

PRELIMINARY DOCUMENTATION ON THE PU-239 EVAL. FOR JEF-2

|                                                                    |                    |                |           |
|--------------------------------------------------------------------|--------------------|----------------|-----------|
| DERRIEN/DESAUSSURE                                                 | PU239 JANUARY 1988 | 9439 1451      | 4         |
|                                                                    |                    | 9439 1451      | 5         |
| STATUS OF THE EVALUATION , JANUARY 1988                            |                    | 9439 1451      | 6         |
|                                                                    |                    | 9439 1451      | 7         |
| *****                                                              |                    | 9439 1451      | 8         |
| THERMAL REGION                                                     |                    | 9439 1451      | 9         |
| *****                                                              |                    | 9439 1451      | 10        |
|                                                                    |                    | 9439 1451      | 11        |
| THE REICH-MOORE RESONANCE PARAMETERS HAVE BEEN OBTAINED FROM THE   |                    | 9439 1451      | 12        |
| ANALYSIS OF SEVERAL TRANSMISSION,FISSION,ABSORPTION AND CAPTURE    |                    | 9439 1451      | 13        |
| EXPERIMENTAL DATA(1,4,5,7,10).THE CROSS-SECTIONS AND THE WESCOTT   |                    | 9439 1451      | 14        |
| FACTORS OBTAINED FROM THESE PARAMETERS AT 0.0253 EV ARE GIVEN IN   |                    | 9439 1451      | 15        |
| THE FOLLOWING TABLE:                                               |                    | 9439 1451      | 16        |
|                                                                    |                    | 9439 1451      | 17        |
|                                                                    |                    | 9439 1451      | 18        |
|                                                                    |                    | 9439 1451      | 19        |
|                                                                    |                    | 9439 1451      | 20        |
| *****                                                              |                    | 9439 1451      | 21        |
| FISSION                                                            | 747.19 746.84      | 747.99+-1.87   | 9439 1451 |
| CAPTURE                                                            | 270.17 270.00      | 271.43+-2.14   | 9439 1451 |
| SCATTERING                                                         | 8.85               | 7.88+-0.97     | 9439 1451 |
| ABSORPTION                                                         | 1017.36 1016.84    | 1019.42+-4.00  | 9439 1451 |
| TOTAL                                                              | 1026.21            | 1027.30+-5.00  | 9439 1451 |
| *****                                                              |                    |                | 9439 1451 |
| GF                                                                 | 1.0526             | 1.0563+-0.0022 | 9439 1451 |
| GA                                                                 | 1.0768             | 1.0782+-0.0024 | 9439 1451 |
| *****                                                              |                    |                | 9439 1451 |
|                                                                    |                    |                | 9439 1451 |
| THE EXPERIMENTAL FISSION CROSS-SECTIONS WERE RENORMALIZED TO THE   |                    |                | 9439 1451 |
| VALUE OF 748.0 BARNS AT 0.0253 EV IN AGREEMENT WITH THE PROPOSED   |                    |                | 9439 1451 |
| STANDARD VALUE AND WITH THE UP-DATED ABSOLUTE VALUE OF DERUYTER    |                    |                | 9439 1451 |
| (12).THE OTHER EXPERIMENTAL ABSOLUTE VALUE IS THE 1025.0+-6.0      |                    |                | 9439 1451 |
| BARNS OBTAINED BY SPENCER(10) FOR THE TOTAL CROSS-SECTION.FITTING  |                    |                | 9439 1451 |
| THE RENORMALIZED EXPERIMENTAL FISSION,CAPTURE AND ABSORPTION DATA  |                    |                | 9439 1451 |
| AND SPENCER EXPERIMENTAL TRANSMISSION OVER THE ENERGY RANGE 0.02   |                    |                | 9439 1451 |
| EV TO 7.0 EV ONE OBTAINS,AT 0.0253 EV,270.00 BARNS FOR THE CAPTURE |                    |                | 9439 1451 |
| CROSS-SECTION AND 746.84 BARNS FOR THE FISSION CROSS-SECTION ,IN   |                    |                | 9439 1451 |
| VERY GOOD AGREEMENT WITH THE PROPOSED STANDARD VALUES.             |                    |                | 9439 1451 |
|                                                                    |                    |                | 9439 1451 |
| THE SCATTERING CROSS-SECTION IS 0.97 BARN LARGER THAN THE PROPOSED |                    |                | 9439 1451 |
| STANDARD.IT CORRESPONDS TO A RADIUS OF 9.48+-0.20 F OBTAINED IN    |                    |                | 9439 1451 |
| THE ANALYSIS OF THE TRANSMISSION DATA UP TO 1 KEV.TO OBTAIN THE    |                    |                | 9439 1451 |
| THE PROPOSED STANDARD VALUE ONE SHOULD USE A RADIUS OF 9.11 F.     |                    |                | 9439 1451 |
|                                                                    |                    |                | 9439 1451 |
| ONE SHOULD ALSO NOTE THAT THE 300 DEGREES K CROSS-SECTIONS CALCUL- |                    |                | 9439 1451 |
| ATED AT 0.0253 EV DEPEND ON THE WAY THE DOPPLER BROADENING CALCUL- |                    |                | 9439 1451 |
| ATION IS PERFORMED.FOR INSTANCE USING A GAUSSIAN BROADENING FUNC-  |                    |                | 9439 1451 |

