

P A C E 4

modified JULIAN

projection angular-momentum coupled evaporation Monte Carlo code

angular distributions obtained using M-states of angular momentum

***** Fusion xsection taken from Bass model

Bass fusion xsection for $E = 420$ MeV is 1230.28 mb

Fusion radius = 9.1 fm. Barrier height is 60.3074 MeV

Transmission probability for a one-dimens. barrier: **Classical**

Starting conditions

	Z	N	A	Spin
Projectile	36	48	84	0
Target	13	14	27	0
Compound nucleus	49	62	111	

Bombarding energy (MeV)	420.00
Center of mass energy (MeV)	102.16
Compound nucleus excitation energy (MeV)	90.918
Q-value of reaction (MeV)	-11.244
Compound nucleus recoil energy (MeV)	317.838
Compound nucleus recoil velocity (cm/ns)	2.352e+00
Compound nucleus velocity/c	7.841e-02
Beam velocity (cm/ns)	3.108e+00
Beam velocity/c	1.036e-01

*** Input transmission coefficients determined by input value of TL diffuseness.

*** diffuseness = 2.00

*** Optical model input calculation bypasses. *****

Experimental fusion cross section (mb) 1.23e+03

Fusion L-grazing 61.94

Fusion L-diffuseness 2.00

Yrast spin at maximum excitation energy 82

Compound nucleus formation cross section (mb) 1.23e+03

Partial cross sections (mb)									
J	SIG(J)	J	SIG(J)	J	SIG(J)	J	SIG(J)	J	SIG(J)
0	0.31	16	10	32	20	48	30	64	11
1	0.94	17	11	33	21	49	31	65	7.3
2	1.6	18	12	34	22	50	32	66	4.8
3	2.2	19	12	35	22	51	32	67	3.1
4	2.8	20	13	36	23	52	33	68	2
5	3.5	21	14	37	24	53	33	69	1.2
6	4.1	22	14	38	24	54	34	70	0.77
7	4.7	23	15	39	25	55	34	71	0.48
8	5.3	24	15	40	25	56	34	72	0.3
9	6	25	16	41	26	57	33	73	0.18
10	6.6	26	17	42	27	58	32	74	0.11
11	7.2	27	17	43	27	59	30	75	0.069
12	7.9	28	18	44	28	60	28		
13	8.5	29	19	45	29	61	24		
14	9.1	30	19	46	29	62	19		
15	9.8	31	20	47	30	63	15		

***Spherical nucleus level density

*** Input fission barrier = 48.72 MeV at L=0 taken from Sierk

*** G.S. little A multiplied by factor 1 to obtain saddle level density

*** No fission calculation for barrier above 30 MeV

*** Little-A = MASS / 10

Energy range for	neutron	proton	alpha	gamma
minimal	0.01	1.10	2.19	0.00
minimal	40.00	30.74	55.84	20.00

*** Internal probability discriminator of program set to 0.002

Number of cascades is 1000

Optical model parameters for light emitted particles														
V	*E	*E**2	R0R	ARD	R0C	W0	*E	*E**2	R01	AID	RMCHD	NPD	IMAG	IRAD
47.010	-0.267	-0.002	1.276	0.660	0.000	9.520	-0.053	0.000	1. 26874	0.48	0.000	250.000	SURF	1.000
55.299	-0.550	0.000	1.250	0.650	1.250	13.500	0.000	0.000	1.25	0.47	0.000	250.000	SURF	1.000
50.000	0.000	0.000	7.392	0.576	5.622	14.655	0.000	0.000	7. 39202	0.576	0.000	250.000	VOL	0.000

E.M.Transition strengths in Weisskopf units

E1 = 0.000014 M1 = 0.010000 E2 = 5.900000 M2 = 0.000880

*** Gilbert - Cameron spin cutoff parameter used

Output results for compound nucleus decay

1. Yields of residual nuclei

Z	N	A	events	percent	x-section(mb)
49	57	106 In	33	3.3%	40.6
48	58	106 Cd	51	5.1%	62.7
47	59	106 Ag	7	0.7%	8.61
49	56	105 In	59	5.9%	72.6
48	57	105 Cd	260	26%	320
47	58	105 Ag	56	5.6%	68.9

46	59	105 Pd	3	0.3%	3.69
49	55	104 In	4	0.4%	4.92
48	56	104 Cd	42	4.2%	51.7
47	57	104 Ag	17	1.7%	20.9
47	56	103 Ag	69	6.9%	84.9
46	57	103 Pd	35	3.5%	43.1
45	58	103 Rh	4	0.4%	4.92
44	59	103 Ru	1	0.1%	1.23
47	55	102 Ag	128	12.8%	157
46	56	102 Pd	110	11%	135
45	57	102 Rh	14	1.4%	17.2
47	54	101 Ag	4	0.4%	4.92
46	55	101 Pd	9	0.9%	11.1
45	56	101 Rh	1	0.1%	1.23
45	55	100 Rh	27	2.7%	33.2
44	56	100 Ru	6	0.6%	7.38
45	54	99 Rh	43	4.3%	52.9
44	55	99 Ru	10	1%	12.3
45	53	98 Rh	1	0.1%	1.23
44	54	98 Ru	2	0.2%	2.46
43	54	97 Tc	2	0.2%	2.46
43	53	96 Tc	2	0.2%	2.46
TOTAL			1000	100	1230.27

