

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 $E = 333$ MeV is 813.592 mb

Fusion radius = 9.8 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) | 333.00 |
| Center of mass energy (MeV) | 81.00 |
| Compound nucleus excitation energy (MeV) | 69.756 |
| Q-value of reaction (MeV) | -11.244 |
| Compound nucleus recoil energy (MeV) | 252.000 |
| Compound nucleus recoil velocity (cm/ns) | 2.095e+00 |
| Compound nucleus velocity/c | 6.982e-02 |
| Beam velocity (cm/ns) | 2.768e+00 |
| Beam velocity/c | 9.226e-02 |

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

*** diffuseness = 2.00

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

Experimental fusion cross section (mb) 8.14e+02

Fusion L-grazing 44.64

Fusion L-diffuseness 2.00

Yrast spin at maximum excitation energy 72

Compound nucleus formation cross section (mb) 8.13e+02

| Partial cross sections (mb) | | | | | | | | | |
|-----------------------------|--------|----|--------|----|--------|----|--------|----|--------|
| J | SIG(J) | J | SIG(J) | J | SIG(J) | J | SIG(J) | J | SIG(J) |
| 0 | 0.4 | 12 | 9.9 | 24 | 19 | 36 | 29 | 48 | 6 |
| 1 | 1.2 | 13 | 11 | 25 | 20 | 37 | 29 | 49 | 4 |
| 2 | 2 | 14 | 12 | 26 | 21 | 38 | 29 | 50 | 2.6 |
| 3 | 2.8 | 15 | 12 | 27 | 22 | 39 | 30 | 51 | 1.6 |
| 4 | 3.6 | 16 | 13 | 28 | 23 | 40 | 29 | 52 | 1 |
| 5 | 4.4 | 17 | 14 | 29 | 23 | 41 | 28 | 53 | 0.64 |
| 6 | 5.2 | 18 | 15 | 30 | 24 | 42 | 27 | 54 | 0.4 |
| 7 | 6 | 19 | 15 | 31 | 25 | 43 | 24 | 55 | 0.25 |
| 8 | 6.7 | 20 | 16 | 32 | 26 | 44 | 20 | 56 | 0.15 |
| 9 | 7.5 | 21 | 17 | 33 | 27 | 45 | 16 | 57 | 0.094 |
| 10 | 8.3 | 22 | 18 | 34 | 27 | 46 | 12 | 58 | 0.058 |
| 11 | 9.1 | 23 | 19 | 35 | 28 | 47 | 8.9 | | |

***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 | 59 | 108 In | 2 | 0.2% | 1.63 |
| 49 | 58 | 107 In | 162 | 16.2% | 132 |
| 48 | 59 | 107 Cd | 93 | 9.3% | 75.7 |
| 47 | 60 | 107 Ag | 13 | 1.3% | 10.6 |
| 49 | 57 | 106 In | 197 | 19.7% | 160 |
| 48 | 58 | 106 Cd | 258 | 25.8% | 210 |
| 47 | 59 | 106 Ag | 13 | 1.3% | 10.6 |
| 46 | 60 | 106 Pd | 1 | 0.1% | 0.813 |
| 49 | 56 | 105 In | 3 | 0.3% | 2.44 |
| 47 | 57 | 104 Ag | 106 | 10.6% | 86.2 |
| 46 | 58 | 104 Pd | 30 | 3% | 24.4 |

| | | | | | |
|--------------|----|---------------|-------------|------------|----------------|
| 47 | 56 | 103 Ag | 85 | 8.5% | 69.1 |
| 46 | 57 | 103 Pd | 16 | 1.6% | 13 |
| 45 | 56 | 101 Rh | 13 | 1.3% | 10.6 |
| 44 | 57 | 101 Ru | 1 | 0.1% | 0.813 |
| 45 | 55 | 100 Rh | 6 | 0.6% | 4.88 |
| 43 | 55 | 98 Tc | 1 | 0.1% | 0.813 |
| TOTAL | | | 1000 | 100 | 813.499 |

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 = 58 (107In)

Residual velocity/c $V_z = 7.24\text{e-}02$ (sig = $1.16\text{e-}03$) rms $V_{xy} = 1.56\text{e-}03$

| 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 186 | | | | | | | | | | | | | | | | | | |
| 222 - 226 | 1 | | | | | | | | | | | | | | | | | |
| 226 - 230 | 1 | 1 | | | | | | | | | | | | | | | | |
| 230 - 234 | 5 | 5 | | | | | | | | | | | | | | | | |
| 234 - 238 | 11 | 13 | 1 | | | | | | | | | | | | | | | |
| 238 - 242 | 13 | 11 | 2 | | | | | | | | | | | | | | | |
| 242 - 246 | 12 | 13 | 5 | | | | | | | | | | | | | | | |
| 246 - 250 | 16 | 14 | 1 | | | | | | | | | | | | | | | |
| 250 - 254 | 6 | 10 | 1 | | | | | | | | | | | | | | | |
| 254 - 258 | 5 | 5 | | | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | | |
|--------------|---------|---------|---------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 258 - 262 | 3 | 5 | | | | | | | | | | | | | | | | |
| 262 - 266 | 2 | | | | | | | | | | | | | | | | | |
| Above 302 | | | | | | | | | | | | | | | | | | |
| Total | 75 | 77 | 10 | | | | | | | | | | | | | | | |
| dSig/dOmegeg | 6.4e+04 | 2.2e+04 | 1.7e+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 - 186 | | | | | | | | | | | | | | | | | | |
| 186 - 248 | 50 | 52 | 9 | | | | | | | | | | | | | | | |
| 248 - 310 | 25 | 25 | 1 | | | | | | | | | | | | | | | |
| Above 310 | | | | | | | | | | | | | | | | | | |