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TION WILL GIVE A FISSION CROSS-SECTION ABOUT 2.5 BARNS LARGER THAN THE ONE OBTAINED FROM THE ACCURATE CALCULATION WHICH CONSERVES THE 1/V CROSSSECTION. THIS DIFFERENCE IS OF THE SAME ORDER OF MAGNITUDE THAN THE ACCURACY CLAIMED ON THE PROPOSED STANDARD FISSION CROSS-SECTION. THE VALUES GIVEN IN THE ABOVE TABLE WERE OBTAINED FROM AN ACCURATE CALCULATION METHOD (SPECIAL SAMMY OPTION FOR THE THERMAL ENERGY RANGE).

THE FOLLOWING TABLE SHOWS THE EXPERIMENTAL CROSS-SECTIONS AVERAGED ON TWO ENERGY INTERVALS AND COMPARED TO THE CALCULATED VALUES:

AVERAGE CROSS-SECTIONS(BARN)  
 \*\*\*\*\*  
 REFERENCES(1-10)      0.02 TO 0.06 EV      0.02 TO 0.65 EV  
 \*\*\*\*\*

|                   | EXP    | CALC           | EXP     | CALC            |
|-------------------|--------|----------------|---------|-----------------|
| GWIN71 FISS       | 631.41 |                | 843.71  |                 |
| GWIN76 FISS       | 631.41 |                | 838.39  |                 |
| GWIN84 FISS(*)    | 631.41 | 630.54(-0.13%) | 837.18  | 836.79(-0.05%)  |
| DERUYTER70 FISS   | 631.41 |                | 859.43  |                 |
| WAGEMANS80 FISS   | 631.41 |                | 862.56  |                 |
| GWIN71 CAPTURE    | 243.84 | 242.83(-0.42%) | 524.75  | 517.67(-1.37%)  |
| GWIN76 ABSORPT(*) | 875.90 | 873.53(-0.27%) | 1359.96 | 1355.67(-0.32%) |
| SPENCER84 TOT(*)  | 883.20 | 882.40(-0.09%) | 1361.69 | 1367.46(+0.48%) |

\*\*\*\*\*  
 (\*)THESE DATA HAD THE LARGIEST WEIGHT IN THE THERMAL FIT. THE VALUES BETWEEN THE PARENTHESES GIVE THE PERCENTAGE DEVIATION BETWEEN THE CALCULATED DATA AND THE EXPERIMENTAL DATA.  
 \*\*\*\*\*

THE VALUE OF 631.4 BARNS FOR ALL THE AVERAGE EXPERIMENTAL FISSION CROSS-SECTIONS IN THE ENERGY RANGE 0.02 EV TO 0.06 EV CORRESPONDS TO THE RENORMALIZATION OF ALL THE FISSION EXPERIMENTS TO 748.+-1. BARNS AT 0.0253 EV. ORNL DATA ARE CONSISTENT WITHIN 0.8% OVER THE 0.3 EV RESONANCE. DERUYTER AND WAGEMANS DATA ARE ABOUT 2.5 % LARGER AND WERE NOT INCLUDED IN THE FIT. WHEN NORMALIZED ON THE STANDARD VALUE AT 0.0253 EV, GWIN76 ABSORPTION AGREES WITH THE ABSORPTION OBTAINED FROM SPENCER TOTAL WITHIN 0.7% OVER THE RESONANCE. THE PRESENT EVALUATION IS ESSENTIALLY THE RESULT OF A CONSISTENT ANALYSIS OF ALL THE AVAILABLE ORNL DATA WITH A LARGER WEIGHT ON GWIN 1984 FISSION, GWIN 1976 ABSORPTION AND SPENCER TRANSMISSION DATA.

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 THE RESOLVED RESONANCE REGION  
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THE REICH-MOORE RESONANCE PARAMETERS ARE GIVEN IN THE ENERGY RANGE UP TO 1 KEV. FOUR NEGATIVE ENERGY RESONANCES AND THREE FICTITIOUS RESONANCES ABOVE 1 KEV ARE USED TO REPRESENT THE EFFECT OF THE EXTERNAL REGION RESONANCES. A CONSTANT VALUE OF 9.48 F COULD BE USED FOR THE SCATTERING RADIUS R' FOR THE CALCULATION OF THE CROSS-SECTION IN THE ENTIRE ENERGY RANGE ANALYSED.