2. Angular distribution results

*** Spin alignment perpendicular to recoil axis - standard compound nucleus angular distribution

2.1 Energy and angular distribution of residual nucleus Z = 49 and N = 57 (106In)

Residual velocity/c Vz = 7.98e-02(sig = 1.41e-03) rms Vxy = 2.13e-03

Energy Range (MeV)	Angular range (deg)																	
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Belo																		

w 211																	
283 - 289	1	1															
289 - 295		1															
295 - 301		5	1														
301 - 307	2	3		1													
307 - 313	2	5	1														
313 - 319	1	2	1														
319 - 325	2	2															
325 - 331	2																
Abov e 385																	
Total	10	19	3	1													
dSig/ dOm eg	1. 3e+0 4	8. 1e+0 3	7. 7e+0 2	1. 8e+0 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0 - 211																	
211 - 313	5	15	2	1													
313 - 415	5	4	1														
Abov e 415																	

2.2 Energy and angular distribution of residual nucleus Z = 48 and N = 58 (106Cd)

Residual velocity/c Vz = 8.15e-02(sig = 1.85e-03) rms Vxy = 2.06e-03

Energy Range (MeV)	Angular range (deg)																	
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Below																		

211																	
271 - 277		1															
277 - 283		1															
283 - 289	1		2														
289 - 295	3	3	2														
295 - 301	3	2															
301 - 307	2	2	1														
307 - 313	4	4	2														
313 - 319	3	3															
319 - 325	1	3	2														
325 - 331	2	3															
331 - 337		1															
Above 385																	
Total	19	23	9														
dSig/dOm eg	2.4e+04	9.9e+03	2.3e+03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0 - 211																	
211 - 313	13	13	7														
313 - 415	6	10	2														
Above 415																	

2.3 Energy and angular distribution of residual nucleus Z = 49 and N = 56 (105In)

Residual velocity/c $V_z = 8.11\text{e-}02(\text{sig} = 1.22\text{e-}03)$ rms $V_{xy} = 1.59\text{e-}03$

Energy Rang	Angular range (deg)
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e (MeV)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Below 211																		
277 - 283	1																	
283 - 289		2																
289 - 295	7	1																
295 - 301	7	3	1															
301 - 307	8	10																
307 - 313	5	5																
313 - 319	3	4	1															
331 - 337	1																	
Above 385																		
Total	32	25	2															
dSig/ dOm eg	4. 1e+0 4	1. 1e+0 4	5. 1e+0 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0 - 211																		
211 - 313	28	21	1															
313 - 415	4	4	1															
Above 415																		

2.4 Energy and angular distribution of residual nucleus Z = 48 and N = 57 (105Cd)

Residual velocity/c $V_z = 7.87\text{e-}02$ (sig = $1.42\text{e-}03$) rms $V_{xy} = 1.99\text{e-}03$

Energy Range	Angular range (deg)

(MeV)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Below 211																		
265 - 271		1																
271 - 277	1	1																
277 - 283	2	1	1															
283 - 289	4	11	1															
289 - 295	20	15	7															
295 - 301	21	21	11	1														
301 - 307	20	23	2															
307 - 313	18	24	3															
313 - 319	11	18	10															
319 - 325	4	6																
325 - 331		1																
337 - 343		1																
Above 385																		
Total	101	123	35	1														
dSig/dOm eg	1.3e+05	5.3e+04	9e+03	1.8e+02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0 - 211																		
211 - 313	86	97	25	1														
313 - 415	15	26	10															
Above 415																		

2.5 Energy and angular distribution of residual nucleus Z = 47 and N = 58 (105Ag)

Residual velocity/c $V_z = 8.03\text{e-}02$ (sig = $1.60\text{e-}03$) rms $V_{xy} = 1.92\text{e-}03$

Energy Range (MeV)	Angular range (deg)																	
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Below 211																		
277 - 283	2																	
283 - 289	1	3																
289 - 295	4	3	1															
295 - 301	3	4																
301 - 307	2	12	1															
307 - 313		2																
313 - 319	3	7	2															
319 - 325		2																
325 - 331	2	2																
Above 385																		
Total	17	35	4															
dSig/dOm eg	2.2e+04	1.5e+04	1e+03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0 - 211																		
211 - 313	12	24	2															
313 - 415	5	11	2															
Above 415																		

2.6 Energy and angular distribution of residual nucleus Z = 48 and N = 56 (104Cd)

Residual velocity/c Vz = 7.80e-02(sig = 1.11e-03) rms Vxy = 1.47e-03

Energy Range (MeV)	Angular range (deg)																	
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Below 211																		
283 - 289	1	1																
289 - 295	7	2																
295 - 301	6	3	2															
301 - 307	7	2																
307 - 313	4	3																
313 - 319	1	2																
319 - 325	1																	
Above 385																		
Total	27	13	2															
dSig/dOm eg	3.5e+04	5.6e+03	5.1e+02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0 - 211																		
211 - 313	25	11	2															
313 - 415	2	2																
Above 415																		