2.2 Energy and angular distribution of residual nucleus Z = 48 and N = 59 (107Cd)

Residual velocity/c $V_z = 7.25e-02$ (sig = $1.40e-03$) rms $V_{xy} = 1.66e-03$

| 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 186 | | | | | | | | | | | | | | | | | | |
| 226 - 230 | 4 | 2 | 2 | | | | | | | | | | | | | | | |
| 230 - 234 | 8 | 3 | | | | | | | | | | | | | | | | |
| 234 - 238 | 5 | 6 | 2 | | | | | | | | | | | | | | | |
| 238 - 242 | 5 | 6 | 2 | | | | | | | | | | | | | | | |
| 242 - 246 | 6 | 6 | 3 | | | | | | | | | | | | | | | |
| 246 - 250 | 3 | 6 | 1 | | | | | | | | | | | | | | | |
| 250 - | 3 | 3 | 1 | | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | | |
|-------------|---------|---------|-------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 254 | | | | | | | | | | | | | | | | | | |
| 254 - 258 | 3 | 4 | | | | | | | | | | | | | | | | |
| 258 - 262 | 4 | 2 | 1 | | | | | | | | | | | | | | | |
| 262 - 266 | 2 | | | | | | | | | | | | | | | | | |
| Above 302 | | | | | | | | | | | | | | | | | | |
| Total | 43 | 38 | 12 | | | | | | | | | | | | | | | |
| dSig/dOm eg | 3.7e+04 | 1.1e+04 | 2e+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 - 186 | | | | | | | | | | | | | | | | | | |
| 186 - 248 | 30 | 25 | 10 | | | | | | | | | | | | | | | |
| 248 - 310 | 13 | 13 | 2 | | | | | | | | | | | | | | | |
| Above 310 | | | | | | | | | | | | | | | | | | |

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

Residual velocity/c Vz = 7.09e-02(sig = 1.09e-03) rms Vxy = 1.41e-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 186 | | | | | | | | | | | | | | | | | | |
| 222 - 226 | 1 | | | | | | | | | | | | | | | | | |
| 226 - 230 | 6 | 3 | | | | | | | | | | | | | | | | |
| 230 - 234 | 12 | 7 | | | | | | | | | | | | | | | | |
| 234 - 238 | 14 | 10 | 1 | | | | | | | | | | | | | | | |
| 238 - 242 | 18 | 22 | 3 | | | | | | | | | | | | | | | |

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|-------------|-------|---------|-------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 242 - 246 | 21 | 12 | 2 | | | | | | | | | | | | | | | |
| 246 - 250 | 19 | 14 | | | | | | | | | | | | | | | | |
| 250 - 254 | 10 | 12 | | | | | | | | | | | | | | | | |
| 254 - 258 | 5 | 2 | | | | | | | | | | | | | | | | |
| 258 - 262 | | 3 | | | | | | | | | | | | | | | | |
| Above 302 | | | | | | | | | | | | | | | | | | |
| Total | 106 | 85 | 6 | | | | | | | | | | | | | | | |
| dSig/dOm eg | 9e+04 | 2.4e+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 - 186 | | | | | | | | | | | | | | | | | | |
| 186 - 248 | 84 | 61 | 6 | | | | | | | | | | | | | | | |
| 248 - 310 | 22 | 24 | | | | | | | | | | | | | | | | |
| Above 310 | | | | | | | | | | | | | | | | | | |

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

Residual velocity/c $V_z = 7.26e-02$ (sig = $1.24e-03$) rms $V_{xy} = 1.50e-03$

| 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 186 | | | | | | | | | | | | | | | | | | |
| 222 - 226 | 1 | 2 | | | | | | | | | | | | | | | | |
| 226 - 230 | 8 | 7 | | | | | | | | | | | | | | | | |
| 230 - 234 | 12 | 8 | 3 | | | | | | | | | | | | | | | |
| 234 - | 20 | 20 | 1 | | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | | |
|-------------|---------|---------|---------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 238 | | | | | | | | | | | | | | | | | | |
| 238 - 242 | 23 | 26 | 2 | | | | | | | | | | | | | | | |
| 242 - 246 | 19 | 18 | 2 | | | | | | | | | | | | | | | |
| 246 - 250 | 15 | 21 | 2 | | | | | | | | | | | | | | | |
| 250 - 254 | 13 | 11 | 1 | | | | | | | | | | | | | | | |
| 254 - 258 | 5 | 5 | 2 | | | | | | | | | | | | | | | |
| 258 - 262 | 6 | 2 | | | | | | | | | | | | | | | | |
| 262 - 266 | 1 | | | | | | | | | | | | | | | | | |
| 266 - 270 | 2 | | | | | | | | | | | | | | | | | |
| Above 302 | | | | | | | | | | | | | | | | | | |
| Total | 125 | 120 | 13 | | | | | | | | | | | | | | | |
| dSig/dOm eg | 1.1e+05 | 3.4e+04 | 2.2e+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 - 186 | | | | | | | | | | | | | | | | | | |
| 186 - 248 | 88 | 91 | 10 | | | | | | | | | | | | | | | |
| 248 - 310 | 37 | 29 | 3 | | | | | | | | | | | | | | | |
| Above 310 | | | | | | | | | | | | | | | | | | |

2.5 Energy and angular distribution of residual nucleus Z = 47 and N = 57 (104Ag)

Residual velocity/c $V_z = 7.02e-02$ (sig = $2.23e-03$) rms $V_{xy} = 2.98e-03$

| 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 186 | | | | | | | | | | | | | | | | | | |
| 206 - | | 1 | | | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | |
|------------|---------|---------|---------|---------|----|------|------|------|------|------|------|------|------|------|------|------|------|
| 210 | | | | | | | | | | | | | | | | | |
| 210 - 214 | 2 | | 1 | | | | | | | | | | | | | | |
| 214 - 218 | 1 | 4 | | 1 | | | | | | | | | | | | | |
| 218 - 222 | | 2 | 3 | | | | | | | | | | | | | | |
| 222 - 226 | 1 | 3 | 3 | 2 | | | | | | | | | | | | | |
| 226 - 230 | | 2 | 2 | 3 | | | | | | | | | | | | | |
| 230 - 234 | 1 | | 6 | 3 | | | | | | | | | | | | | |
| 234 - 238 | | 3 | 5 | 2 | | | | | | | | | | | | | |
| 238 - 242 | | 3 | 2 | 3 | 1 | | | | | | | | | | | | |
| 242 - 246 | | | 4 | 3 | | | | | | | | | | | | | |
| 246 - 250 | 1 | 2 | 6 | 2 | | | | | | | | | | | | | |
| 250 - 254 | | 1 | 4 | 2 | | | | | | | | | | | | | |
| 254 - 258 | 2 | 3 | 3 | | | | | | | | | | | | | | |
| 258 - 262 | | 2 | 5 | | | | | | | | | | | | | | |
| 262 - 266 | | 1 | | | | | | | | | | | | | | | |
| 266 - 270 | 1 | 2 | 1 | | | | | | | | | | | | | | |
| 270 - 274 | 1 | | | | | | | | | | | | | | | | |
| Above 302 | | | | | | | | | | | | | | | | | |
| Total | 10 | 29 | 45 | 21 | 1 | | | | | | | | | | | | |
| dSig/dOmeq | 8.5e+03 | 8.2e+03 | 7.7e+03 | 2.6e+03 | 95 | 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 - 186 | | | | | | | | | | | | | | | | | |
| 186 - 248 | 5 | 20 | 29 | 18 | 1 | | | | | | | | | | | | |
| 248 - 310 | 5 | 9 | 16 | 3 | | | | | | | | | | | | | |
| Above 310 | | | | | | | | | | | | | | | | | |

