**======================================================================= Groupie**

**Groupie**

**PROGRAM GROUPIE Groupie**

**=============== Groupie**

**VERSION 76-1 (NOVEMBER 1976) Groupie**

**VERSION 79-1 (OCTOBER 1979) CDC-7600 AND CRAY-1 VERSION. Groupie**

**VERSION 80-1 (MAY 1980) IBM, CDC AND CRAY VERSION Groupie**

**VERSION 81-1 (JANUARY 1981) EXTENSION TO 3000 GROUPS Groupie**

**VERSION 81-2 (MARCH 1981) IMPROVED SPEED Groupie**

**VERSION 81-3 (AUGUST 1981) BUILT-IN 1/E WEIGHTING SPECTRUM Groupie**

**VERSION 82-1 (JANUARY 1982) IMPROVED COMPUTER COMPATIBILITY Groupie**

**VERSION 83-1 (JANUARY 1983)\*MAJOR RE-DESIGN. Groupie**

**\*ELIMINATED COMPUTER DEPENDENT CODING. Groupie**

**\*NEW, MORE COMPATIBLE I/O UNIT NUMBERS. Groupie**

**\*NEW MULTI-BAND LIBRARY BINARY FORMAT. Groupie**

**VERSION 83-2 (OCTOBER 1983) ADDED OPTION TO ALLOW SIGMA-0 TO BE Groupie**

**DEFINED EITHER AS MULTIPLES OF Groupie**

**UNSHIELDED TOTAL CROSS SECTION IN EACH Groupie**

**GROUP, OR POWERS OF 10 IN ALL GROUPS. Groupie**

**VERSION 84-1 (APRIL 1984) ADDED MORE BUILT IN MULTIGROUP ENERGY Groupie**

**STRUCTURES. Groupie**

**VERSION 85-1 (APRIL 1985) \*UPDATED FOR ENDF/B-VI FORMATS. Groupie**

**\*SPECIAL I/O ROUTINES TO GUARANTEE Groupie**

**ACCURACY OF ENERGY. Groupie**

**\*DOUBLE PRECISION TREATMENT OF ENERGY Groupie**

**(REQUIRED FOR NARROW RESONANCES). Groupie**

**\*MINIMUM TOTAL CROSS SECTION TREATMENT Groupie**

**VERSION 85-2 (AUGUST 1985) \*FORTRAN-77/H VERSION Groupie**

**VERSION 86-1 (JANUARY 1986)\*ENDF/B-VI FORMAT Groupie**

**VERSION 86-2 (JUNE 1986) \*BUILT-IN MAXWELLIAN, 1/E AND FISSION Groupie**

**WEIGHTING SPECTRUM. Groupie**

**VERSION 88-1 (JULY 1988) \*OPTION...INTERNALLY DEFINE ALL I/O Groupie**

**FILE NAMES (SEE, SUBROUTINES FILIO1 Groupie**

**FILIO2 FOR DETAILS). Groupie**

**\*IMPROVED BASED ON USER COMMENTS. Groupie**

**VERSION 89-1 (JANUARY 1989)\*PSYCHOANALYZED BY PROGRAM FREUD TO Groupie**

**INSURE PROGRAM WILL NOT DO ANYTHING Groupie**

**CRAZY. Groupie**

**\*UPDATED TO USE NEW PROGRAM CONVERT Groupie**

**KEYWORDS. Groupie**

**\*ADDED LIVERMORE CIVIC COMPILER Groupie**

**CONVENTIONS. Groupie**

**VERSION 91-1 (JUNE 1991) \*INCREASED PAGE SIZE FROM 1002 TO 5010 Groupie**

**POINTS Groupie**

**\*UPDATED BASED ON USER COMMENTS Groupie**

**\*ADDED FORTRAN SAVE OPTION Groupie**

**\*COMPLETELY CONSISTENT ROUTINE TO READ Groupie**

**FLOATING POINT NUMBERS. Groupie**

**VERSION 92-1 (JANUARY 1992)\*ADDED RESONANCE INTEGRAL CALCULATION - Groupie**

**UNSHIELDED AND/OR SHIELDED - FOR Groupie**

**DETAILS SEE BELOW Groupie**

**\*INCREASED NUMBER OF ENERGY POINTS Groupie**

**IN BUILT-IN SPECTRA - TO IMPROVE Groupie**

**ACCURACY. Groupie**

**\*ALLOW SELECTION OF ZA/MF/MT OR Groupie**

**MAT/MF/MT RANGES - ALL DATA NOT Groupie**

**SELECTED IS SKIPPED ON INPUT AND Groupie**

**NOT WRITTEN AS OUTPUT. Groupie**

**\*COMPLETELY CONSISTENT I/O ROUTINES - Groupie**

**TO MINIMIZE COMPUTER DEPENDENCE. Groupie**

**\*NOTE, CHANGES IN INPUT PARAMETER Groupie**

**FORMAT - FOR ZA/MF/MT OR MAT/MF/MT Groupie**

**RANGES. Groupie**

**VERSION 92-2 (JUNE 1992) \*MULTIBAND PARAMETERS OUTOUT AS Groupie**

**CHARACTER (RATHER THAN BINARY) FILE. Groupie**

**VERSION 93-1 (APRIL 1993) \*INCREASED PAGE SIZE FROM 5010 TO Groupie**

**30000 POINTS Groupie**

**\*ELIMINATED COMPUTER