2.7 Energy and angular distribution of residual nucleus Z = 47 and N = 56 (103Ag)

Residual velocity/c Vz = 7.77e-02(sig = 2.59e-03) rms Vxy = 3.39e-03

Energy	Angular range (deg)																	
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y Range																		
(MeV)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Below 211																		
253 - 259	1																	
259 - 265			1															
265 - 271		2	1															
271 - 277				1														
277 - 283	1	3	3	1	1													
283 - 289	1	2	3	1														
289 - 295		3	3	3														
295 - 301			2	2														
301 - 307	2	1	3	3														
307 - 313			3	1														
313 - 319	2	3	2	1														
319 - 325	1	2	3	1														
325 - 331		1	2															
331 - 337			1															
337 - 343	1	1																
Above 385																		
Total	9	18	27	14	1													
dSig/ dOm eg	1. 2e+0 4	7. 7e+0 3	6. 9e+0 3	2. 6e+0 3	1. 4e+0 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0 - 211																		
211 - 313	5	11	19	12	1													

313 - 415	4	7	8	2														
Above 415																		

2.8 Energy and angular distribution of residual nucleus Z = 46 and N = 57 (103Pd)

Residual velocity/c $V_z = 8.10\text{e-}02$ (sig = $2.86\text{e-}03$) rms $V_{xy} = 3.13\text{e-}03$

Energy Range (MeV)	Angular range (deg)																	
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Below 211																		
253 - 259		1																
259 - 265		1																
265 - 271		3	1															
271 - 277		1	1															
277 - 283	1	1		1														
283 - 289		3		1														
289 - 295		1	1	2														
295 - 301		1	1	1														
301 - 307		2																
307 - 313		2	1	1														
313 - 319			1															
319 - 325			1	1														
325 - 331			2															
331 -			1															

337																		
343 - 349	1																	
Above 385																		
Total	2	16	10	7														
dSig/dOmegeg	2.6e+03	6.9e+03	2.6e+03	1.3e+03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0 - 211																		
211 - 313	1	16	5	6														
313 - 415	1		5	1														
Above 415																		

2.9 Energy and angular distribution of residual nucleus Z = 47 and N = 55 (102Ag)

Residual velocity/c $V_z = 7.70e-02$ (sig = $2.08e-03$) rms $V_{xy} = 3.10e-03$

Energy Range (MeV)	Angular range (deg)																	
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Below 211																		
259 - 265	2																	
265 - 271	3			1														
271 - 277	2		6	1	1													
277 - 283	3	4	5	6														
283 - 289		5	6	1														
289 - 295		6	9	5	1													
295 - 301		5	6	2														

301 - 307		8	10	1														
307 - 313	2	4	6	2														
313 - 319	2	4																
319 - 325	1	3																
325 - 331		2	1															
331 - 337	1																	
337 - 343	1																	
Above 385																		
Total	17	41	49	19	2													
dSig/dOm eg	2.2e+04	1.8e+04	1.3e+04	3.5e+03	2.9e+02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0 - 211																		
211 - 313	12	32	48	19	2													
313 - 415	5	9	1															
Above 415																		

2.10 Energy and angular distribution of residual nucleus Z = 46 and N = 56 (102Pd)

Residual velocity/c Vz = 8.41e-02(sig = 2.22e-03) rms Vxy = 3.16e-03

Energy Range (MeV)	Angular range (deg)																	
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Below 211																		
253 - 259			1															
259 -		1																

265																		
265 - 271	2	3	2															
271 - 277	2	4	4															
277 - 283	3	3	4	1														
283 - 289		10	2	5														
289 - 295		5	4	2	1													
295 - 301	3	4	7															
301 - 307	1	2	6	7														
307 - 313		2	1	1														
313 - 319		5	2	1														
319 - 325	4		1															
325 - 331		2	1		1													
Above 385																		
Total	15	41	35	17	2													
dSig/dOm eg	1.9e+04	1.8e+04	9e+03	3.1e+03	2.9e+02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0 - 211																		
211 - 313	11	34	31	16	1													
313 - 415	4	7	4	1	1													
Above 415																		

2.11 Energy and angular distribution of residual nucleus Z = 45 and N = 55 (100Rh)

Residual velocity/c $V_z = 7.56e-02$ (sig = $3.65e-03$) rms $V_{xy} = 3.55e-03$

Energy Rang	Angular range (deg)
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e																		
(MeV)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Below 211																		
229 - 235			1															
235 - 241			1															
253 - 259		1																
259 - 265		1																
265 - 271				1														
271 - 277						1												
277 - 283	1		1															
283 - 289		2		1	1													
289 - 295		1																
295 - 301	1	1		1														
301 - 307	2																	
307 - 313			1	1														
313 - 319			1	2														
319 - 325	1																	
331 - 337			2															
337 - 343	1																	
Above 385																		
Total	6	6	7	6	1	1												
dSig/dOmegeg	7.7e+03	2.6e+03	1.8e+03	1.1e+03	1.4e+02	1.2e+02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0 - 211																		
211 - 313	4	6	4	4	1	1												

313 - 415	2		3	2														
Above 415																		

2.12 Energy and angular distribution of residual nucleus Z = 45 and N = 54 (99Rh)

Residual velocity/c $V_z = 7.27\text{e-}02$ (sig = $2.83\text{e-}03$) rms $V_{xy} = 3.79\text{e-}03$