2.6 Energy and angular distribution of residual nucleus Z = 46 and N = 58 (104Pd)

Residual velocity/c $V_z = 7.14\text{e-}02$ (sig = $2.10\text{e-}03$) rms $V_{xy} = 2.92\text{e-}03$

| 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 186 | | | | | | | | | | | | | | | | | | |
| 206 - 210 | 1 | | | | | | | | | | | | | | | | | |
| 214 - 218 | 1 | | | | | | | | | | | | | | | | | |
| 218 - 222 | | | 1 | 1 | | | | | | | | | | | | | | |
| 222 - 226 | | 2 | 1 | | | | | | | | | | | | | | | |
| 226 - 230 | | | 1 | | | | | | | | | | | | | | | |
| 230 - 234 | | 1 | 2 | | | | | | | | | | | | | | | |
| 234 - 238 | | 1 | | 3 | | | | | | | | | | | | | | |
| 238 - 242 | 1 | | 1 | | | | | | | | | | | | | | | |
| 242 - 246 | | 1 | | 1 | | | | | | | | | | | | | | |
| 246 - 250 | 1 | | | 1 | | | | | | | | | | | | | | |
| 250 - 254 | | | 3 | | | | | | | | | | | | | | | |
| 254 - 258 | 1 | 1 | 2 | | | | | | | | | | | | | | | |
| 258 - 262 | | | 1 | | | | | | | | | | | | | | | |
| 262 - 266 | | | 1 | | | | | | | | | | | | | | | |
| Above 302 | | | | | | | | | | | | | | | | | | |
| Total | 5 | 6 | 13 | 6 | | | | | | | | | | | | | | |
| dSig/ | 4. | 1. | 2. | 7. | 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 |

| | | | | | | | | | | | | | | | | | | |
|---------------|-----------|-----------|-----------|-----------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| dOm eg | 3e+0 3 | 7e+0 3 | 2e+0 3 | 3e+0 2 | | | | | | | | | | | | | | |
| 0 - 186 | | | | | | | | | | | | | | | | | | |
| 186 - 248 | 4 | 5 | 6 | 6 | | | | | | | | | | | | | | |
| 248 - 310 | 1 | 1 | 7 | | | | | | | | | | | | | | | |
| Abov e 310 | | | | | | | | | | | | | | | | | | |

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

Residual velocity/c Vz = 7.19e-02(sig = 2.12e-03) rms Vxy = 2.48e-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 186 | | | | | | | | | | | | | | | | | | |
| 202 - 206 | | 1 | | | | | | | | | | | | | | | | |
| 210 - 214 | 2 | 1 | | | | | | | | | | | | | | | | |
| 214 - 218 | | 2 | | | | | | | | | | | | | | | | |
| 218 - 222 | | 3 | 1 | | | | | | | | | | | | | | | |
| 222 - 226 | | 1 | 2 | 1 | | | | | | | | | | | | | | |
| 226 - 230 | 2 | 3 | 6 | 1 | | | | | | | | | | | | | | |
| 230 - 234 | | 5 | 2 | 1 | | | | | | | | | | | | | | |
| 234 - 238 | | 1 | 2 | 1 | | | | | | | | | | | | | | |
| 238 - 242 | | 1 | 1 | 1 | | | | | | | | | | | | | | |
| 242 - 246 | | 3 | 4 | | | | | | | | | | | | | | | |
| 246 - | 1 | 1 | 5 | 1 | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | | |
|--------------|---------|---------|---------|---------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 250 | | | | | | | | | | | | | | | | | | |
| 250 - 254 | 2 | 5 | 3 | | | | | | | | | | | | | | | |
| 254 - 258 | 3 | 6 | 2 | 2 | | | | | | | | | | | | | | |
| 258 - 262 | 2 | 2 | | | | | | | | | | | | | | | | |
| 262 - 266 | 2 | | | | | | | | | | | | | | | | | |
| Above 302 | | | | | | | | | | | | | | | | | | |
| Total | 14 | 35 | 28 | 8 | | | | | | | | | | | | | | |
| dSig/dOmegeg | 1.2e+04 | 9.9e+03 | 4.8e+03 | 9.7e+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 - 186 | | | | | | | | | | | | | | | | | | |
| 186 - 248 | 4 | 22 | 22 | 6 | | | | | | | | | | | | | | |
| 248 - 310 | 10 | 13 | 6 | 2 | | | | | | | | | | | | | | |
| Above 310 | | | | | | | | | | | | | | | | | | |

2.8 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 186 | | | | | | | | | | | | | | | | | | |
| 194 - 198 | | | 1 | | | | | | | | | | | | | | | |
| 202 - 206 | 1 | 2 | | | | | | | | | | | | | | | | |
| 206 - 210 | 1 | 1 | 1 | | | | | | | | | | | | | | | |
| 210 - 214 | 4 | 2 | 1 | 1 | | | | | | | | | | | | | | |
| 214 - 218 | 2 | 6 | 2 | 1 | | | | | | | | | | | | | | |
| 218 - 222 | | 5 | 6 | 2 | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | | |
|-------------|---------|---------|---------|-------|---------|----|------|------|------|------|------|------|------|------|------|------|------|------|
| 222 - 226 | 4 | 8 | 6 | 4 | 1 | | | | | | | | | | | | | |
| 226 - 230 | 22 | 19 | 12 | 4 | | | | | | | | | | | | | | |
| 230 - 234 | 39 | 31 | 16 | 5 | | | | | | | | | | | | | | |
| 234 - 238 | 51 | 57 | 17 | 7 | | | | | | | | | | | | | | |
| 238 - 242 | 63 | 76 | 15 | 4 | 1 | 1 | | | | | | | | | | | | |
| 242 - 246 | 61 | 56 | 21 | 4 | | | | | | | | | | | | | | |
| 246 - 250 | 56 | 63 | 17 | 4 | | | | | | | | | | | | | | |
| 250 - 254 | 35 | 45 | 14 | 2 | | | | | | | | | | | | | | |
| 254 - 258 | 25 | 26 | 10 | 3 | | | | | | | | | | | | | | |
| 258 - 262 | 15 | 16 | 7 | | | | | | | | | | | | | | | |
| 262 - 266 | 7 | 2 | 2 | | | | | | | | | | | | | | | |
| 266 - 270 | 3 | 2 | 1 | | | | | | | | | | | | | | | |
| 270 - 274 | 1 | | | | | | | | | | | | | | | | | |
| Above 302 | | | | | | | | | | | | | | | | | | |
| Total | 390 | 417 | 149 | 41 | 2 | 1 | | | | | | | | | | | | |
| dSig/dOm eg | 3.3e+05 | 1.2e+05 | 2.5e+04 | 5e+03 | 1.9e+02 | 77 | 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 - 186 | | | | | | | | | | | | | | | | | | |
| 186 - 248 | 275 | 296 | 109 | 35 | 2 | 1 | | | | | | | | | | | | |
| 248 - 310 | 115 | 121 | 40 | 6 | | | | | | | | | | | | | | |
| Above 310 | | | | | | | | | | | | | | | | | | |