THE SET OF RESONANCE PARAMETERS IS ESSENTIALLY THE RESULT OF A BAYESIAN REICH-MOORE ANALYSIS(SAMMY)(13) OF THE HARVEY TRANSMISSION DATA(9) AND GWIN AND WESTON 1984 FISSION DATA(7,8). THE HARVEY DATA WERE TAKEN ON A 80 M FLIGHT PATH AT LIQUID NITROGEN TEMPERA-

TURE WITH A RESOLUTION GOOD ENOUGH TO SEPARATE MORE THAN 80 % OF THE RESONANCE UP TO 1 KEV. BLONS 1973 DATA(3), WHICH HAVE BETTER RESOLUTION THAN WESTON DATA, WERE USED TO IDENTIFY THE NARROW FISSION RESONANCES IN THE HIGH ENERGY REGION. A PRELIMINARY CORRELATED FIT ON HARVEY, WESTON AND BLONS DATA, ALLOWING THE ADJUSTMENT OF THE NORMALIZATION COEFFICIENTS AND OF THE BACKGROUND CORRECTIONS, HAS SHOWN THAT NO SUCH ADJUSTMENT WAS NECESSARY TO HAVE CONSISTENCY BETWEEN HARVEY DATA AND WESTON DATA. BLONS NEEDED A LARGE READJUSTMENT OF THE BACKGROUND AND OF THE NORMALISATION. THE FINAL FIT WAS PERFORMED BY USING ONLY HARVEY, GWIN 1984(E < 30 EV) AND WESTON 1984(E > 10 EV) AS INPUT TO SAMMY.

IF ONE COMPARES THE MOST RECENT EXPERIMENTAL FISSION DATA, IN THE RESOLVED RESONANCE REGION ABOVE 100 EV, ONE FINDS THAT WESTON DATA ARE THE SMALLEST AND BLONS DATA THE LARGEST. THE FOLLOWING TABLE SHOWS THE PROPOSED ENDF/B-6 STANDARD VALUES(11) AND THE VALUES OBTAINED FROM THE RESONANCE PARAMETERS, AVERAGED IN THE SAME ENERGY INTERVALS:

| CROSS-SECTIONS IN BARN |        |               |              |             |  |  |
|------------------------|--------|---------------|--------------|-------------|--|--|
| *****                  |        |               |              |             |  |  |
| ENERGY                 | CALCUL | WESTON84      | BLONS73      | PROPOSED    |  |  |
| (KEV)                  |        |               |              | STANDARD    |  |  |
| *****                  |        |               |              |             |  |  |
| 0.1-0.2                | 18.070 | 18.095(-3.1%) | 18.93(+1.4%) | 18.66+-0.13 |  |  |
| 0.2-0.3                | 17.371 | 17.441(-2.7%) | 17.79(-0.5%) | 17.88+-0.12 |  |  |
| 0.3-0.4                | 8.083  | 8.130(-3.6%)  | 8.91(+5.7%)  | 8.43+-0.06  |  |  |
| 0.4-0.5                | 9.387  | 9.337(-2.5%)  | 9.71(+1.5%)  | 9.57+-0.07  |  |  |
| 0.5-0.6                | 15.086 | 15.170(-2.6%) | 15.51(-0.3%) | 15.56+-0.11 |  |  |
| 0.6-0.7                | 4.159  | 4.192(-6.4%)  | 4.63(+3.8%)  | 4.46+-0.04  |  |  |
| 0.7-0.8                | 5.316  | 5.385(-4.5%)  | 5.94(+5.5%)  | 5.63+-0.04  |  |  |
| 0.8-0.9                | 4.726  | 4.765(-4.5%)  | 5.11(+2.6%)  | 4.98+-0.04  |  |  |
| 0.9-1.0                | 8.086  | 8.165(-1.7%)  | 8.57(+3.3%)  | 8.30+-0.07  |  |  |
| *****                  |        |               |              |             |  |  |
| 0.1-1.0                | 10.033 | 10.075(-3.1%) | 10.57(+1.7%) | 10.39       |  |  |
| *****                  |        |               |              |             |  |  |

THE VALUES BETWEEN PARENTHESES ARE THE PERCENTAGE DEVIATION FROM THE STANDARD DATA. THE CALCULATED CROSS-SECTIONS AGREE WITHIN 0.4% ON AVERAGE WITH WESTON VALUES AND ARE ABOUT 3.5% SMALLER THAN THE PROPOSED STANDARD VALUES. THEY ARE ONLY 1.8% SMALLER THAN ENDF/B-5 OVER THE ENERGY RANGE 0.1 TO 1.0 KEV. THE AUTHORS OF THE PRESENT EVALUATION HAVE THE FEELING THAT MANY OF THE EXPERIMENTAL FISSION CROSS-SECTIONS SUFFER OF AN UNDERESTIMATION OF THE EXPERIMENTAL BACKGROUND LEADING TO SYSTEMATIC OVERESTIMATE OF THE CROSS-SECTION. THE AUTHORS OF ENDF/B-6 STANDARD EVALUATION HAVE PROBABLY NOT CONSIDERED THE BACKGROUND PROBLEMS IN THIS WAY. THE VERY SMALL ERRORS THEY OBTAINED ARE DUE TO A STATISTICAL PROCESSING OF A LARGE AMOUNT OF EXPERIMENTAL DATA. BLONS FISSION CROSS-SECTION ARE AN EXAMPLE OF DATA IN WHICH THE UNDERESTIMATION OF THE EXPERIMENTAL BACKGROUND COULD BE VERY IMPORTANT (ABOUT 3 BARN AT 40 EV AND 0.4 BARN AT 1 KEV).