DEPENDENCE. Groupie**

**VERSION 94-1 (JANUARY 1994)\*VARIABLE ENDF/B DATA FILENAMES Groupie**

**TO ALLOW ACCESS TO FILE STRUCTURES Groupie**

**(WARNING - INPUT PARAMETER FORMAT Groupie**

**HAS BEEN CHANGED) Groupie**

**\*CLOSE ALL FILES BEFORE TERMINATING Groupie**

**(SEE, SUBROUTINE ENDIT) Groupie**

**VERSION 95-1 (JANUARY 1994)\*CORRECTED MAXWELLIAN WEIGHTING Groupie**

**\*CHANGING WEIGHTING SPECTRUM FROM Groupie**

**0.1 TO 0.001 % UNCERTAINTY Groupie**

**VERSION 96-1 (JANUARY 1996) \*COMPLETE RE-WRITE Groupie**

**\*IMPROVED COMPUTER INDEPENDENCE Groupie**

**\*ALL DOUBLE PRECISION Groupie**

**\*ON SCREEN OUTPUT Groupie**

**\*UNIFORM TREATMENT OF ENDF/B I/O Groupie**

**\*IMPROVED OUTPUT PRECISION Groupie**

**\*DEFINED SCRATCH FILE NAMES Groupie**

**\*UP TO 1000 GROUP MULTI-BAND Groupie**

**CALCULATION (PREVIOUSLY 175) Groupie**

**\*MAXIMUM NUMBER OF GROUPS REDUCED Groupie**

**FROM 3,000 TO 1,000 Groupie**

**\*UP TO 1000 MATERIALS Groupie**

**(PREVIOUSLY 100) Groupie**

**\*CORRECTED USE OF MAXWELLIAN + Groupie**

**1/E + FISSION SPECTRUM Groupie**

**\*ONLY 2 BAND VERSION DISTRIBUTED Groupie**

**(CONTACT AUTHOR FOR DETAILS) Groupie**

**\*DEFINED SCRATCH FILE NAMES Groupie**

**VERSION 99-1 (MARCH 1999) \*CORRECTED CHARACTER TO FLOATING Groupie**

**POINT READ FOR MORE DIGITS Groupie**

**\*UPDATED TEST FOR ENDF/B FORMAT Groupie**

**VERSION BASED ON RECENT FORMAT CHANGE Groupie**

**\*GENERAL IMPROVEMENTS BASED ON Groupie**

**USER FEEDBACK Groupie**

**VERSION 99-2 (JUNE 1999) \*ASSUME ENDF/B-VI, NOT V, IF MISSING Groupie**

**MF=1, MT-451. Groupie**

**VERS. 2000-1 (FEBRUARY 2000)\*ADDED MF=10, ACTIVATION CROSS SECTION Groupie**

**PROCESSING. Groupie**

**\*GENERAL IMPROVEMENTS BASED ON Groupie**

**USER FEEDBACK Groupie**

**VERS. 2002-1 (FEBRUARY 2002)\*ADDED TART 700 GROUP STRUCTURE Groupie**

**\*ADDED VARIABLE SIGMA0 INPUT OPTION Groupie**

**(MAY 2002) \*OPTIONAL INPUT PARAMETERS Groupie**

**(NOV. 2002) \*ADDED SAND-II EXTENDED DOWN TO Groupie**

**1.0D-5 EV. Groupie**

**(JUNE 2003) \*CORRECTED SAND-II 620 AND 640 GROUP Groupie**

**ENERGY BOUNDARIES DEFINITIONS. Groupie**

**VERS. 2004-1 (SEPT. 2004) \*INCREASED PAGE SIZE FROM 30000 TO Groupie**

**120000 POINTS Groupie**

**\*ADDED "OTHER" AS ADDITIONAL REACTION Groupie**

**TO IMPROVE MULTI-BAND FITTING Groupie**

**\*ADDED ITERATION FOR "BEST" PARTIAL Groupie**

**PARAMETERS. Groupie**

**\*DO NOT SKIP LOW TOTAL ENERGY RANGES Groupie**

**WHEN DEFINING AVERAGE CROSS SECTIONS - Groupie**

**THIS MAKES OUTPUT COMPATIBLE WITH Groupie**

**ANY STANDARD AVERAGING PROCEDURE Groupie**

**VERS. 2005-1 (JAN. 2005) \*ADDED OPTION TO CHANGE TEMPERATURE OF Groupie**

**BUILT-IN STANDARD SPECTRUM. Groupie**

**VERS. 2007-1 (JAN. 2007) \*CHECKED AGAINST ALL ENDF/B-VII. Groupie**

**\*INCREASED PAGE SIZE FROM 120,000 TO Groupie**

**600,000 POINTS Groupie**

**VERS. 2008-1 (JAN. 2008) \*72 CHARACTER FILE NAMES. Groupie**

**\*GENERAL UPDATES Groupie**

**VERS. 2010-1 (Apr. 2010) \*INCREASED WEIGHTING SPECTRUM TO 30,000 Groupie**

**FROM 3,000 ENERGY POINTS. Groupie**

**\*ADDED OUTPUT TO PLOT/COMPARE SHIELDED Groupie**

**AND UNSHIELDED CROSS SECTIONS. Groupie**

**VERS. 2011-1 (June 2011) \*Corrected TART 700 groups to extend up Groupie**

**to 1 GeV (1,000 MeV) - previously it Groupie**

**was ERRONEOUSLY cutoff at 