Energy Range (MeV)	Angular range (deg)																	
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Below 211																		
241 - 247			1															
247 - 253		1			1													
253 - 259		1				1												
259 - 265			1	1														
265 - 271		1		1														
271 - 277	1	1	1		1													
277 - 283	1	4		4														
283 - 289	1	2	2	1														
289 - 295	1	1	1		1													
295 - 301			1	1	2													
301 - 307	1																	
307 - 313	1				1													
319 - 325			1	1														
325 -			1															

331																		
343 - 349	1																	
Above 385																		
Total	7	11	9	9	6	1												
dSig/dOmegeg	9e+03	4.7e+03	2.3e+03	1.7e+03	8.6e+02	1.2e+02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0 - 211																		
211 - 313	6	11	7	8	6	1												
313 - 415	1		2	1														
Above 415																		

2.13 Energy and angular distribution of ALL residual nuclei

Energy Range (MeV)	Angular range (deg)																	
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Below 211																		
229 - 235			1															
235 - 241			1															
241 - 247		1	1															
247 - 253		1			1													
253 - 259	1	4	1			1												
259 - 265	2	4	2	1														
265 - 271	5	13	5	4														
271 - 277	6	13	13	2	2	1												
277 -	15	19	16	15	1													

283																		
283 - 289	12	44	19	14	1													
289 - 295	43	44	29	12	4													
295 - 301	47	55	35	10	2													
301 - 307	48	69	24	14														
307 - 313	38	55	21	6	1													
313 - 319	29	53	21	6														
319 - 325	19	20	8	3														
325 - 331	6	12	9		1													
331 - 337	2	1	4															
337 - 343	3	2																
343 - 349	2																	
Above 385																		
Total	278	410	210	87	13	2												
dSig/dOm eg	3.6e+05	1.8e+05	5.4e+04	1.6e+04	1.9e+03	2.3e+02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0 - 211																		
211 - 313	217	322	168	78	12	2												
313 - 415	61	88	42	9	1													
Above 415																		

Neutron spectra in laboratory coordinates 4539 events

Energy range (MeV)	Angular range (deg)																	
	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0-1		4	15	36	47	61	38	30	34	19	22	14	18	20	6	7	1	

1 - 2	2	5	4	13	54	71	47	45	45	26	16	14	6	7	7	4	1	2
2 - 3	3	4	10	18	73	98	72	53	29	21	19	10	8	5	3	1		
3 - 4	7	11	1	34	84	71	52	36	16	14	8	7	3	1	3			
4 - 5	1	8	15	68	99	62	31	24	20	10	11	2		1		2	1	
5 - 6	4	6	32	88	86	60	26	14	11	3	5	1		1	1		1	
6 - 7	1	14	64	80	60	41	34	12	8	7	5	5		1				1
7 - 8	7	55	80	66	54	48	21	8	4	3	2							
8 - 9	21	71	72	48	43	22	20	8	5	2	2	1						
9 - 10	34	54	56	47	38	22	6	3	3				1					
10 - 11	19	40	39	34	30	14	14	3	5									
11 - 12	20	38	31	35	28	11	9	4	2									
12 - 13	15	30	39	32	23	9	7	3	2	1	1							
13 - 14	10	29	28	20	16	1	4		1	2								
14 - 15	7	23	24	19	17	8	1	1										
15 - 16	5	19	16	11	9	5	5											
16 - 17	11	9	15	12	7	3	1	2										
17 - 18	2	7	8	5	7	5	2	1										
18 - 19	5	7	14	2	3	1		1	1									
19 - 20	2	4	10	9	4	3	1											
20 - 21	4	5	5	1	3													
21 - 22	2	3	7	1	1	1												
22 - 23	3	4	4	2	2	1												
23 - 24		3	3	4		1												
24 - 25	1	1	4	1														
25 - 26			2	1														
26 - 27		3	1		1													
27 - 28	1					1												
28 -	1	1	1															

29																		
29 - 30			1	1														
Above 30	2	2																
Total	190	460	601	688	789	620	391	248	186	108	91	54	36	36	20	14	4	3
dSig/dOmega	2446.59	1994.64	1595.97	1346.14	1252.22	849.386	484.136	288.111	209.509	121.644	105.701	66.8443	49.2987	57.1015	39.099	37.1302	17.3064	38.3705
0 - 5	13	32	45	169	357	363	240	188	144	90	76	47	35	34	19	14	3	2
5 - 10	67	200	304	329	281	193	107	45	31	15	14	7	1	2	1		1	1
10 - 20	96	206	224	179	144	60	44	15	11	3	1							
Above 20	14	22	28	11	7	4												