Neutron spectra in laboratory coordinates 3847 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 | | 6 | 15 | 23 | 39 | 49 | 45 | 29 | 30 | 22 | 21 | 21 | 10 | 8 | 4 | 4 | |
| 1 - 2 | 2 | 3 | 8 | 8 | 23 | 80 | 58 | 52 | 53 | 34 | 14 | 20 | 15 | 13 | 5 | 7 | 6 | |
| 2 - 3 | 10 | 2 | 8 | 19 | 41 | 87 | 64 | 41 | 41 | 20 | 10 | 7 | 9 | 2 | 3 | | 2 | 1 |
| 3 - 4 | 1 | 6 | 6 | 28 | 84 | 75 | 50 | 33 | 32 | 17 | 11 | 5 | 1 | 2 | 1 | | 2 | |
| 4 - 5 | | 7 | 16 | 59 | 72 | 65 | 40 | 24 | 15 | 6 | 6 | 4 | 1 | | | | | |
| 5 - 6 | 2 | 17 | 49 | 77 | 50 | 55 | 27 | 14 | 15 | 5 | 4 | 3 | 1 | | | | | |
| 6 - 7 | 11 | 28 | 69 | 71 | 56 | 36 | 26 | 10 | 6 | 4 | 2 | 2 | | | | | | |
| 7 - 8 | 22 | 58 | 84 | 49 | 35 | 25 | 18 | 10 | 5 | 3 | | | | | | | | |
| 8 - 9 | 22 | 56 | 51 | 54 | 43 | 22 | 9 | 11 | 4 | 1 | 1 | | | | | | | |
| 9 - 10 | 8 | 33 | 52 | 54 | 26 | 14 | 10 | 3 | | 1 | | 1 | | | | | | |
| 10 - 11 | 14 | 38 | 34 | 45 | 22 | 9 | 8 | 2 | 2 | | | | | | | | | |
| 11 - 12 | 11 | 25 | 38 | 23 | 18 | 6 | 5 | 3 | 2 | 2 | | | | | | | | |
| 12 - 13 | 5 | 15 | 25 | 18 | 17 | 2 | 1 | 1 | 2 | 1 | | | | | | | | |
| 13 - 14 | 5 | 32 | 22 | 5 | 8 | 5 | 2 | | | | | | | | | | | |
| 14 - 15 | 5 | 12 | 10 | 14 | 7 | 4 | 1 | | | | | | | | | | | |
| 15 - 16 | 5 | 10 | 5 | 6 | 4 | 3 | | 2 | | | | | | | | | | |
| 16 - 17 | 3 | 7 | 5 | 6 | 2 | 1 | 2 | 2 | | | | | | | | | | |
| 17 - 18 | 1 | 3 | 6 | 5 | 1 | 1 | | | | | | | | | | | | |
| 18 - 19 | 2 | 1 | 7 | 2 | | 1 | | | | | | | | | | | | |
| 19 - 20 | | 4 | 2 | 1 | | | | | | | | | | | | | | |
| 20 - 21 | 1 | 2 | 5 | 2 | | | | | | | | | | | | | | |
| 21 - 22 | | | 3 | | 1 | | | | | | | | | | | | | |
| 22 - 23 | 2 | | 1 | 2 | | | | | | | | | | | | | | |
| 23 - 24 | 1 | | | | | 2 | | | | | | | | | | | | |
| 24 - 25 | 1 | | | 1 | | | 1 | | | | | | | | | | | |
| 25 - 26 | | | 1 | 1 | | | | | | | | | | | | | | |
| 26 - 27 | 1 | | 1 | | | | | | | | | | | | | | | |
| 27 - | | | | 1 | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | | |
|-------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------|---------|---------|---------|---------|---------|---------|---------|---------|
| 28 | | | | | | | | | | | | | | | | | | |
| Above 30 | | 1 | | | | | | | | | | | | | | | | |
| Total | 137 | 360 | 514 | 566 | 533 | 532 | 371 | 253 | 206 | 124 | 70 | 63 | 48 | 27 | 17 | 11 | 14 | 1 |
| dSig/dOmega | 1166.51 | 1032.21 | 902.552 | 732.281 | 559.355 | 481.929 | 303.754 | 194.351 | 153.431 | 92.352 | 53.7644 | 51.5667 | 43.4643 | 28.3183 | 21.9757 | 19.2908 | 40.0528 | 8.45735 |
| 0 - 5 | 15 | 18 | 44 | 129 | 243 | 346 | 261 | 195 | 170 | 107 | 63 | 57 | 47 | 27 | 17 | 11 | 14 | 1 |
| 5 - 10 | 65 | 192 | 305 | 305 | 210 | 152 | 90 | 48 | 30 | 14 | 7 | 6 | 1 | | | | | |
| 10 - 20 | 51 | 147 | 154 | 125 | 79 | 32 | 19 | 10 | 6 | 3 | | | | | | | | |
| Above 20 | 6 | 3 | 11 | 7 | 1 | 2 | 1 | | | | | | | | | | | |