20 MeV. Groupie**

**VERS. 2011-2 (Nov. 2011) \*Corrected TART 616 groups lowest Groupie**

**energy from 1.0D-4 eV to 1.0D-5 eV. Groupie**

**\*Added TART 666 to 200 MeV (for TENDL). Groupie**

**\*Optional high energy cross section Groupie**

**extension above tabulated energy range Groupie**

**(either = 0 = standard, or constant) Groupie**

**WARNING - ENDF/B standard convention Groupie**

**is that the cross section = 0 where it Groupie**

**is not explicitly defined - extension Groupie**

**= 0 is standard, constant is NOT, so Groupie**

**constant extension is NOT RECOMMENDED. Groupie**

**VERS. 2012-1 (Aug. 2012) \*Added CODENAME Groupie**

**\*32 and 64 bit Compatible Groupie**

**\*Added ERROR stop. Groupie**

**VERS. 2013-1 (Nov. 2013) \*Extended OUT9. Groupie**

**\*Uses OUTG, not OUT10 for energies. Groupie**

**VERS. 2015-1 (Jan. 2015) \*Corrected SPECTM - handle ALL included Groupie**

**group structures, i.e., even those Groupie**

**that start above thremal range by Groupie**

**ALWAYS constructing weigthing spectrum Groupie**

**to be AT LEAST 1.0D-5 eV to 20 MeV. Groupie**

**\*Extended OUTG Groupie**

**\*Replaced ALL 3 way IF Statements. Groupie**

**\*Generalized TART Group Strructures. Groupie**

**\*Generalized SAND-II Group Structures. Groupie**

**\*Extended SAND-II to 60, 150, 200 MeV. Groupie**

**VERS. 2015-2 (Mar. 2015) \*Deleted 1P from formats reading input Groupie**

**parameters, causing incorrect scaling Groupie**

**\*Changed ALL data to "D" instead of Groupie**

**"E" to insure it is REAL\*8 and avoid Groupie**

**Truncation ERRORS. Groupie**

**VERS. 2015-3 (July 2015) \*Insure no 10 digit output - not Groupie**

**needed for multi-group and this makes Groupie**

**listings simpler. Groupie**

**\*Corrected High Energy Extension = Groupie**

**Can effect highest energy group. Groupie**

**VERS. 2016-1 (July 2016) \*Added UKAEA 1102 Group Structure. Groupie**

**\*Increased storage to accommodate Groupie**

**much larger group structures = Groupie**

**up to 20,000 Groups. Groupie**

**\*Added output listing of the complete Groupie**

**input parameters for URRFIT, including Groupie**

**the NJOY parameters LSSF and ICOMP. Groupie**

**\*Changed multiple IF statements to Groupie**

**accommodate compiler optimizer Groupie**

**\*Cosmetic changes based on FREUD Groupie**

**psychoanalysis. Groupie**

**\*Updated multi-band treatment to Groupie**

**explcitly handle small shielding Groupie**

**limit - without this update the small Groupie**

**limit becomes numerically unstable. Groupie**

**VERS. 2017-1 (May 2017) \*Increased max. points to 3,000,000. Groupie**

**\*METHODB was incorrecctly named Groupie**

**METHOD in one routine = corrected. Groupie**

**\*Default multi-band is method #2 = Groupie**

**conserve <x>, <1/(x+<x>>, <1/x>. Groupie**

**\*Definition of built-in group structure Groupie**

**using SUBROUTINE GROPE is identical Groupie**

**for GROUPIE and VIRGIN. Groupie**

**\*All floating input parameters changed Groupie**

**to character input + IN9 conversion. Groupie**

**\*Output report identfies MF now that Groupie**

**this code does more than just MF=3. Groupie**

**\*Added NRO = energy dependent scatter Groupie**

**radius to copying FILE2 parameters Groupie**

**to define unresolved energy range. Groupie**

**\*Corrected energy dependent