Proton spectra in laboratory coordinates 729 events

Energy range (MeV)	Angular range (deg)																	
	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0 - 1												2		1		1	4	
1 - 2											1	3	5	5	5	2		
2 - 3								1	3	3	6	5	1	5	3	1	1	1
3 - 4								6	7	6	9	5	2	3	2	2	1	
4 - 5							4	5	6	8	1	4	5	1	1	2		
5 - 6							4	2	6	6	8	4	1		3			
6 - 7						2	4	9	3	3	2	2	1					
7 - 8				2	3	9	8	5	3	4	1		1				1	
8 - 9				2	7	12	10	7	7	2		1						
9 - 10				1	1	6	11	7	4	4								
10 - 11			2	4	3	10	9	6		2	1							
11 - 12			1	3	4	6	8	3	3	1								
12 - 13		1	1	7	13	2	5	2		1	1	1						
13 - 14			1	5	7	6	5	4	2	1								
14 - 15	1	2	3	5	7	7	2	1	2									
15 - 16	2	4	6	3	9	4		2			1		1					
16 -		4	5	14	8	5	4											

17																		
17 - 18	2	4	5	8	7	2			1									
18 - 19		2	4	7	3	2												
19 - 20	3	5	9	9	3	1												
20 - 21	4		6	8	3	1												
21 - 22	2	5	5	2	1	1	1											
22 - 23	3	3	6	2	4													
23 - 24	2	3	1	2	1	1												
24 - 25	1	1	2	2														
25 - 26		3	2	2														
26 - 27		5	2	1														
27 - 28	1	1		1														
28 - 29		1	1															
29 - 30			2		1													
Above 30	1	2		1	1													
Total	22	46	64	87	80	66	78	66	49	45	36	27	17	16	14	8	7	1
dSig/dOmega	283.29	199.464	169.954	170.225	126.967	90.4185	96.5795	76.6746	55.1932	50.685	41.8159	33.4221	23.28	25.3784	27.3693	21.2173	30.2862	12.7902
0 - 5							4	12	16	17	17	19	13	15	11	8	6	1
5 - 10				1	5	18	40	36	25	23	16	7	3	1	3		1	
10 - 20	8	22	37	65	64	45	33	18	8	5	3	1	1					
Above 20	14	24	27	21	11	3	1											

Alpha spectra in laboratory coordinates 568 events

Energy range (MeV)	Angular range (deg)																	
	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0 - 1							2	1	1	4	1	3	1	2	3			

1 - 2								3	1	3	2	1	3	1				1
2 - 3								2	3	4			1		1			
3 - 4							1	1	4	3	1	3	1					
4 - 5							1	4	1	1		1		1				
5 - 6							2	4	4	1			1					
6 - 7							1	1	1	3								
7 - 8							1	6	2	3								
8 - 9							3	3	2	2								
9 - 10						1	5	6	2		1							
10 - 11							3	3	2		1							
11 - 12							4	3	1	1								
12 - 13							8	4		1								
13 - 14						4	1	1										
14 - 15						4	8	1	1									
15 - 16						4	7											
16 - 17						3		2										
17 - 18					1	6	3	1										
18 - 19					1	5	2	1										
19 - 20						4	5	1										
20 - 21					3	9	2											
21 - 22					3	8	3	1										
22 - 23						4												
23 - 24				1	5	7	1											
24 - 25				1	3	3	1											
25 - 26					5	6		1										
26 - 27					2	3	2											
27 - 28				1	7	2												
28 -				1	6	2												

29																		
29 - 30			1		6	1												
Above 30	15	54	72	69	29	8	1											
Total	15	54	73	73	71	84	67	50	25	26	6	8	7	4	4			1
dSig/dOmega	193.152	234.153	193.854	142.832	112.684	115.078	82.9593	58.0868	28.1598	29.2846	6.96931	9.90285	9.58586	6.34461	7.8198	0	0	12.7902
0 - 5							4	11	10	15	4	8	6	4	4			1
5 - 10						1	12	20	11	9	1		1					
10 - 20					2	30	41	17	4	2	1							
Above 20	15	54	73	73	69	53	10	2										

Gamma ray spectrum 8735 events

Emission from unbound and bound states(*), and total gamma ray spectrum

(*) note that emission of a particle from an unbound state is not allowed in the code if E_{cm} is less than E_{min}

=====

Energy range (MeV)	Unbound	Bound	TOTAL
0 - 1	0	570	570
1 - 2	5374	2790	8164
8 - 9	1	0	1
Total	5375	3360	8735

4.4 percent of cascades trapped before reaching ground state due to spin inhibition

Average energy at which cascades were trapped is **0.5** MeV, average spin = **4.84091** hbar

**** successive decays through single yrast cascade assumed

----- C.M. spectra of emitted particles -----

Ex(MeV)	Neut	Prot	Alpha	Gamma
0 - 1	100			570
1 - 2	862			8164

2 - 3	1045			
3 - 4	720	5		
4 - 5	540	23		
5 - 6	392	59		
6 - 7	267	89		
7 - 8	189	112		
8 - 9	126	99	2	1
9 - 10	105	105	2	
10 - 11	55	76	19	
11 - 12	42	42	30	
12 - 13	30	49	54	
13 - 14	27	23	77	
14 - 15	14	17	59	
15 - 16	6	9	80	
16 - 17	9	8	50	
17 - 18	3	5	51	
18 - 19	4	3	32	
19 - 20	1	2	30	
20 - 21	1	2	19	
21 - 22	1		18	
22 - 23			11	
23 - 24			10	
24 - 25			6	
25 - 26			2	
26 - 27		1	5	
27 - 28			6	
28 - 29			2	
30 - 31			1	
31 - 32			1	
32 - 33			1	
Total	4539	729	568	8735
Average Energy	4.12327	9.15569	16.1813	1.43555