GWIN 1971 AND GWIN 1976 ABSORPTION DATA(1,4) WERE NOT INCLUDED IN THE R-MATRIX ANALYSIS OF THE RESOLVED RESONANCE REGION. ACCURATE ABSORPTION CROSS-SECTIONS SHOULD BE CALCULATED BY THE PARAMETERS OBTAINED FROM THE ANALYSIS OF THE TRANSMISSION DATA. THE FOLLOWING

TABLE SHOWS AVERAGE CALCULATED VALUES OF THE CAPTURE, ABSORPTION AND ALPHA COMPARED TO GWIN 1976 DATA:

| CROSS-SECTIONS IN BARN |                   |        |       |                |         |
|------------------------|-------------------|--------|-------|----------------|---------|
| *****                  |                   |        |       |                |         |
| ENERGY(EV)             | CALCULATED VALUES |        |       | GWIN 1976 DATA |         |
| *****                  |                   |        |       |                |         |
|                        | CAPT              | ABSORP | ALPHA | ABSORP         | ALPHA   |
| 7.3- 16.0              | 79.16             | 195.40 | 0.681 | 208.00         | 0.74(*) |
| 16.0- 37.5             | 21.06             | 44.68  | 0.892 | 46.50          | 0.89(*) |
| 37.5- 50.0             | 49.28             | 69.82  | 2.401 | 83.15          | 2.96(*) |
| 50.0-100.0             | 34.16             | 91.12  | 0.600 | 92.84          | 0.63    |
| 100.0-200.0            | 15.69             | 33.76  | 0.868 | 33.66          | 0.87    |
| 200.0-300.0            | 16.01             | 33.38  | 0.922 | 34.69          | 0.94    |
| 300.0-400.0            | 9.65              | 17.68  | 1.194 | 18.31          | 1.16    |
| 400.0-500.0            | 3.88              | 13.27  | 0.414 | 13.56          | 0.44    |
| 500.0-600.0            | 10.18             | 25.27  | 0.675 | 26.54          | 0.72    |
| 600.0-700.0            | 6.30              | 10.46  | 1.515 | 11.57          | 1.54    |
| 700.0-800.0            | 4.65              | 9.97   | 0.875 | 10.52          | 0.97    |
| 800.0-900.0            | 3.51              | 8.24   | 0.743 | 9.30           | 0.82    |
| 900.0-999.9            | 4.96              | 12.99  | 0.613 | 13.23          | 0.70    |
| *****                  |                   |        |       |                |         |
| (*) GWIN 1971 DATA     |                   |        |       |                |         |

BELOW 500 EV THE CALCULATED ABSORPTION VALUES AGREE QUITE WELL WITH GWIN 1976 EXPERIMENTAL DATA AND ARE ON AVERAGE 6.2% LOWER ABOVE 500 EV .THE CALCULATED ALPHA VALUES ARE ON AVERAGE 7.4% LOWER ABOVE 500 EV.

THE FISSION AND CAPTURE RESONANCE INTEGRALS ARE COMPARED TO ENDF/ B-5 DATA IN THE FOLLOWING TABLE:

|                  |               |         |               |         |  |
|------------------|---------------|---------|---------------|---------|--|
| *****            |               |         |               |         |  |
| ENERGY RANGE(EV) | FISSION(BARN) |         | CAPTURE(BARN) |         |  |
| *****            |               |         |               |         |  |
|                  | ENDF/B-5      | PRESENT | ENDF/B-5      | PRESENT |  |
| 0.5 - 5.0        | 86.02         | 85.62   | 32.31         | 27.91   |  |
| 5.0 - 10.0       | 26.03         | 25.19   | 20.14         | 19.06   |  |
| 10.0 - 50.0      | 100.25        | 96.82   | 78.66         | 77.41   |  |
| 50.0 - 100.0     | 40.32         | 40.41   | 27.23         | 25.54   |  |
| 100.0 - 301.0    | 19.98         | 19.66   | 19.52         | 17.91   |  |
| 301.0 -1000.0    | 10.15         | 10.03   | 8.54          | 8.16    |  |
| *****            |               |         |               |         |  |
| 0.5 -1000.0      | 282.76        | 277.73  | 186.30        | 175.99  |  |
| *****            |               |         |               |         |  |

BY ADDING THE ENDF/B-5 VALUE ABOVE 1 KEV ON OBTAIN FROM THE PRE-SENT EVALUATION:

RI FISSION 297.10 BARNS  
RI CAPTURE 183.79 BARNS

THE CORRESPONDING VALUES FROM ENDF/B-5 EVALUATION ARE:

