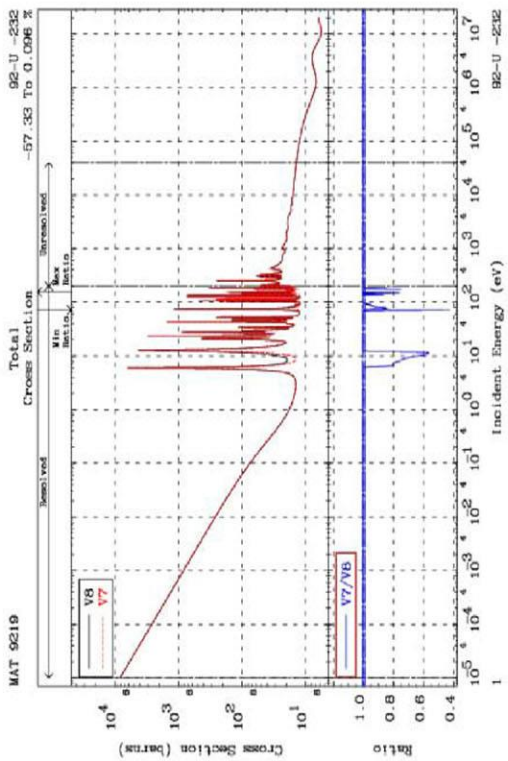
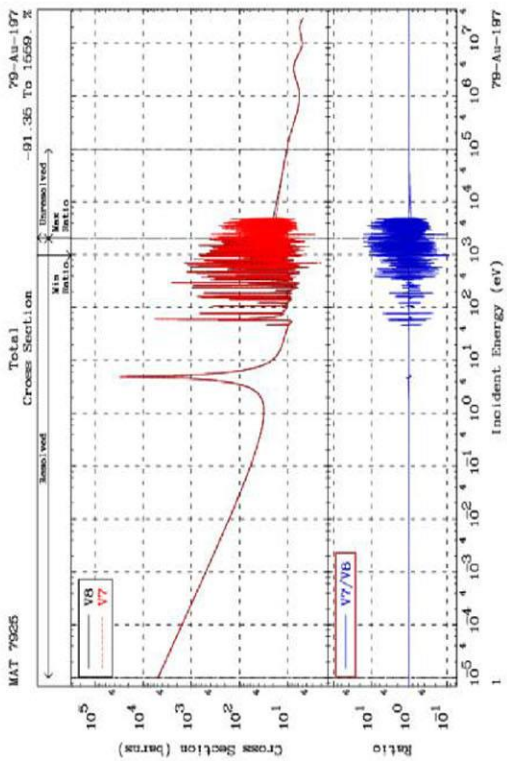
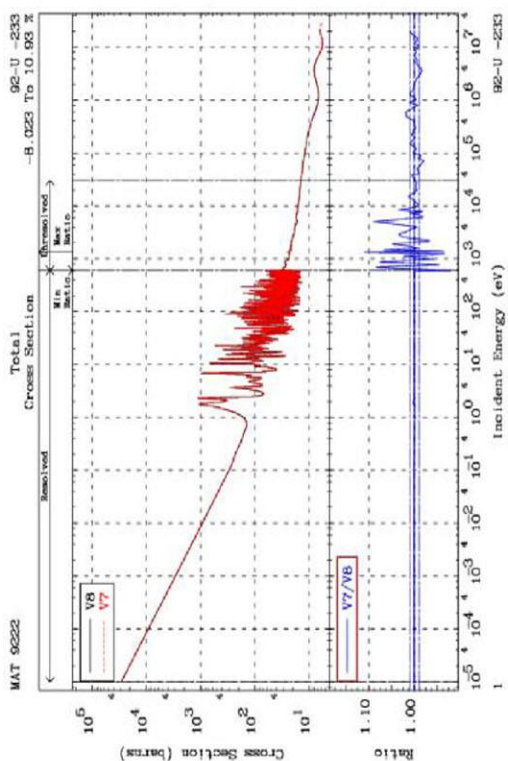
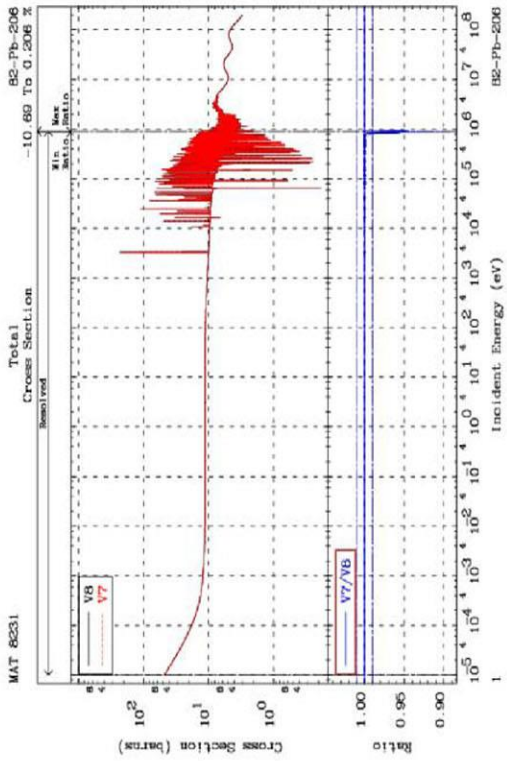


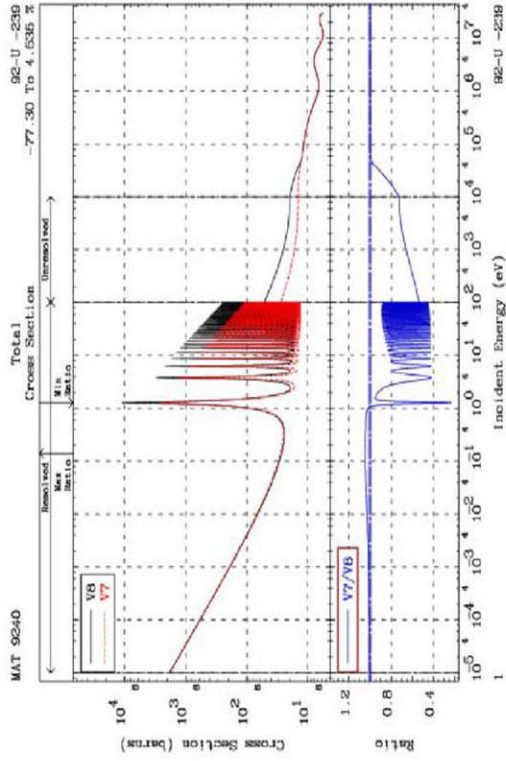