Track down of decay modes at **90.818** , **45.959** , **10** MeV excitation

Ex = 90.818

Gamma = 0.566
MeV

Lifetime =
1.18e-21 sec

Average J =
20.077

Stand.dev. =
7.099

	Part	Num	DeIJ	RMS-dJ
Neut	1515	-1.36238	2.68328	15.5757
Prot	244	-1.04918	2.27423	16.0983
Alph	241	-5.16183	6.797	20.9408

Ex = 45.959

**Gamma = 0.0799
MeV**

**Lifetime =
1.11e-20 sec**

**Average J =
15.784**

**Stand.dev. =
5.754**

	Part	Num	DeIJ	RMS-dJ
Neut	1458	-1.51646	2.56052	14.249
Prot	230	-1.4	2.56396	15.7826
Alph	312	-4.71474	6.38131	19.6955

Ex = 10

**Gamma =
0.000194 MeV**

**Lifetime =
3.34e-11 sec**

Average J = 9.041

**Stand.dev. =
3.887**

	Part	Num	DeIJ	RMS-dJ
Neut	1065	-1.70141	2.34491	12.0746
Prot	148	-1.31081	1.83804	11.6351
Alph	46	-3.56522	4.54925	15.3261
Gamm	741	-1.8475	1.94353	1

---- end of evaporation calculation ----

******* Complete traceback diagnostic of particle and gamma emission *******

Components of gamma spectrum

Energy	E1-spec	E2-spec
0.05 - 0.15		25
0.15 - 0.25		31

0.25 - 0.35		6
0.35 - 0.45		25
0.45 - 0.55		13
0.55 - 0.65	159	311
1.05 - 1.15	512	7652
Above 3.05	0	1

M states at final J vs Ex

0 - 4	0.26	2.13	1.00	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4 - 8	0.34	2.29	2.76	1.00	..	..	..	..	..	..	..	..	..	..	..	..	..
8 - 12	0.77	2.37	2.51	2.21	..	..	..	..	..	..	..	..	..	..	..	..	..
12 - 16	1.48	2.53	2.98	2.74	1.50	..	..	..	..	..	..	..	..	..	..	..	..
16 - 20	1.14	2.18	2.69	2.78	4.09	..	..	..	..	..	..	..	..	..	..	..	..
20 - 24	0.69	2.48	2.68	3.18	3.43	..	..	..	..	..	..	..	..	..	..	..	..
24 - 28	1.18	2.13	2.65	2.92	2.39	..	..	..	..	..	..	..	..	..	..	..	..
28 - 32	1.54	2.39	2.72	3.01	2.54	5.50	..	..	..	..	..	..	..	..	..	..	..
32 - 36	1.17	2.17	2.41	2.46	2.47	..	..	..	..	..	..	..	..	..	..	..	..
36 - 40	0.80	2.19	2.47	2.95	3.64	4.00	..	..	..	..	..	..	..	..	..	..	..
40 - 44	0.71	2.24	2.65	2.67	2.23	2.71	..	..	..	..	..	..	..	..	..	..	..
44 - 48	1.17	2.35	2.51	2.31	2.91	3.00	..	..	..	..	..	..	..	..	..	..	..
48 - 52	1.00	2.29	2.47	2.10	2.67	2.94	..	..	..	..	..	..	..	..	..	..	..
52 - 56	1.33	1.89	2.74	2.64	1.60	2.08	..	..	..	..	..	..	..	..	..	..	..
56 - 60	1.00	2.46	2.18	1.94	2.42	2.29	2.00	..	..	..	..	..	..	..	..	..	..
60 - 64	1.50	1.74	2.24	1.99	1.95	2.67	1.50	1.00	..	..	..	..	..	..	..	..	..
64 - 68	1.33	1.65	1.80	1.78	1.24	1.61	2.67	..	..	..	..	..	..	..	..	..	..
68 - 72	..	2.06	2.18	2.12	2.03	2.00	2.50	2.50	..	..	..	..	..	..	..	..	..
72 - 76	1.67	1.72	1.70	1.76	1.67	1.70	2.08	2.00	1.00	..	..	..	..	..	..	..	..
76 -	..	0.81	1.33	1.46	1.10	1.10	0.92	0.67	..	..	..	..	..	..	..	..	..

80																	
80 - 84	1.00	0.27	1.10	0.96	0.88	0.65	0.71	..	..	..	..	..	..	..	..	..	..
84 - 88	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
88 - 92	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
92 - 96	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
96 - 100	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
100 - 104	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
104 - 108	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
108 - 112	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
112 - 116	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
116 - 120	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Ex / J	-4.00	-9.00	-14.0	-19.0	-24.0	-29.0	-34.0	-39.0	-44.0	-49.0	-54.0	-59.0	-64.0	-69.0	-74.0	-79.0	
			0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Decay summary. Mode = NEUT Total = 4539 Out of = 1000 events Multiplicity = 4.539