RI FISSION 302.13 BARNS  
RI CAPTURE 194.10 BARNS

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|--------------------------------------------------------------------|------|------|-----|
| *****                                                              | 9439 | 1451 | 216 |
| NU PROMPT                                                          | 9439 | 1451 | 217 |
| *****                                                              | 9439 | 1451 | 218 |
|                                                                    | 9439 | 1451 | 219 |
| THE VALUES ARE GIVEN IN THE ENERGY RANGE 1.E-05 TO 30 MEV FROM     | 9439 | 1451 | 220 |
| FREHAUT 1986 EVALUATION(NEANDC(E)238/L,1986).THEY SHOULD BE REPLA- | 9439 | 1451 | 221 |
| CED BY THE CADARACHE EVALUATION(E.FORT,IN PROGRESS).               | 9439 | 1451 | 222 |
|                                                                    | 9439 | 1451 | 223 |
| *****                                                              | 9439 | 1451 | 224 |
| REFERENCES                                                         | 9439 | 1451 | 225 |
| *****                                                              | 9439 | 1451 | 226 |
|                                                                    | 9439 | 1451 | 227 |
| 1-R.GWIN ET AL.,NUCL.SCI.ENG.,45,25(1971)                          | 9439 | 1451 | 228 |
| 2-A.J.DERUYTER ET AL.,J.NCL.ENER.,26,293(1972)                     | 9439 | 1451 | 229 |
| 3-J.BLONS, NUCL.SCI.ENG.,51,130(1973)                              | 9439 | 1451 | 230 |
| 4-R.GWIN ET AL.,NUCL.SCI.ENG.,59,79(1976)                          | 9439 | 1451 | 231 |
| 5-R.GWIN ET AL.,NUCL.SCI.ENG.,61,116(1976)                         | 9439 | 1451 | 232 |
| 6-W.WAGEMANS,ANNALS OF NUCL.ENER.7,9,495(1980)                     | 9439 | 1451 | 233 |
| 7-R.GWIN ET AL.,NUCL.SCI.ENG.,88,37(1984)                          | 9439 | 1451 | 234 |
| 8-L.W.WESTON ET AL.,NUCL.SCI.ENG.88,567(1984)                      | 9439 | 1451 | 235 |
| 9-J.A.HARVEY ,PRIVATE COMMUNICATION(1985)                          | 9439 | 1451 | 236 |
| 10-R.R.SPENCER ET AL.,NUCL.SCI.ENG.,96,318(1987)                   | 9439 | 1451 | 237 |
| 11-A.CARLSON ET AL.,PRELIMINARY RESULTS OF THE ENDF/B-6 STANDARD   | 9439 | 1451 | 238 |
| EVALUATION(SEPT 8 1987)                                            | 9439 | 1451 | 239 |
| 12-A.J.DERUYTER,J.NUCL.ENER.,26,293(1972)                          | 9439 | 1451 | 240 |
| 13-N.M.LARSON ET AL.,ORNL/TM-7485,ORNL/TM-9179,ORNL/TM-9719/R1     | 9439 | 1451 | 241 |
|                                                                    | 9439 | 1451 | 242 |
| *****                                                              | 9439 | 1451 | 243 |

PRELIMINARY DOCUMENTATION ON THE PU-241 EVAL. FOR JEF-2

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|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|-----|
| 94-PU-241 ORNL/CAD EVAL-1988 H.DERRIEN                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 9439 | 1451 | 244 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 9441 | 1451 | 4   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 9441 | 1451 | 5   |
| STATUS OF THE EVALUATION , MARCH 1988                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 9441 | 1451 | 6   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 9441 | 1451 | 7   |
| THERMAL RANGE-----                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 9441 | 1451 | 8   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 9441 | 1451 | 9   |
| THE CROSS-SECTION VALUES PROPOSED BY THE ENDF/B-6 STANDARD EVALUATION GROUP HAVE BEEN USED AS REFERENCE AT 0.0253 EV(1).ALL THE EXPERIMENTAL DATA CONSIDERED IN THE PRESENT EVALUATION HAVE BEEN RENORMALIZED TO THIS REFERENCE IN THE ENERGY RANGE 0.02 EV TO 0.03 EV.THE EXPERIMENTAL DATA ANALYSED ARE THE TOTAL CROSS-SECTIONS FROM YOUNG ET AL (2) AND FROM SIMPSON ET AL (3),THE FISSION CROSS SECTIONS FROM WAGEMANS ET AL (4) AND FROM WESTON ET AL (5),THE CAPTURE CROSS-SECTIONS FROM WESTON ET AL (5).THE CROSS-SECTION VALUES ARE GIVEN ON THE FOLLOWING TABLE: | 9441 | 1451 | 10  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 9441 | 1451 | 11  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 9441 | 1451 | 12  |
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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 9441 | 1451 | 17  |
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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 9441 | 1451 | 19  |
| *****                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 9441 | 1451 | 20  |
| ENDF/B-6 PROPOSED ENERGY RANGE CALCULATED OK                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 9441 | 1451 | 21  |
| STANDARD AT 0.0253 EV 0.02-0.03 EV(*) AT 0.0253 EV(**)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 9441 | 1451 | 22  |
| (BARNS) (BARNS) (BARNS)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 9441 | 1451 | 23  |
| *****                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 9441 | 1451 | 24  |
| FISSION 1012.68+-6.58 1023.9 1011.88                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 9441 | 1451 | 25  |
| CAPTURE 361.29+-4.95 366.0 362.95                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 9441 | 1451 | 26  |
| SCATTERING 12.17+-2.62 11.16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 9441 | 1451 | 27  |
| TOTAL 1386.14+-8.64 1402.1 1386.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 9441 | 1451 | 28  |
| *****                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 9441 | 1451 | 29  |
| (*)AVERAGE CROSS-SECTIONS FOR THE RENORMALIZATION OF THE EXPERIMENTAL DATA TO THE PROPOSED STANDARD VALUES.                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 9441 | 1451 | 30  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 9441 | 1451 | 31  |
| (**)R-MATRIX CALCULATION FROM THE EVALUATED DATA SET OF RESONANCE PARAMETERS.THE CALCULATED VALUES ARE IN VERY GOOD AGREEMENT WITH THE PROPOSED STANDARD AT 0.0253 EV.                                                                                                                                                                                                                                                                                                                                                                                                      | 9441 | 1451 | 32  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 9441 | 1451 | 33  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 9441 | 1451 | 34  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 9441 | 1451 | 35  |
| THE CORRELATED R -MATRIX FIT WAS PERFORMED ON YOUNG TOTAL,SIMPSON TOTAL AND WAGEMANS FISSION IN THE ENERGY RANGE 0.001 TO 3 EV.THE RENORMALIZED SEPPI FISSION DATA(6) WERE ALSO CONSIDERED AS A POSSIBLE REFERENCE POINT IN THE ENERGY RANGE 0.002 TO 0.005 EV.THE CROSS-SECTIONS INTEGRATED OVER THE 0.27 EV RESONANCE,IN THE ENERGY RANGE 0.02 EV TO 0.45 EV, ARE SHOWN ON THE FOLLOWING TABLE:                                                                                                                                                                           | 9441 | 1451 | 36  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 9441 | 1451 | 37  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 9441 | 1451 | 38  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 9441 | 1451 | 39  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 9441 | 1451 | 40  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 9441 | 1451 | 41  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 9441 | 1451 | 42  |
| *****                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 9441 | 1451 | 43  |
| CROSS-SECTIONS(BARN.EV) DEVIATION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 9441 | 1451 | 44  |
| EXPERIMENTAL CALCULATED                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 9441 | 1451 | 45  |
| YOUNG TOTAL 455.01 456.19 +0.3 %                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 9441 | 1451 | 46  |
| SIMPSON TOTAL 458.97 459.12 +0.0 %                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 9441 | 1451 | 47  |
| WAGEMANS FISSION 326.03 327.79 +0.5 %                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 9441 | 1451 | 48  |
| WESTON FISSION 334.18 327.80 -1.9 %                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 9441 | 1451 | 49  |
| WESTON CAPTURE 137.43 126.49 -8.6 %                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 9441 | 1451 | 50  |
| *****                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 9441 | 1451 | 51  |