Proton spectra in laboratory coordinates 453 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 | | | | | | | | | | | | | 1 | | | | | |
| 1 - 2 | | | | | | | | | | | | 3 | | | 3 | 2 | 1 | |
| 2 - 3 | | | | | | | | | 1 | 5 | 3 | 4 | 4 | 2 | 1 | 1 | | 1 |
| 3 - 4 | | | | | | | 2 | 1 | 5 | 9 | 3 | 6 | 3 | 4 | | 2 | | |
| 4 - 5 | | | | | | 1 | 1 | 3 | 7 | 7 | 5 | 3 | 4 | 2 | 1 | | | |
| 5 - 6 | | | | | | 1 | 6 | 6 | 8 | 6 | 2 | 2 | | | 1 | 1 | | |
| 6 - 7 | | | | | | 1 | 2 | 3 | 3 | 4 | 1 | | 1 | | | | | |
| 7 - 8 | | | | | 1 | 2 | 7 | 8 | 4 | | 3 | 1 | | | | | | |
| 8 - 9 | | | | | 1 | 3 | 6 | 6 | | | | 1 | | | | | | |
| 9 - 10 | | | 1 | 2 | 2 | 3 | 7 | 5 | 3 | 1 | | 1 | | | | | | |
| 10 - 11 | | | | 1 | 3 | 8 | 1 | 6 | 2 | 2 | | | | | | | | |
| 11 - 12 | | | 3 | 1 | 9 | 4 | 5 | 2 | 4 | | | | | | | | | |
| 12 - 13 | | 1 | 2 | 3 | 4 | 9 | 3 | | | | | | | | | | | |
| 13 - 14 | | 4 | 3 | 5 | 5 | 3 | | 4 | | | | | | | | | | |
| 14 - 15 | | 2 | 4 | 3 | 6 | 5 | 4 | 2 | 1 | | | | | | | | | |
| 15 - 16 | | 7 | 3 | 2 | 1 | 1 | | | | | | | | | | | | |
| 16 - 17 | 1 | 3 | 5 | 8 | 2 | 1 | | | | | | | | | | | | |
| 17 - | 3 | 2 | 6 | 5 | 5 | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | | |
|-------------|-------------|-------------|-------------|-------------|-------------|------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|------------|-------------|-------------|-------------|-------------|
| 18 | | | | | | | | | | | | | | | | | | |
| 18 - 19 | 1 | 3 | 4 | 1 | | | | | | | | | | | | | | |
| 19 - 20 | | 3 | 4 | 4 | 1 | | | | | | | | | | | | | |
| 20 - 21 | | 2 | 1 | 3 | | | | | | | | | | | | | | |
| 21 - 22 | 1 | 6 | 1 | 1 | | | | | | | | | | | | | | |
| 22 - 23 | | 1 | 2 | | | | | | | | | | | | | | | |
| 23 - 24 | 1 | 1 | 2 | 1 | | | | | | | | | | | | | | |
| 24 - 25 | 1 | 1 | 3 | 2 | | | | | | | | | | | | | | |
| 25 - 26 | | 1 | | 1 | | | | | | | | | | | | | | |
| 27 - 28 | | 1 | | | | | | | | | | | | | | | | |
| 28 - 29 | | 1 | | | | | | | | | | | | | | | | |
| 29 - 30 | | | | 1 | | | | | | | | | | | | | | |
| Above 30 | | | 1 | | | | | | | | | | | | | | | |
| Total | 8 | 39 | 45 | 44 | 40 | 42 | 44 | 46 | 38 | 34 | 17 | 21 | 13 | 8 | 6 | 6 | 1 | 1 |
| dSig/dOmega | 68.1 172 | 111. 823 | 79.0 172 | 56.9 264 | 41.9 779 | 38.0 47 | 36.0 248 | 35.3 365 | 28.3 029 | 25.3 223 | 13.0 571 | 17.1 889 | 11.7 716 | 8. 3906 | 7. 75613 | 10.5 223 | 2. 86092 | 8. 45735 |
| 0 - 5 | | | | | | 1 | 3 | 4 | 13 | 21 | 11 | 16 | 12 | 8 | 5 | 5 | 1 | 1 |
| 5 - 10 | | | 1 | 2 | 4 | 10 | 28 | 28 | 18 | 11 | 6 | 5 | 1 | | 1 | 1 | | |
| 10 - 20 | 5 | 25 | 34 | 33 | 36 | 31 | 13 | 14 | 7 | 2 | | | | | | | | |
| Above 20 | 3 | 14 | 10 | 9 | | | | | | | | | | | | | | |

Alpha spectra in laboratory coordinates 280 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 | | | | | | | | | | | | 1 | 2 | 2 | | | | |
| 1 - 2 | | | | | | | | 1 | | 4 | 3 | 1 | | | | | | |
| 2 - 3 | | | | | | | | | 1 | 3 | 3 | | | | | | | |
| 3 - 4 | | | | | | | | | 1 | 3 | 2 | 1 | | | | | | |

| | | | | | | | | | | | | | | | | | | |
|----------|---|----|----|----|----|---|---|---|---|---|---|---|---|--|--|--|--|--|
| 4 - 5 | | | | | | | | 2 | 2 | 1 | 1 | 1 | | | | | | |
| 5 - 6 | | | | | | | | | 3 | 1 | 2 | 1 | 1 | | | | | |
| 6 - 7 | | | | | | | | 1 | 1 | | | 1 | | | | | | |
| 7 - 8 | | | | | | | | 4 | 2 | 1 | | | | | | | | |
| 8 - 9 | | | | | | | | 4 | 4 | 2 | | | | | | | | |
| 9 - 10 | | | | | | | 1 | 4 | 1 | | | | | | | | | |
| 10 - 11 | | | | | | | 1 | 2 | 3 | | | | | | | | | |
| 11 - 12 | | | | | | | 4 | 4 | 1 | 1 | | | | | | | | |
| 12 - 13 | | | | | | | | 4 | 2 | | | | | | | | | |
| 13 - 14 | | | | | | 1 | 3 | 2 | | | | | | | | | | |
| 14 - 15 | | | | | | 3 | | 2 | | | | | | | | | | |
| 15 - 16 | | | | | | 2 | 3 | 2 | 1 | | | | | | | | | |
| 16 - 17 | | | | | | 2 | 4 | | | | | | | | | | | |
| 17 - 18 | | | | | | 6 | 1 | 3 | | | | | | | | | | |
| 18 - 19 | | | | | | 2 | 2 | | | | | | | | | | | |
| 19 - 20 | | | | | | 2 | | 1 | | | | | | | | | | |
| 20 - 21 | | | | | 1 | 2 | 2 | | | | | | | | | | | |
| 21 - 22 | | | | | 1 | 4 | | | | | | | | | | | | |
| 23 - 24 | | | | | 3 | | 2 | 1 | | | | | | | | | | |
| 24 - 25 | | | | | 3 | 3 | | | | | | | | | | | | |
| 25 - 26 | | | | | 8 | | | | | | | | | | | | | |
| 26 - 27 | | | | 2 | 2 | 1 | | | | | | | | | | | | |
| 27 - 28 | | | | 1 | 2 | 1 | | | | | | | | | | | | |
| 28 - 29 | | | | 4 | 4 | 1 | | | | | | | | | | | | |
| 29 - 30 | | | 1 | 2 | 5 | | | | | | | | | | | | | |
| Above 30 | 7 | 26 | 20 | 27 | 10 | 1 | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | | |
|-----------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|------------|-----------------|-----------------|-----------------|-----------------|---|---|---|---|
| Total | 7 | 26 | 21 | 36 | 39 | 31 | 23 | 36 | 21 | 8 | 13 | 12 | 5 | 2 | | | | |
| dSig/ dOmega | 59.6 025 | 74.5 483 | 36.8 747 | 46.5 761 | 40.9 284 | 28.0 823 | 18.8 311 | 27.6 547 | 15.6 411 | 5. 9582 | 9. 9848 2 | 9. 8222 2 | 4. 5275 3 | 2. 0976 5 | 0 | 0 | 0 | 0 |
| 0 - 5 | | | | | | | | 2 | 3 | 3 | 11 | 10 | 4 | 2 | | | | |
| 5 - 10 | | | | | | | 1 | 13 | 11 | 4 | 2 | 2 | 1 | | | | | |
| 10 - 20 | | | | | | 18 | 18 | 20 | 7 | 1 | | | | | | | | |
| Above 20 | 7 | 26 | 21 | 36 | 39 | 13 | 4 | 1 | | | | | | | | | | |