Average Ecm = 4.1 Average spin removed = 1.5

8 - 12	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	2	0
12 - 16	13	77	24	..	..	..	..	..	..	..	..	..	..	..	..	114	7.48246	2.80736
16 - 20	11	84	115	10	..	..	..	..	..	..	..	..	..	..	..	220	9.81818	3.30477
20 - 24	11	68	109	53	2	..	..	..	..	..	..	..	..	..	..	243	11.321	4.16381
24 - 28	10	67	95	62	13	..	..	..	..	..	..	..	..	..	..	247	12.0202	4.72948
28 - 32	11	57	91	75	9	2	..	..	..	..	..	..	..	..	..	245	12.4082	4.8273
32 - 36	9	50	85	76	22	..	..	..	..	..	..	..	..	..	..	242	13.0744	4.96711
36 - 40	3	40	73	63	26	3	..	..	..	..	..	..	..	..	..	208	13.875	5.10408
40 - 44	5	37	71	64	24	4	..	..	..	..	..	..	..	..	..	205	13.878	5.22748
44 - 48	3	27	64	75	29	7	..	..	..	..	..	..	..	..	..	205	14.9512	5.19827
48 - 52	1	53	84	64	49	13	..	..	..	..	..	..	..	..	..	264	14.7652	5.78381
52 - 56	2	29	53	65	34	8	..	..	..	..	..	..	..	..	..	191	15.2461	5.48078
56 - 60	1	20	45	59	35	11	1	..	..	..	..	..	..	..	..	172	16.186	5.62183
60 - 64	2	29	66	70	58	17	2	..	..	..	..	..	..	..	..	244	16.3443	5.9005
64 - 68	5	22	66	61	40	23	1	..	..	..	..	..	..	..	..	218	16.1743	6.18943

68 - 72	..	11	37	42	27	6	1	..	..	..	..	..	..	..	..	..	124	16.3145	5.28749
72 - 76	2	17	61	65	50	32	8	..	1	..	..	..	..	..	..	..	236	17.8898	6.62658
76 - 80	1	20	68	93	69	53	8	1	..	..	..	..	..	..	..	..	313	18.4696	6.31292
80 - 84	..	7	15	20	24	13	6	1	..	..	..	..	..	..	..	..	86	19.5	6.97796
88 - 92	6	46	128	199	183	131	52	13	3	..	..	..	..	..	..	..	761	19.8252	7.20689
Ex / J	-4	-9	-14	-19	-24	-29	-34	-39	-44	-49	-54	-59	-64	-69	-74	-79	sum	avrg	stdv
Sum	97	761	1350	1216	694	323	79	15	4	..	..	..	..	..	..	..

Decay summary. Mode = PROT Total = 729 Out of = 1000 events Multiplicity = 0.729

Average Ecm = 9.2 Average spin removed = 1.3

12 - 16	1	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5	6	2
16 - 20	3	14	19	9	..	..	..	..	..	..	..	..	..	..	..	..	45	10.7778	4.23682
20 - 24	2	18	24	4	..	..	..	..	..	..	..	..	..	..	..	..	48	10.125	3.47985
24 - 28	1	10	12	9	..	..	..	..	..	..	..	..	..	..	..	..	32	11.5313	4.21296
28 - 32	1	6	17	8	1	..	..	..	..	..	..	..	..	..	..	..	33	12.303	4.07122
32 - 36	3	10	17	14	6	..	..	..	..	..	..	..	..	..	..	..	50	13	5.38516
36 - 40	2	15	22	6	..	..	..	..	..	..	..	..	..	..	..	..	45	10.5556	3.74496
40 - 44	1	7	12	8	3	2	..	..	..	..	..	..	..	..	..	..	33	13.6667	5.86033
44 - 48	1	6	15	8	4	..	..	..	..	..	..	..	..	..	..	..	34	13.1765	4.85962
48 - 52	..	1	19	12	4	..	..	..	..	..	..	..	..	..	..	..	36	14.6389	3.62976
52 - 56	1	3	9	6	2	1	..	..	..	..	..	..	..	..	..	..	22	13.8182	5.54843
56 - 60	2	4	10	6	5	..	..	..	..	..	..	..	..	..	..	..	27	13.4815	5.74373
60 - 64	..	5	3	9	11	1	..	..	..	..	..	..	..	..	..	..	29	17	5.72351
64 - 68	1	7	8	10	6	3	1	..	..	..	..	..	..	..	..	..	36	15.6111	6.93332
68 - 72	..	2	5	3	3	4	..	..	..	..	..	..	..	..	..	..	17	17.5882	6.83468
72 - 76	..	3	10	10	8	2	..	..	..	..	..	..	..	..	..	..	33	16.3939	5.33109
76 - 80	1	6	13	10	18	4	1	..	..	..	..	..	..	..	..	..	53	17.0943	6.4786
80 - 84	1	1	4	2	4	6	..	..	..	..	..	..	..	..	..	..	18	18.9444	7.66284
88 - 92	2	5	19	39	41	16	10	1	..	..	..	..	..	..	..	..	133	19.7068	6.5612
Ex / J	-4	-9	-14	-19	-24	-29	-34	-39	-44	-49	-54	-59	-64	-69	-74	-79	sum	avrg	stdv
Sum	23	127	238	173	116	39	12	1	..	..	..	..	..	..	..	..