THE DIFFERENCE BETWEEN YOUNG AND SIMPSON TOTAL DATA IS NEARLY THE SAME ON THE EXPERIMENTAL AND ON THE CALCULATED DATA ;IT IS DUE TO DIFFERENT EXPERIMENTAL RESOLUTION FUNCTION.THERE IS A SEVERE DISCREPANCY ON THE WESTON CAPTURE DATA WHICH WAS ALREADY DISCUSSED BY WESTON ET AL IN THE ENDF/B-5 EVALUATION(7).THE SHAPE OF WESTON FISSION CROSS-SECTION IN THE ENERGY RANGE BELOW 0.03 EV DIFFERS FROM THAT OF WAGEMANS.NORMALIZING WESTON AND WAGEMANS IN THE ENERGY RANGE 0.02 TO 0.03 EV RESULTS IN A DISCREPANCIES OF ABOUT 2 % OVER THE 0.26 EV RESONANCE.THE SAME REMARK APPLIES TO THE WESTON ABSORPTION DATA WHICH SHOULD BE NORMALIZED TO SIMPSON OR YOUNG ABSORPTION DATA OVER AN ENERGY RANGE INCLUDING THE 0.26 EV RESONANCE.FOR DETAIL DISCUSSION OF THIS PROBLEM SEE THE EVALUATION REPORT ORNL/TM-

# THE RESOLVED RESONANCE REGION-----

THE HARVEY-SIMPSON TRANSMISSION DATA(8) WHICH WERE OBTAINED IN 1972 FROM SAMPLE COOLED DOWN TO NITROGEN TEMPERATURE WERE ANALYSED IN THE ENERGY RANGE 0.3 EV 300 EV ALONG WITH BLONS(9),MIGNECO(10) AND WESTON(5) FISSION DATA.A CORRELATED SAMMY REICH-MOORE FIT WAS PERFORMED WITH 50 EV OR 100 EV RANGE CORRELATION MATRICES.FICTITIOUS RESONANCES (NEGATIVE ENERGY RESONANCES AND RESONANCES ABOVE 300 EV) WERE USED TO TAKE INTO ACCOUNT THE EFFECT OF THE EXTERNAL RANGE IN SUCH A WAY THAT THE CROSS-SECTIONS IN THE RANGE THERMAL TO 300 EV COULD BE REPRODUCED BY THE SET OF RESONANCE PARAMETERS WITHOUT THE USE OF A FILE 3.A RADIUS  $R'=9.50$  FERMI WAS USED.