scatter Groupie**

**for all resonance types (see, above Groupie**

**comments) = for multi-band output Groupie**

**VERS. 2018-1 (Jan. 2018) \*Added on-line output for ALL ENDERROR Groupie**

**VERS. 2019-1 (June 2019) \*Major re-write to re-order output to Groupie**

**include Unresolved Resonance Region Groupie**

**self-shielding. Groupie**

**\*Added Unresolved self-shielding by Groupie**

**Extrapolating cross section moments Groupie**

**from Resolved (supersedes URRDO and Groupie**

**URRFIT codes). Groupie**

**\*Added entire self-shielding array to Groupie**

**memory - previously only one group Groupie**

**results were in memory - saving ALL Groupie**

**greatly simplifies the logic. Groupie**

**\*Additional Interpolation Law Tests Groupie**

**\*Check maximum Tabulated Energy of MTs Groupie**

**to insure they ALL end at the same Groupie**

**energy. Groupie**

**\*Multi-band = 1 no longer allowed. Groupie**

**The only allowed values are, Groupie**

**0 = no multi-band calculations, or, Groupie**

**2 = Conserve 1/[total + <total>] Groupie**

**\*Unresolved Resonance Region Groupie**

**Self-Shielding Requires all of these, Groupie**

**1) Unresolved data with ENDF input Groupie**

**2) 616 TART Groups (input -11) Groupie**

**3) Define Sigma0 standard (input = 0) Groupie**

**\*Unresolved Resonance Region Groupie**

**Self-Shielding Always Outputs, Groupie**

**1) LSSF = 0 = Output cross sections Groupie**

**2) INTUNR = 2 = Interpolation law Groupie**

**\*Added ZAzzzaaa to filenames. Groupie**

**Groupie**

**2015-2 Acknowledgment Groupie**

**===================== Groupie**

**I thank Chuck Whitmer (TerraPower,WA) and Andrej Trkov (NDS,IAEA) Groupie**

**for reporting the errors that led to the 2015-2 Improvements in Groupie**

**this code. Groupie**

**Groupie**

**I thank Jean-Christophe Sublet (UKAEA) for contributing MAC Groupie**

**executables and Bojan Zefran (IJS, Slovenia) for contributing Groupie**

**LINUX (32 or 63 bit) executables. And most of all I must thank Groupie**

**Andrej Trkov (NDS, IAEA) for overseeing the entire PREPRO project Groupie**

**at IAEA, Vienna. This was a truly International team who worked Groupie**

**together to produce PREPRO 2015-2. Groupie**

**Groupie**

**OWNED, MAINTAINED AND DISTRIBUTED BY Groupie**

**------------------------------------ Groupie**

**THE NUCLEAR DATA SECTION Groupie**

**INTERNATIONAL ATOMIC ENERGY AGENCY Groupie**

**P.O. BOX 100 Groupie**

**A-1400, VIENNA, AUSTRIA Groupie**

**EUROPE Groupie**

**Groupie**

**ORIGINALLY WRITTEN BY Groupie**

**------------------------------------ Groupie**

**Dermott E. Cullen Groupie**

**Groupie**

**PRESENT CONTACT INFORMATION Groupie**

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**Groupie**

**AUTHORS MESSAGE Groupie**

**--------------- Groupie**

**THE REPORT DESCRIBED ABOVE IS THE LATEST PUBLISHED DOCUMENTATION Groupie**

**FOR THIS PROGRAM. HOWEVER, THE COMMENTS BELOW SHOULD BE CONSIDERED Groupie**

**THE LATEST DOCUMENTATION INCLUDING ALL RECENT IMPROVEMENTS. PLEASE Groupie**

**READ ALL OF THESE COMMENTS BEFORE IMPLEMENTATION, PARTICULARLY Groupie**

**THE COMMENTS CONCERNING MACHINE DEPENDENT CODING. Groupie**

**Groupie**

**AT THE PRESENT TIME WE ARE ATTEMPTING TO DEVELOP A SET OF COMPUTER Groupie**

**INDEPENDENT PROGRAMS THAT CAN EASILY BE IMPLEMENTED