Decay summary. Mode = ALPH Total = 568 Out of = 1000 events Multiplicity = 0.568

Average Ecm = 16 Average spin removed = 4.5

16 - 20	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	7	0
20 - 24	..	3	4	1	..	..	..	..	..	..	..	..	..	..	..	..	8	10.75	3.30719
24 - 28	..	5	9	8	..	..	..	..	..	..	..	..	..	..	..	..	22	12.6818	3.78257
28 - 32	1	7	10	4	2	..	..	..	..	..	..	..	..	..	..	..	24	11.7917	4.89029
32 - 36	..	3	8	4	4	..	..	..	..	..	..	..	..	..	..	..	19	14.3684	4.96525
36 - 40	..	7	9	12	10	..	..	..	..	..	..	..	..	..	..	..	38	15.2895	5.29104
40 - 44	1	5	6	4	3	1	..	..	..	..	..	..	..	..	..	..	20	13.5	6.34429
44 - 48	2	1	9	12	1	1	..	..	..	..	..	..	..	..	..	..	26	14.3077	5.23133
48 - 52	..	2	2	14	10	4	..	..	..	..	..	..	..	..	..	..	32	18.875	4.96078
52 - 56	..	3	3	10	7	3	..	..	..	..	..	..	..	..	..	..	26	17.7692	5.66574
56 - 60	1	..	6	13	5	6	..	..	..	..	..	..	..	..	..	..	31	18.2903	5.81541
60 - 64	..	1	7	13	8	6	..	1	..	..	..	..	..	..	..	..	36	19.0833	6.05243
64 - 68	..	2	6	8	12	7	1	..	..	..	..	..	..	..	..	..	36	19.6389	6.06517
68 - 72	..	3	2	7	6	8	1	2	..	..	..	..	..	..	..	..	29	21.3103	7.84814
72 - 76	1	5	9	12	11	6	5	1	..	..	..	..	..	..	..	..	50	19	7.93725
76 - 80	..	1	6	9	19	11	3	2	..	..	..	..	..	..	..	..	51	21.902	6.37783
80 - 84	..	3	2	1	4	1	1	1	..	..	..	..	..	..	..	..	13	18.9231	9.31055
88 - 92	..	2	17	24	26	19	12	5	1	..	..	..	..	..	..	..	106	21.9057	7.49154
Ex / J	-4	-9	-14	-19	-24	-29	-34	-39	-44	-49	-54	-59	-64	-69	-74	-79	sum	avrg	stdv
Sum	6	54	115	156	128	73	23	12	1	..	..	..	..	..	..	..

Decay summary. Mode = G-E1 Total = 671 Out of = 1000 events Multiplicity = 0.671

Average Ecm = 1.3 Average spin removed = 0.22

0 - 4	357	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	357	2	0
4 - 8	245	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	245	2	0
8 - 12	68	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	68	2	0
12 - 16	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	2	0
Ex / J	-4	-9	-14	-19	-24	-29	-34	-39	-44	-49	-54	-59	-64	-69	-74	-79	sum	avrg	stdv
Sum	671	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Decay summary. Mode = G-E2 Total = 8064 Out of = 1000 events Multiplicity = 8.064

Average Ecm = 1.4 Average spin removed = 1.1

0 - 4	1957	213	1	..	..	..	..	..	..	..	..	..	..	..	..	..	2171	2.49516	1.50122
4 - 8	2099	775	117	1	..	..	..	..	..	..	..	..	..	..	..	..	2992	3.69118	2.75702

8 - 12	776	728	383	33	..	..	..	..	..	..	..	..	..	..	..	..	1920	6.14844	4.01058
12 - 16	37	291	331	78	2	..	..	..	..	..	..	..	..	..	..	..	739	10.0853	3.75423
16 - 20	..	..	98	88	11	..	..	..	..	..	..	..	..	..	..	..	197	14.7919	2.99277
20 - 24	..	..	..	20	19	..	..	..	..	..	..	..	..	..	..	..	39	19.4359	2.49918
24 - 28	..	..	..	..	5	..	..	..	..	..	..	..	..	..	..	..	5	22	0
28 - 32	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	1	22	0
Ex / J	-4	-9	-14	-19	-24	-29	-34	-39	-44	-49	-54	-59	-64	-69	-74	-79	sum	avrg	stdv
Sum	4869	2007	930	220	38	..	..	..	..	..	..	..	..	..	..	..

Fission probability as function of excitation

Ex.Energy Probability

88 - 92	0.00e+00
80 - 84	0.00e+00
76 - 80	0.00e+00
72 - 76	0.00e+00
68 - 72	0.00e+00
64 - 68	0.00e+00
60 - 64	0.00e+00
56 - 60	0.00e+00
52 - 56	0.00e+00
48 - 52	0.00e+00
44 - 48	0.00e+00
40 - 44	0.00e+00
36 - 40	0.00e+00
32 - 36	0.00e+00
28 - 32	0.00e+00
24 - 28	0.00e+00
20 - 24	0.00e+00
16 - 20	0.00e+00
12 - 16	0.00e+00
8 - 12	0.00e+00
4 - 8	0.00e+00
0 - 4	0.00e+00

Total sum of fission probabilities 0.000e+00

Excitation energy window - average = 0 FWHM = 0

Spin window - average = 0 FWHM = 0

Average fabs projection 0 Average rms proj 0