COMPARISON OF ALL THE AVAILABLE FISSION DATA IN THE RESOLVED ENERGY RANGE WAS MADE BY WESTON ET AL(5) SHOWING THAT LARGE DISCREPANCIES EXIST AMONG THE DATA.THESE DISCREPANCIES COULD BE DUE TO BACK-GROUND CORRECTION EFFECTS OR OTHER EXPERIMENTAL EFFECTS LEADING TO LOCAL NORMALIZATION ERRORS.THE SAMMY FITS HAVE BEEN PERFORMED TO TAKE INTO ACCOUNT THE EVENTUAL LOCAL RENORMALIZATION AND BACK-GROUND CORRECTIONS.THE SET OF RESONANCE PARAMETERS OBTAINED IS EXPECTED TO REPRESENT THE CROSS-SECTIONS WITH ABOUT 5 % ACCURACY AT LEAST FOR THE FISSION CROSS-SECTIONS.

COMPARISONS BETWEEN CALCULATED AND EXPERIMENTAL INTEGRATED FISSION CROSS-SECTIONS ARE SHOWN ON THE FOLLOWING TABLE:

\*\*\*\*\*

| ENERGY RANGE |      | CROSS-SECTIONS(BARN-EV) |        |            |      |         |
|--------------|------|-------------------------|--------|------------|------|---------|
| EV           |      | AVERAGE(*)              | WESTON | CALCULATED |      |         |
| *****        |      |                         |        |            |      |         |
| 3.0-         | 4.9  | 350.8                   | 370.6  | 359.2      | 9441 | 1451 52 |
| 4.9-         | 8.0  | 876.8                   | 891.7  | 836.7      | 9441 | 1451 53 |
| 8.0-         | 9.0  | 237.6                   | 243.8  | 234.4      | 9441 | 1451 54 |
| 9.0-         | 12.0 | 311.1                   | 321.4  | 292.0      | 9441 | 1451 55 |
| 12.0-        | 14.0 | 284.8                   | 286.3  | 279.4      | 9441 | 1451 56 |
| 14.0-        | 17.4 | 928.0                   | 953.1  | 922.2      | 9441 | 1451 57 |
| 17.4-        | 20.0 | 143.8                   | 146.2  | 139.8      | 9441 | 1451 58 |
| 20.0-        | 30.0 | 795.3                   | 866.1  | 842.9      | 9441 | 1451 59 |
| 30.0-        | 40.0 | 452.0                   | 492.7  | 485.9      | 9441 | 1451 60 |
| 40.0-        | 50.0 | 390.9                   | 436.6  | 408.8      | 9441 | 1451 61 |
| 50.0-        | 60.0 | 173.1                   | 176.1  | 175.5      | 9441 | 1451 62 |
| 60.0-        | 70.0 | 559.1                   | 591.1  | 570.4      | 9441 | 1451 63 |
| 70.0-        | 80.0 | 278.3                   | 270.4  | 267.6      | 9441 | 1451 64 |