ON ANY ONE Groupie**

**OF A WIDE VARIETY OF COMPUTERS. IN ORDER TO ASSIST IN THIS PROJECT Groupie**

**IT WOULD BE APPECIATED IF YOU WOULD NOTIFY THE AUTHOR OF ANY Groupie**

**COMPILER DIAGNOSTICS, OPERATING PROBLEMS OR SUGGESTIONS ON HOW TO Groupie**

**IMPROVE THIS PROGRAM. HOPEFULLY, IN THIS WAY FUTURE VERSIONS OF Groupie**

**THIS PROGRAM WILL BE COMPLETELY COMPATIBLE FOR USE ON YOUR Groupie**

**COMPUTER. Groupie**

**Groupie**

**PURPOSE Groupie**

**------- Groupie**

**THIS PROGRAM IS DESIGNED TO CALCULATE ANY COMBINATION OF Groupie**

**THE FOLLOWING QUANTITIES FROM LINEARLY INTERPOLABLE TABULATED Groupie**

**CROSS SECTIONS IN THE ENDF/B FORMAT Groupie**

**Groupie**

**(1) UNSHIELDED GROUP AVERAGED CROSS SECTIONS Groupie**

**(2) BONDARENKO SELF-SHIELDED GROUP AVERAGED CROSS SECTIONS Groupie**

**(3) MULTI-BAND PARAMETERS Groupie**

**Groupie**

**IN THE FOLLOWING FOR SIMPLICITY THE ENDF/B TERMINOLOGY--ENDF/B Groupie**

**TAPE--WILL BE USED. IN FACT THE ACTUAL MEDIUM MAY BE TAPE, CARDS, Groupie**

**DISK OR ANY OTHER MEDIUM. Groupie**

**Groupie**

**ENDF/B FORMAT Groupie**

**------------- Groupie**

**THIS PROGRAM ONLY USES THE ENDF/B BCD OR CARD IMAGE FORMAT (AS Groupie**

**OPPOSED TO THE BINARY FORMAT) AND CAN HANDLE DATA IN ANY VERSION Groupie**

**OF THE ENDF/B FORMAT (I.E., ENDF/B-I, II,III, IV OR V FORMAT). Groupie**

**Groupie**

**IT IS ASSUMED THAT THE DATA IS CORRECTLY CODED IN THE ENDF/B Groupie**

**FORMAT AND NO ERROR CHECKING IS PERFORMED. IN PARTICULAR IT IS Groupie**

**ASSUMED THAT THE MAT, MF AND MT ON EACH CARD IS CORRECT. SEQUENCE Groupie**

**NUMBERS (COLUMNS 76-80) ARE IGNORED ON INPUT, BUT WILL BE Groupie**

**CORRECTLY OUTPUT ON ALL CARDS. THE FORMAT OF SECTION MF=1, MT=451 Groupie**

**AND ALL SECTIONS OF MF= 3 MUST BE CORRECT. THE PROGRAM COPIES ALL Groupie**

**OTHER SECTION OF DATA AS HOLLERITH AND AS SUCH IS INSENSITIVE TO Groupie**

**THE CORRECTNESS OR INCORRECTNESS OF ALL OTHER SECTIONS. Groupie**

**Groupie**

**ALL FILE 3 CROSS SECTIONS THAT ARE USED BY THIS PROGRAM MUST BE Groupie**

**LINEARLY INTERPOLABLE IN ENERGY AND CROSS SECTION (ENDF/B Groupie**

**INTERPOLATION LAW 2). FILE 3 BACKGROUND CROSS SECTIONS MAY BE MADE Groupie**

**LINEARLY INTERPOLABLE USING PROGRAM LINEAR (UCRL-50400, VOL. 17, Groupie**

**PART A). THE RESONANCE CONTRIBUTION MAY BE ADDED TO THE BACKGROUND Groupie**

**CROSS SECTIONS USING PROGRAM RECENT (UCRL-50400, VOL. 17, PART B). Groupie**

**IF THIS PROGRAM FINDS THAT THE FILE 3 CROSS SECTIONS ARE NOT Groupie**

**LINEARLY INTERPOLABLE THIS PROGRAM WILL TERMINATE EXECUTION. Groupie**

**Groupie**

**CONTENTS OF OUTPUT Groupie**

**------------------ Groupie**

**IF ENDF/B FORMATTED OUTPUT IS REQUESTED ENTIRE EVALUATIONS ARE Groupie**

**OUTPUT, NOT JUST THE MULTI-GROUPED FILE 3 CROSS SECTIONS, E.G. Groupie**

**ANGULAR AND ENERGY DISTRIBUTIONS ARE ALSO INCLUDED. Groupie**

**Groupie**

**DOCUMENTATION Groupie**

**------------- Groupie**

**THE FACT THAT THIS PROGRAM HAS OPERATED ON THE DATA IS DOCUMENTED Groupie**

**BY THE ADDITION OF THREE COMMENT CARDS AT THE END OF EACH Groupie**

**HOLLERITH SECTION TO DESCRIBE THE GROUP STRUCTURE AND WEIGHTING Groupie**

**SPECTRUM, E.G. Groupie**

**Groupie**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* PROGRAM GROUPIE (2019-1) \*\*\*\*\*\*\*\*\*\*\*\*\*\*\* Groupie**