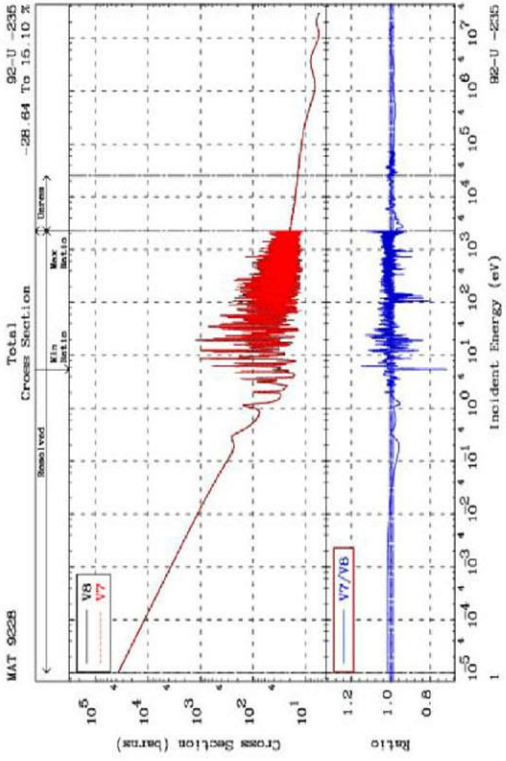
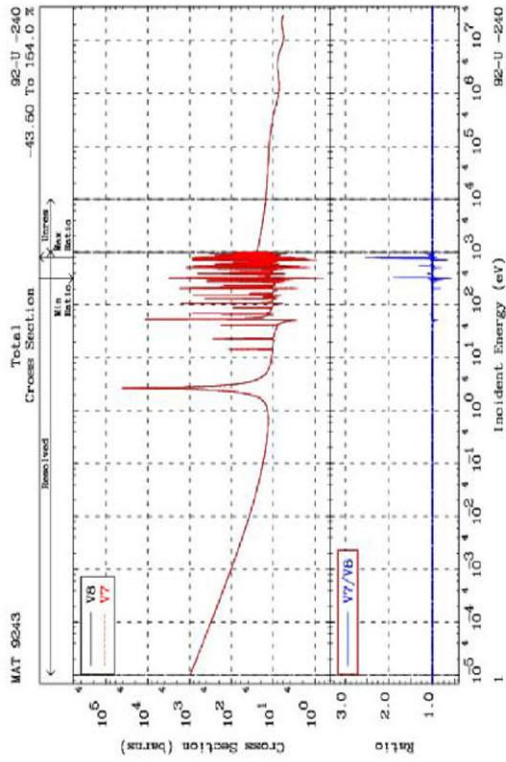
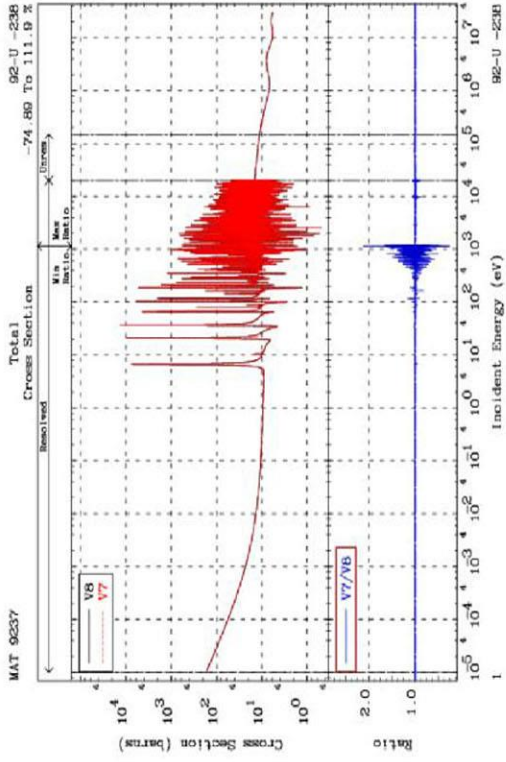


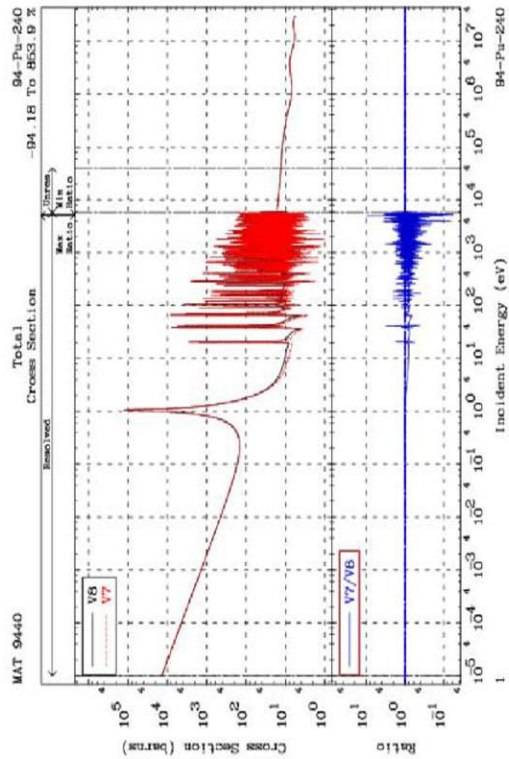
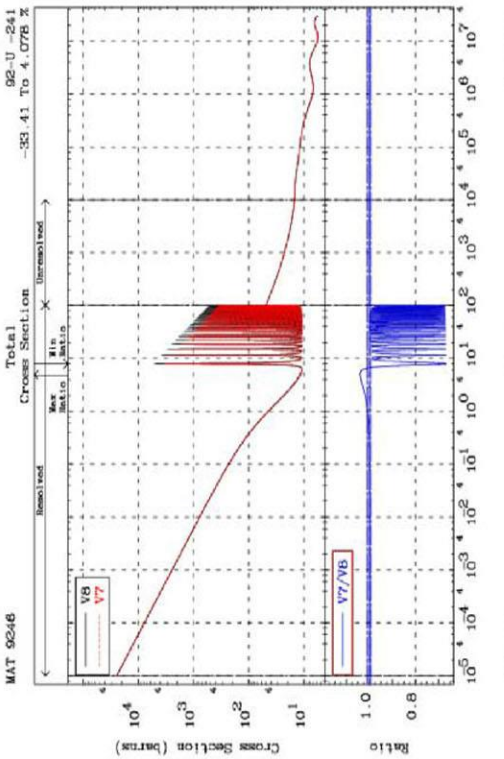
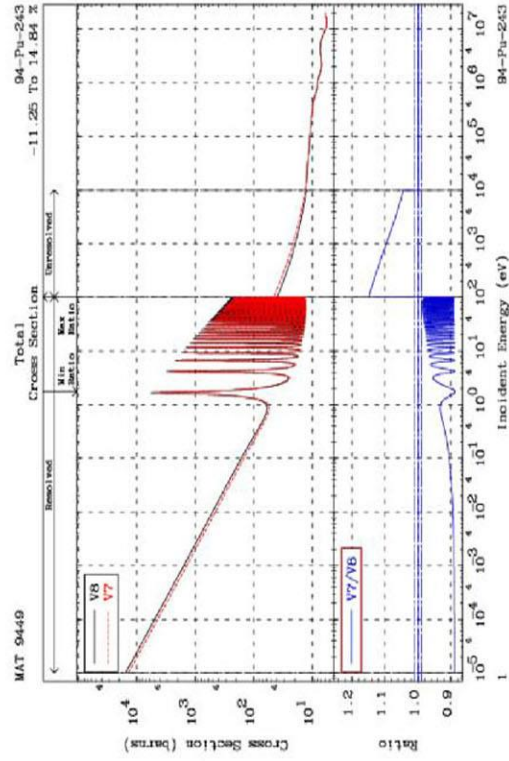