Gamma ray spectrum 8403 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 | 693 | 693 |
| 1 - 2 | 5140 | 2570 | 7710 |
| Total | 5140 | 3263 | 8403 |

7.8 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 = **5.51282** hbar

**** successive decays through single yrast cascade assumed

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

| Ex(MeV) | Neut | Prot | Alpha | Gamma |
|---------|------|------|-------|-------|
| 0 - 1 | 112 | | | 693 |
| 1 - 2 | 798 | | | 7710 |
| 2 - 3 | 871 | | | |
| 3 - 4 | 670 | 5 | | |
| 4 - 5 | 503 | 17 | | |
| 5 - 6 | 338 | 48 | | |
| 6 - 7 | 212 | 74 | | |

| | | | | |
|-----------------------|---------|---------|---------|---------|
| 7 - 8 | 115 | 77 | | |
| 8 - 9 | 71 | 71 | | |
| 9 - 10 | 60 | 58 | 1 | |
| 10 - 11 | 34 | 36 | 9 | |
| 11 - 12 | 23 | 26 | 14 | |
| 12 - 13 | 10 | 18 | 36 | |
| 13 - 14 | 12 | 10 | 44 | |
| 14 - 15 | 6 | 8 | 43 | |
| 15 - 16 | 6 | 3 | 39 | |
| 16 - 17 | 1 | | 24 | |
| 17 - 18 | | | 16 | |
| 18 - 19 | 4 | 2 | 14 | |
| 19 - 20 | | | 7 | |
| 20 - 21 | | | 16 | |
| 21 - 22 | 1 | | 6 | |
| 22 - 23 | | | 3 | |
| 23 - 24 | | | 3 | |
| 24 - 25 | | | 3 | |
| 25 - 26 | | | 1 | |
| 26 - 27 | | | 1 | |
| Total | 3847 | 453 | 280 | 8403 |
| Average Energy | 3.77242 | 8.40508 | 15.4607 | 1.41753 |

Track down of decay modes at **69.6558** , **35.3779** , **10** MeV excitation

Ex = 69.6558

**Gamma = 0.221
MeV**

**Lifetime = 3e-21
sec**

**Average J =
16.045**

**Stand.dev. =
5.649**

| | Part | Num | DeIJ | RMS-dJ |
|------|-------------|------------|-------------|---------------|
| Neut | 4104 | -0.25 | 2.56171 | 14.8168 |
| Prot | 543 | -0.305709 | 2.3332 | 15.5546 |
| Alph | 352 | -3.40341 | 5.65836 | 19.4384 |
| Gamm | 1 | 2 | 2 | 10.3099 |

Ex = 35.3779

**Gamma = 0.0353
MeV**

**Lifetime =
2.28e-20 sec**

**Average J =
13.471**

**Stand.dev. =
4.964**

| | Part | Num | DeIJ | RMS-dJ |
|------|------|-----------|---------|---------|
| Neut | 4001 | -0.866783 | 2.27304 | 13.3477 |
| Prot | 544 | -0.895221 | 2.05843 | 14.7868 |
| Alph | 450 | -3.44444 | 5.37484 | 18.4644 |

Ex = 10

Gamma =
0.000173 MeV

Lifetime =
1.89e-11 sec

Average J = 8.826

Stand.dev. =
3.512

| | Part | Num | DeIJ | RMS-dJ |
|------|------|----------|---------|---------|
| Neut | 3134 | -1.20772 | 2.05562 | 11.833 |
| Prot | 250 | -1.14 | 1.93184 | 11.592 |
| Alph | 77 | -2.92208 | 4.21654 | 15.4416 |
| Gamm | 1530 | -1.78758 | 1.9215 | 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 | | 54 |
| 0.15 - 0.25 | | 66 |
| 0.25 - 0.35 | | 16 |
| 0.35 - 0.45 | | 50 |
| 0.45 - 0.55 | | 12 |
| 0.55 - 0.65 | 181 | 314 |
| 1.05 - 1.15 | 513 | 7197 |
| Above 3.05 | 0 | 0 |