**UNSHIELDED GROUP AVERAGES USING 69 GROUPS (WIMS) Groupie**

**MAXWELLIAN, 1/E AND FISSION WEIGHTING SPECTRUM Groupie**

**Groupie**

**THE ORDER OF ALL SIMILAR COMMENTS (FROM LINEAR, RECENT AND SIGMA1) Groupie**

**REPRESENTS A COMPLETE HISTORY OF ALL OPERATIONS PERFORMED ON Groupie**

**THE DATA. Groupie**

**Groupie**

**THESE COMMENT CARDS ARE ONLY ADDED TO EXISTING HOLLERITH SECTIONS, Groupie**

**I.E., THIS PROGRAM WILL NOT CREATE A HOLLERITH SECTION. THE FORMAT Groupie**

**OF THE HOLLERITH SECTION IN ENDF/B-V DIFFERS FROM THE THAT OF Groupie**

**EARLIER VERSIONS OF ENDF/B. BY READING AN EXISTING MF=1, MT=451 Groupie**

**IT IS POSSIBLE FOR THIS PROGRAM TO DETERMINE WHICH VERSION OF Groupie**

**THE ENDF/B FORMAT THE DATA IS IN. WITHOUT HAVING A SECTION OF Groupie**

**MF=1, MT=451 PRESENT IT IS IMPOSSIBLE FOR THIS PROGRAM TO Groupie**

**DETERMINE WHICH VERSION OF THE ENDF/B FORMAT THE DATA IS IN, AND Groupie**

**AS SUCH IT IS IMPOSSIBLE FOR THE PROGRAM TO DETERMINE WHAT FORMAT Groupie**

**SHOULD BE USED TO CREATE A HOLLERITH SECTION. Groupie**

**Groupie**

**REACTION INDEX Groupie**

**-------------- Groupie**

**THIS PROGRAM DOES NOT USE THE REACTION INDEX WHICH IS GIVEN IN Groupie**

**SECTION MF=1, MT=451 OF EACH EVALUATION. Groupie**

**Groupie**

**THIS PROGRAM DOES NOT UPDATE THE REACTION INDEX IN MF=1, MT=451. Groupie**

**THIS CONVENTION HAS BEEN ADOPTED BECAUSE MOST USERS DO NOT Groupie**

**REQUIRE A CORRECT REACTION INDEX FOR THEIR APPLICATIONS AND IT WAS Groupie**

**NOT CONSIDERED WORTHWHILE TO INCLUDE THE OVERHEAD OF CONSTRUCTING Groupie**

**A CORRECT REACTION INDEX IN THIS PROGRAM. HOWEVER, IF YOU REQUIRE Groupie**

**A REACTION INDEX FOR YOUR APPLICATIONS, AFTER RUNNING THIS PROGRAM Groupie**

**YOU MAY USE PROGRAM DICTIN TO CREATE A CORRECT REACTION INDEX. Groupie**

**Groupie**

**SECTION SIZE Groupie**

**------------ Groupie**

**SINCE THIS PROGRAM USES A LOGICAL PAGING SYSTEM THERE IS NO LIMIT Groupie**

**TO THE NUMBER OF POINTS IN ANY SECTION, E.G., THE TOTAL CROSS Groupie**

**SECTION MAY BE REPRESENTED BY 200,000 DATA POINTS. Groupie**

**Groupie**

**SELECTION OF DATA Groupie**

**----------------- Groupie**

**THE PROGRAM SELECTS MATERIALS TO BE PROCESSED BASED EITHER ON Groupie**

**MAT (ENDF/B MAT NO.) OR ZA. THE PROGRAM ALLOWS UP TO 100 MAT OR Groupie**

**ZA RANGES TO BE SPECIFIED. THE PROGRAM WILL ASSUME THAT THE Groupie**

**ENDF/B TAPE IS IN EITHER MAT OR ZA ORDER, WHICHEVER CRITERIA IS Groupie**

**USED TO SELECT MATERIALS, AND WILL TERMINATE WHEN A MAT OR ZA Groupie**

**IS FOUND THAT IS ABOVE THE RANGE OF ALL REQUESTS. Groupie**

**Groupie**

**ENERGY ORDER AND UNITS Groupie**

**---------------------- Groupie**

**ALL ENERGIES (FOR CROSS SECTIONS, WEIGHTING SPECTRUM OR GROUP Groupie**