|                                                                    |                      |            |              |      |      |     |
|--------------------------------------------------------------------|----------------------|------------|--------------|------|------|-----|
| 80.0- 90.0                                                         | 685.9                | 733.1      | 722.0        | 9441 | 1451 | 109 |
| 90.0-100.0                                                         | 279.2                | 278.5      | 282.7        | 9441 | 1451 | 110 |
| 100.0-200.0                                                        | 2660.0               | 2686.5     | 2592.5       | 9441 | 1451 | 111 |
| 200.0-300.0                                                        | 2780.0               | 2861.1     | 2795.5       | 9441 | 1451 | 112 |
| *****                                                              |                      |            |              | 9441 | 1451 | 113 |
| ENERGY RANGE                                                       | CROSS-SECTIONS(BARN) |            |              | 9441 | 1451 | 114 |
| EV                                                                 | AVERAGE(*)           | WESTON     | CALCULATED   | 9441 | 1451 | 115 |
| *****                                                              |                      |            |              | 9441 | 1451 | 116 |
| 3.0-300.0                                                          | 41.03                | 42.44      | 41.10        | 9441 | 1451 | 117 |
| *****                                                              |                      |            |              | 9441 | 1451 | 118 |
| (*)AVERAGE OVER ALL AVAILABLE FISSION DATA(SEE REFERENCE(5))       |                      |            |              | 9441 | 1451 | 119 |
|                                                                    |                      |            |              | 9441 | 1451 | 120 |
| THE CROSS-SECTIONS CALCULATED BY THE SET OF RESONANCE PARAMATERS   |                      |            |              | 9441 | 1451 | 121 |
| ARE IN GOOD AGREEMENT WITH THE AVERAGE DATA FROM ALL THE AVAILA-   |                      |            |              | 9441 | 1451 | 122 |
| BLE EXPERIMENTAL VALUES.THE AGREEMENT IS EVEN PERFECT IF ONE CON-  |                      |            |              | 9441 | 1451 | 123 |
| SIDERS THE AVERAGE VALUES OVER THE ENTIRE ENERGY RANGE.THE 3 %     |                      |            |              | 9441 | 1451 | 124 |
| DIFFERENCE OBSERVED ON WESTON DATA SHOULD GO AWAY AFTER A RENORMA- |                      |            |              | 9441 | 1451 | 125 |
| LIZATION OVER THE 0.26 EV RESONANCE ON WAGEMANS DATA.              |                      |            |              | 9441 | 1451 | 126 |
|                                                                    |                      |            |              | 9441 | 1451 | 127 |
| THE FOLLOWING TABLE SHOWS THE CALCULATED CAPTURE CROSS-SECTIONS    |                      |            |              | 9441 | 1451 | 128 |
| AND ALPHA VALUES COMPARED TO WESTON(5) EXPERIMENTAL DATA:          |                      |            |              | 9441 | 1451 | 129 |
|                                                                    |                      |            |              | 9441 | 1451 | 130 |
| *****                                                              |                      |            |              | 9441 | 1451 | 131 |
| ENERGY RANGE                                                       | CALCULATED           | CALCULATED | EXPERIMENTAL | 9441 | 1451 | 132 |
| EV                                                                 | CAPTURE              | ALPHA      | ALPHA        | 9441 | 1451 | 133 |
| *****                                                              |                      |            |              | 9441 | 1451 | 134 |
| 10.- 20.                                                           | 74.72                | 0.509      | 0.559        | 9441 | 1451 | 135 |
| 20.- 30.                                                           | 15.46                | 0.183      | 0.213        | 9441 | 1451 | 136 |
| 30.- 40.                                                           | 9.78                 | 0.201      | 0.216        | 9441 | 1451 | 137 |
| 40.- 50.                                                           | 5.45                 | 0.133      | 0.184        | 9441 | 1451 | 138 |
| 50.- 60.                                                           | 2.16                 | 0.123      | 0.198        | 9441 | 1451 | 139 |
| 60.- 70.                                                           | 12.90                | 0.226      | 0.279        | 9441 | 1451 | 140 |
| 70.- 80.                                                           | 14.62                | 0.546      | 0.572        | 9441 | 1451 | 141 |
| 80.- 90.                                                           | 22.89                | 0.317      | 0.337        | 9441 | 1451 | 142 |
| 90.-100.                                                           | 5.75                 | 0.203      | 0.207        | 9441 | 1451 | 143 |
| 100.-200.                                                          | 5.87                 | 0.226      | 0.268        | 9441 | 1451 | 144 |
| 200.-300.                                                          | 6.62                 | 0.237      | 0.264        | 9441 | 1451 | 145 |
| *****                                                              |                      |            |              | 9441 | 1451 | 146 |
| 10.-300.                                                           |                      | 0.244      | 0.279        | 9441 | 1451 | 147 |
| *****                                                              |                      |            |              | 9441 | 1451 | 148 |
|                                                                    |                      |            |              | 9441 | 1451 | 149 |
| ON AVERAGE THE ALPHA VALUES CALCULATED FROM THE RESONANCE PARAME-  |                      |            |              | 9441 | 1451 | 150 |
| TERS ARE ABOUT 14 % SMALLER THAN THE EXPERIMENTAL VALUES GIVEN BY  |                      |            |              | 9441 | 1451 | 151 |
| WESTON(5).A TENTATIVE SAMMY FIT WAS PERFORMED ON THE WESTON        |                      |            |              | 9441 | 1451 | 152 |
| CAPTURE IN THE ENERGY RANGE 3. EV TO 20. EV ONLY ,IN CORRELATION   |                      |            |              | 9441 | 1451 | 153 |
| WITH THE FISSIONS EXPERIMENTAL DATA AND THE TRANSMISSION DATA.A    |                      |            |              | 9441 | 1451 | 154 |
| RENORMALIZATION OF 15 % FOR THE CAPTURE WAS OBTAINED IN THIS ENER- |                      |            |              | 9441 | 1451 | 155 |
| GY RANGE.THE ABSORPTION EXPERIMENTAL DATA WERE NORMALIZED BY WES-  |                      |            |              | 9441 | 1451 | 156 |
| TON ON THE ABSORPTION OBTAINED FROM KOLAR TOTAL CROSS-SECTIONS(11) |                      |            |              | 9441 | 1451 | 157 |
| THE PRESENT EVALUATION,WHICH WAS MAINLY BASED ON THE HARVEY-SIMP-  |                      |            |              | 9441 | 1451 | 158 |
| SON TRANSMISSION DATA FOR THE DETERMINATION OF THE NEUTRON WIDTHS, |                      |            |              | 9441 | 1451 | 159 |
| GIVES NEUTRON WIDTHS WHICH ARE 8 % ON AVERAGE SMALLER THAN THOSE   |                      |            |              | 9441 | 1451 | 160 |
| OBTAINED FROM KOLAR TRANSMISSION DATA.RENORMALIZING WESTON AB-     |                      |            |              | 9441 | 1451 | 161 |
| SORPTION DATA ON VALUES CALCULATED FROM THE NEW SET OF NEUTRON     |                      |            |              | 9441 | 1451 | 162 |
| WIDTHS SHOULD GIVE MORE REALISTIC VALUES OF THE EXPERIMENTAL AB-   |                      |            |              | 9441 | 1451 | 163 |
| SORPTION CROSS-SECTIONS.                                           |                      |            |              | 9441 | 1451 | 164 |

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| MT=452 TAKEN FROM JENDL2 -----                                | 9441 1451 | 165 |
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