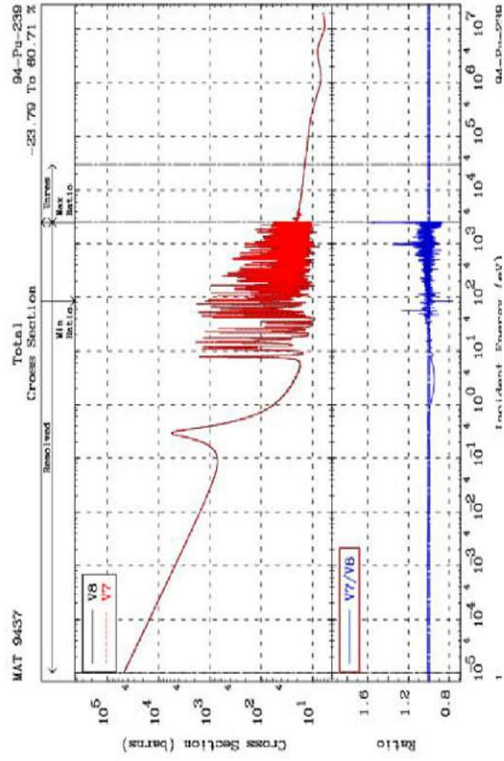


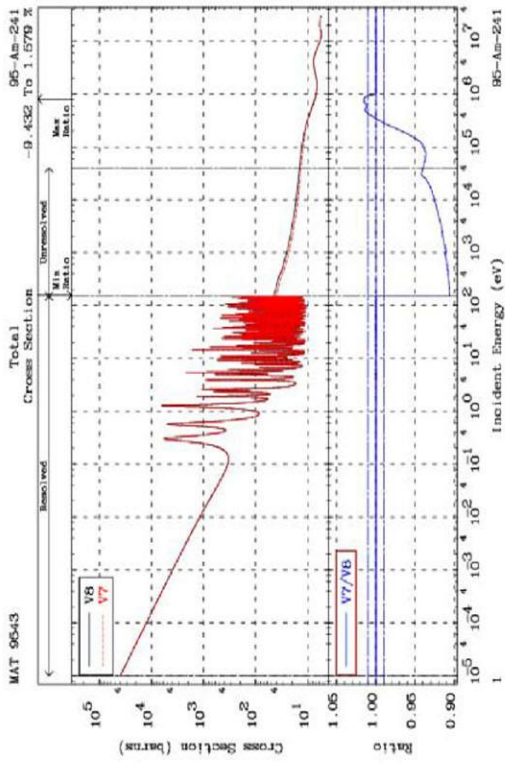
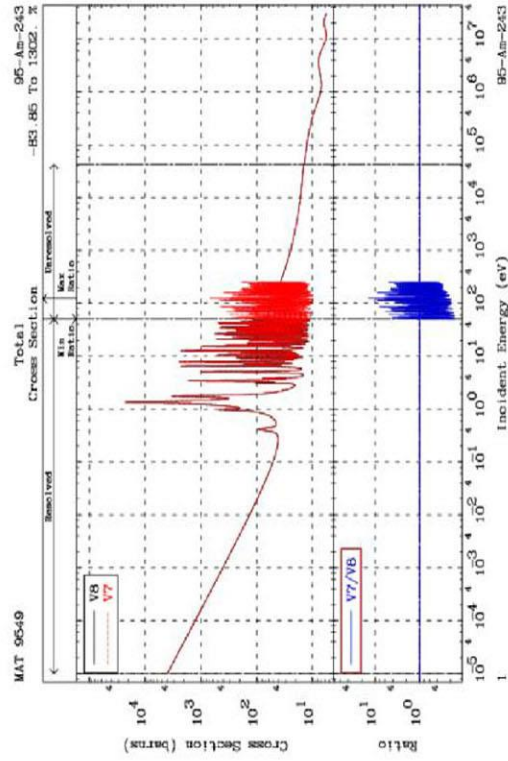












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Nuclear Data Section
International Atomic Energy Agency
Vienna International Centre, P.O. Box 100
A-1400 Vienna, Austria

E-mail: nds.contact-point@iaea.org
Fax: (43-1) 26007
Telephone: (43-1) 2600 21725
Web: <http://www-nds.iaea.org>