**BOUNDARIES) MUST BE IN UNITS OF EV AND MUST BE IN ASCENDING Groupie**

**NUMERICAL ORDER. Groupie**

**Groupie**

**ENERGY GRID Groupie**

**----------- Groupie**

**ALTHOUGH ALL REACTIONS MUST TO LINEARLY INTERPOLABLE, THEY DO NOT Groupie**

**ALL HAVE TO USE THE SAME ENERGY GRID. EACH REACTION CAN BE GIVEN Groupie**

**BY AN INDEPENDENT ENERGY GRID. THIS PROGRAM WILL PROCEED FROM Groupie**

**THE LOWEST TO HIGHEST ENERGY SELECTING EACH ENERGY INTERVAL OVER Groupie**

**WHICH ALL DATA, FOR ANY GIVEN CALCULATION, ARE ALL LINEARLY Groupie**

**INTERPOLABLE. Groupie**

**Groupie**

**GROUP STRUCTURE Groupie**

**--------------- Groupie**

**THIS PROGRAM IS DESIGNED TO USE AN ARBITRARY ENERGY GROUP Groupie**

**STRUCTURE WHERE THE ENERGIES ARE IN EV AND ARE IN INCREASING Groupie**

**ENERGY ORDER. THE MAXIMUM NUMBER OF GROUPS IS 20,000. Groupie**

**Groupie**

**THE USER MAY INPUT AN ARBITRARY GROUP STRUCTURE OR THE USER MAY Groupie**

**USE USE ONE OF THE SEVEN BUILT-IN GROUP STRUCTURES. Groupie**

**(0) 175 GROUP (TART STRUCTURE) Groupie**

**(1) 50 GROUP (ORNL STRUCTURE) Groupie**

**(2) 126 GROUP (ORNL STRUCTURE) Groupie**

**(3) 171 GROUP (ORNL STRUCTURE) Groupie**

**(4) 620 GROUP (SAND-II STRUCTURE, UP TO 18 MEV) Groupie**

**(5) 640 GROUP (SAND-II STRUCTURE, UP TO 20 MEV) Groupie**

**(6) 69 GROUP (WIMS STRUCTURE) Groupie**

**(7) 68 GROUP (GAM-I STRUCTURE) Groupie**

**(8) 99 GROUP (GAM-II STRUCTURE) Groupie**

**(9) 54 GROUP (MUFT STRUCTURE) Groupie**

**(10) 28 GROUP (ABBN STRUCTURE) Groupie**

**(11) 616 GROUP (TART STRUCTURE TO 20 MeV) Groupie**

**(12) 700 GROUP (TART STRUCTURE TO 1 GEV) Groupie**

**(13) 665 GROUP (SAND-II STRUCTURE, 1.0D-5 eV, UP TO 18 MEV) Groupie**

**(14) 685 GROUP (SAND-II STRUCTURE, 1.0D-5 eV, UP TO 20 MEV) Groupie**

**(15) 666 GROUP (TART STRUCTURE TO 200 MeV) Groupie**

**(16) 725 GROUP (SAND-II STRUCTURE, 1.0D-5 eV, UP TO 60 MEV) Groupie**

**(17) 755 GROUP (SAND-II STRUCTURE, 1.0D-5 eV, UP TO 150 MEV) Groupie**

**(18) 765 GROUP (SAND-II STRUCTURE, 1.0D-5 eV, UP TO 200 MEV) Groupie**

**(19)1102 GROUP (UKAEA STRUCTURE, 1.0D-5 eV, UP TO 1 GeV) Groupie**

**Groupie**

**GROUP AVERAGES Groupie**

**-------------- Groupie**

**THIS PROGRAM DEFINES GROUP AVERAGED CROSS SECTIONS AS... Groupie**

**Groupie**

**(INTEGRAL E1 TO E2) (SIGMA(E)\*S(E)\*WT(E)\*DE) Groupie**

**AVERAGE = ----------------------------------------- Groupie**

**(INTEGRAL E1 TO E2) (S(E)\*WT(E)\*DE) Groupie**

**WHERE... Groupie**

**Groupie**

**AVERAGE = GROUP AVERAGED CROSS SECTION Groupie**

**E1, E2 = ENERGY LIMITS OF THE GROUP Groupie**

**SIGMA(E) = ENERGY DEPENDENT CROSS SECTION FOR ANY GIVEN REACTION Groupie**

**S(E) = ENERGY DEPENDENT WEIGHTING SPECTRUM Groupie**

**WT(E) = ENERGY DEPENDENT SELF-SHIELDING