M states at final J vs Ex

0 - 3 0.35 2.15 5.00

| | | | | | | | | | | | | | | | | | |
|---------|------|------|------|------|------|------|------|----|----|----|----|----|----|----|----|----|----|
| 3 - 6 | 0.25 | 2.08 | 2.21 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 6 - 9 | 0.47 | 2.01 | 2.04 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 9 - 12 | 0.99 | 2.22 | 2.49 | 2.85 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 12 - 15 | 1.56 | 2.51 | 2.56 | 2.31 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 15 - 18 | 1.19 | 1.98 | 2.71 | 2.95 | 6.50 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 18 - 21 | 1.38 | 1.98 | 2.16 | 2.51 | 2.88 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 21 - 24 | 1.38 | 1.93 | 2.60 | 2.51 | 2.58 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 24 - 27 | 1.15 | 2.28 | 2.78 | 2.35 | 1.00 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 27 - 30 | 1.13 | 2.23 | 2.31 | 2.88 | 3.00 | 3.00 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 30 - 33 | 1.14 | 1.77 | 2.07 | 2.19 | 2.75 | 1.00 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 33 - 36 | 1.29 | 1.98 | 2.19 | 2.56 | 1.71 | 5.00 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 36 - 39 | 1.00 | 1.97 | 2.39 | 2.48 | 2.42 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 39 - 42 | 1.75 | 2.04 | 1.99 | 1.97 | 3.00 | 2.00 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 42 - 45 | 1.11 | 1.83 | 1.75 | 1.71 | 2.85 | 1.00 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 45 - 48 | 0.67 | 1.58 | 1.66 | 1.90 | 1.88 | 2.50 | 2.00 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 48 - 51 | 1.50 | 1.88 | 1.77 | 1.53 | 2.47 | 3.00 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 51 - 54 | 1.00 | 1.63 | 1.72 | 1.98 | 1.64 | 0.50 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 54 - 57 | 0.86 | 1.47 | 1.65 | 1.59 | 1.42 | 0.80 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 57 - 60 | 2.00 | 1.02 | 1.01 | 1.10 | 0.92 | 1.20 | 1.00 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 60 - 63 | .. | .. | 0.33 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 63 - 66 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 66 - 69 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 69 - 72 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 72 - 75 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 75 - 78 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |

| | | | | | | | | | | | | | | | | | |
|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----|
| 78 - 81 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 81 - 84 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 84 - 87 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 87 - 90 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 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 = 3847 Out of = 1000 events Multiplicity = 3.847

Average Ecm = 3.8 Average spin removed = 1.3

| | | | | | | | | | | | | | | | | | | |
|------------|----|----|-----|-----|----|----|----|----|----|----|----|----|----|----|----|-----|---------|---------|
| 9 - 12 | 3 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 3 | 2 | 0 |
| 12 - 15 | 10 | 44 | 13 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 67 | 7.22388 | 2.92095 |
| 15 - 18 | 14 | 93 | 102 | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 210 | 9.14286 | 3.1135 |
| 18 - 21 | 10 | 74 | 87 | 18 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 189 | 9.98942 | 3.66304 |
| 21 - 24 | 5 | 54 | 73 | 43 | 3 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 178 | 11.5787 | 4.23562 |
| 24 - 27 | 12 | 43 | 65 | 41 | 3 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 164 | 11.3902 | 4.64537 |
| 27 - 30 | 7 | 52 | 103 | 52 | 8 | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | 223 | 12.1121 | 4.40251 |
| 30 - 33 | 13 | 71 | 89 | 62 | 12 | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | 248 | 11.8387 | 4.93651 |
| 33 - 36 | 6 | 39 | 70 | 39 | 13 | 3 | .. | .. | .. | .. | .. | .. | .. | .. | .. | 170 | 12.6765 | 5.11469 |
| 36 - 39 | 3 | 31 | 47 | 38 | 8 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 127 | 12.6693 | 4.66863 |
| 39 - 42 | 4 | 42 | 81 | 62 | 13 | 3 | .. | .. | .. | .. | .. | .. | .. | .. | .. | 205 | 13.1463 | 4.79105 |
| 42 - 45 | 8 | 57 | 84 | 68 | 26 | 5 | .. | .. | .. | .. | .. | .. | .. | .. | .. | 248 | 13.25 | 5.41149 |
| 45 - 48 | 3 | 36 | 76 | 51 | 18 | 1 | 1 | .. | .. | .. | .. | .. | .. | .. | .. | 186 | 13.3978 | 4.93863 |
| 48 - 51 | 1 | 21 | 26 | 23 | 11 | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. | 84 | 13.6667 | 5.4736 |
| 51 - 54 | 2 | 25 | 48 | 43 | 22 | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. | 142 | 14.2535 | 5.19268 |
| 54 - 57 | 5 | 49 | 102 | 109 | 51 | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. | 318 | 14.4843 | 5.02742 |

| | | | | | | | | | | | | | | | | | | | |
|---------------|-----|-----|------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------------|-------------|-------------|
| 57 - 60 | 3 | 38 | 82 | 82 | 44 | 14 | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. | 265 | 15.3208 | 5.73889 |
| 60 - 63 | 1 | 1 | 3 | .. | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 7 | 12.7143 | 6.77631 |
| 69 - 72 | 8 | 101 | 218 | 269 | 163 | 48 | 6 | .. | .. | .. | .. | .. | .. | .. | .. | .. | 813 | 15.9729 | 5.7326 |
| Ex / J | -4 | -9 | -14 | -19 | -24 | -29 | -34 | -39 | -44 | -49 | -54 | -59 | -64 | -69 | -74 | -79 | sum | avrg | stdv |
| Sum | 118 | 871 | 1369 | 1001 | 397 | 82 | 9 | .. | .. | .. | .. | .. | .. | .. | .. | .. | | | |

Decay summary. Mode = PROT Total = 453 Out of = 1000 events Multiplicity = 0.453

Average Ecm = 8.4 Average spin removed = 1

| | | | | | | | | | | | | | | | | | | | |
|---------------|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------------|-------------|-------------|
| 15 - 18 | 2 | 7 | 6 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 15 | 8.33333 | 3.39935 |
| 18 - 21 | 3 | 16 | 24 | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 44 | 9.61364 | 3.28368 |
| 21 - 24 | 3 | 6 | 12 | 6 | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 29 | 11.6552 | 5.24093 |
| 24 - 27 | .. | 4 | 11 | 4 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 19 | 12 | 3.24443 |
| 27 - 30 | 1 | 6 | 8 | 3 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 18 | 10.6111 | 4.01579 |
| 30 - 33 | 1 | 3 | 14 | 5 | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 25 | 12.8 | 4.4 |
| 33 - 36 | 1 | 6 | 7 | 4 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 18 | 10.8889 | 4.2673 |
| 36 - 39 | .. | 3 | 7 | 5 | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 16 | 13.25 | 4.14578 |
| 39 - 42 | .. | 3 | 7 | 6 | 3 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 19 | 14.3684 | 4.69278 |
| 42 - 45 | 1 | 4 | 13 | 6 | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 25 | 12.4 | 4.22374 |
| 45 - 48 | .. | 5 | 6 | 4 | 3 | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 19 | 14.1053 | 5.91959 |
| 48 - 51 | .. | 2 | 3 | 4 | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 11 | 14.7273 | 4.93763 |
| 51 - 54 | .. | 1 | 2 | 3 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 6 | 13.6667 | 3.72678 |
| 54 - 57 | 1 | 7 | 15 | 15 | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 40 | 13.25 | 4.43706 |
| 57 - 60 | 1 | 1 | 14 | 11 | 3 | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 31 | 14.7419 | 4.72446 |
| 69 - 72 | 4 | 16 | 31 | 41 | 17 | 8 | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | 118 | 15.3475 | 6.10831 |
| Ex / J | -4 | -9 | -14 | -19 | -24 | -29 | -34 | -39 | -44 | -49 | -54 | -59 | -64 | -69 | -74 | -79 | sum | avrg | stdv |
| Sum | 18 | 90 | 180 | 118 | 36 | 10 | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | | | |

Decay summary. Mode = ALPH Total = 280 Out of = 1000 events Multiplicity = 0.28

Average Ecm = 15 Average spin removed = 3.6

| | | | | | | | | | | | | | | | | | | | |
|---------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|---|---------|---------|
| 15 - 18 | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | 7 | 0 |
| 18 - 21 | .. | 2 | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 3 | 8.66667 | 2.35702 |
| 21 - 24 | .. | .. | 3 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 3 | 12 | 0 |
| 24 - 27 | 1 | 3 | 1 | 3 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 8 | 10.75 | 5.44862 |

| | | | | | | | | | | | | | | | | | | | |
|---------|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---------|---------|
| 27 - 30 | .. | 2 | 3 | 5 | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 12 | 14.9167 | 4.76897 |
| 30 - 33 | .. | 1 | 6 | 6 | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 15 | 15 | 4 |
| 33 - 36 | .. | 2 | 2 | 5 | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 10 | 14.5 | 4.60977 |
| 36 - 39 | .. | 1 | 2 | 5 | 3 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 11 | 16.5455 | 4.49977 |
| 39 - 42 | .. | .. | 6 | 7 | 1 | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 15 | 16 | 4.16333 |
| 42 - 45 | .. | 2 | 6 | 6 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 14 | 13.4286 | 3.49927 |
| 45 - 48 | .. | 4 | 4 | 5 | 3 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 16 | 14.1875 | 5.29409 |
| 48 - 51 | 1 | 1 | 2 | 3 | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 9 | 14.2222 | 6.28539 |
| 51 - 54 | .. | 1 | 3 | 4 | 3 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 11 | 16.0909 | 4.67983 |
| 54 - 57 | 1 | 4 | 5 | 12 | 9 | 3 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 34 | 16.8529 | 6.12196 |
| 57 - 60 | 1 | 5 | 13 | 12 | 5 | 10 | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. | 48 | 17.5208 | 7.37674 |
| 60 - 63 | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | 17 | 0 |
| 69 - 72 | .. | 6 | 9 | 24 | 24 | 6 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 69 | 18.087 | 5.3072 |
| Ex / J | -4 | -9 | -14 | -19 | -24 | -29 | -34 | -39 | -44 | -49 | -54 | -59 | -64 | -69 | -74 | -79 | sum | avrg | stdv |
| Sum | 4 | 35 | 66 | 98 | 55 | 20 | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. | | | |

Decay summary. Mode = G-E1 Total = 694 Out of = 1000 events Multiplicity = 0.694

Average Ecm = 1.2 Average spin removed = 0.27

| | | | | | | | | | | | | | | | | | | | |
|---------|-----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| 0 - 3 | 279 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 279 | 2 | 0 |
| 3 - 6 | 252 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 252 | 2 | 0 |
| 6 - 9 | 127 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 127 | 2 | 0 |
| 9 - 12 | 35 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 35 | 2 | 0 |
| 12 - 15 | 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 | 694 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | | | |

Decay summary. Mode = G-E2 Total = 7709 Out of = 1000 events Multiplicity = 7.709

Average Ecm = 1.4 Average spin removed = 1.1

| | | | | | | | | | | | | | | | | | | | |
|---------|------|-----|-----|----|----|----|----|----|----|----|----|----|----|----|----|----|------|---------|---------|
| 0 - 3 | 1220 | 175 | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1396 | 2.63395 | 1.67442 |
| 3 - 6 | 1882 | 442 | 29 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 2353 | 3.06247 | 2.19083 |
| 6 - 9 | 1137 | 592 | 138 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1867 | 4.32458 | 3.14881 |
| 9 - 12 | 407 | 552 | 242 | 20 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1221 | 6.48812 | 3.8294 |
| 12 - 15 | 25 | 228 | 298 | 39 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 590 | 9.97458 | 3.38356 |
| 15 - | .. | 1 | 129 | 78 | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 210 | 13.9286 | 2.57638 |

| | | | | | | | | | | | | | | | | | | | |
|---------|------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---------|--------|------|
| 18 | | | | | | | | | | | | | | | | | | | |
| 18 - 21 | .. | .. | 1 | 56 | 8 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 65 | 17.5385 | 1.7809 | |
| 21 - 24 | .. | .. | .. | .. | 7 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 7 | 22 | 0 | |
| Ex / J | -4 | -9 | -14 | -19 | -24 | -29 | -34 | -39 | -44 | -49 | -54 | -59 | -64 | -69 | -74 | -79 | sum | avrg | stdv |
| Sum | 4671 | 1990 | 838 | 193 | 17 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | | | |

Fission probability as function of excitation

Ex.Energy Probability

| | |
|---------|----------|
| 69 - 72 | 0.00e+00 |
| 60 - 63 | 0.00e+00 |
| 57 - 60 | 0.00e+00 |
| 54 - 57 | 0.00e+00 |
| 51 - 54 | 0.00e+00 |
| 48 - 51 | 0.00e+00 |
| 45 - 48 | 0.00e+00 |
| 42 - 45 | 0.00e+00 |
| 39 - 42 | 0.00e+00 |
| 36 - 39 | 0.00e+00 |
| 33 - 36 | 0.00e+00 |
| 30 - 33 | 0.00e+00 |
| 27 - 30 | 0.00e+00 |
| 24 - 27 | 0.00e+00 |
| 21 - 24 | 0.00e+00 |
| 18 - 21 | 0.00e+00 |
| 15 - 18 | 0.00e+00 |
| 12 - 15 | 0.00e+00 |
| 9 - 12 | 0.00e+00 |
| 6 - 9 | 0.00e+00 |
| 3 - 6 | 0.00e+00 |
| 0 - 3 | 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