FACTOR. Groupie**

**Groupie**

**ENERGY DEPENDENT WEIGHTING SPECTRUM Groupie**

**----------------------------------- Groupie**

**THE ENERGY DEPENDENT WEIGHTING SPECTRUM IS GIVEN BY AN ARBITRARY Groupie**

**TABULATED LINERLY INTERPOLABLE FUNCTION WHICH CAN BE DESCRIBED Groupie**

**BY AN ARBITRARY NUMBER OF POINTS. THIS ALLOWS THE USER TO Groupie**

**SPECIFY ANY DESIRED WEIGHTING SPECTRUM TO ANY GIVEN DEGREE OF Groupie**

**ACCURACY. REMEMBER THAT THE PROGRAM WILL ASSUME THAT THE SPECTRUM Groupie**

**IS LINEARLY INTERPOLABLE BETWEEN TABULATED POINTS. THEREFORE THE Groupie**

**USER SHOULD USE ENOUGH POINTS TO INSURE AN ADEQUATE REPRESENTATION Groupie**

**OF THE SPECTRUM BETWEEN TABULATED DATA POINTS. Groupie**

**Groupie**

**THE PRESENT VERSION OF THE CODE HAS THREE BULIT-IN WEIGHTING Groupie**

**SPECTRA, Groupie**

**Groupie**

**(1) CONSTANT Groupie**

**(2) 1/E Groupie**

**(3) MAXWELLIAN = E\*EXP(-E/KT)/KT (0.0 TO 4\*KT) Groupie**

**1/E = C1/E (4\*KT TO 67 KEV) Groupie**

**FISSION = C2\*EXP(-E/WA)\*SINH(SQRT(E\*WB)) (ABOVE 67 KEV) Groupie**

**Groupie**

**KT = 0.253 EV (293 KELVIN) Groupie**

**WA = 9.65D+5 Groupie**

**WB = 2.29D-6 Groupie**

**C1, C2 = DEFINED TO MAKE SPECTRUM CONTINUOUS Groupie**

**Groupie**

**FISSION SPECTRUM CONSTANTS FROM Groupie**

**A.F.HENRY, NUCLEAR REACTOR ANALYSIS, P. 11, MIT PRESS (1975) Groupie**

**Groupie**

**UNSHIELDED GROUP AVERAGES Groupie**

**------------------------- Groupie**

**FOR UNSHIELDED AVERAGES THE SELF-SHIELDING FACTOR (WT(E)) IS SET Groupie**

**TO UNITY. THIS PROGRAM ALLOWS UP TO 20,000 GROUPS. Groupie**

**Groupie**

**SELF-SHIELDED GROUP AVERAGES Groupie**

**---------------------------- Groupie**

**IF SELF-SHIELDED AVERAGES AND/OR MULTI-BAND PARAMETERS ARE Groupie**

**CALCULATED THIS PROGRAM ALLOWS UP TO 20,000 GROUPS. SELF-SHIELDED Groupie**

**AVERAGES AND/OR MULTI-BAND PARAMETERS ARE CALCULATED FOR THE Groupie**

**TOTAL, ELASTIC, CAPTURE AND FISSION. Groupie**

**Groupie**

**FOR THE TOTAL, ELASTIC, CAPTURE AND FISSION THE PROGRAM USES A Groupie**

**WEIGHTING FUNCTION THAT IS A PRODUCT OF THE ENERGY DEPENDENT Groupie**

**WEIGHTING SPECTRUM TIMES A BONDERENKO TYPE SELF-SHIELDING FACTOR. Groupie**

**Groupie**

**WT(E) = S(E)/(TOTAL(E)+SIGMA0)\*\*N Groupie**

**Groupie**

**WHERE... Groupie**

**Groupie**

**S(E) - ENERGY DEPENDENT WEIGHTING SPECTRUM (DEFINED BY Groupie**

**TABULATED VALUES AND LINEAR INTERPOLATION BETWEEN Groupie**

**TABULATED VALUES). Groupie**

**TOTAL(E) - ENERGY DEPENDENT TOTAL CROSS SECTION FOR ONE MATERIAL Groupie**

**(DEFINED BY TABULATED VALUES AND LINEAR INTERPOLATION Groupie**

**BETWEEN TABULATED VALUES). Groupie**

**SIGMA0 - CROSS SECTION TO REPRESENT THE EFFECT OF ALL OTHER Groupie**

**MATERIALS AND LEAKAGE (DEFINED WITHIN EACH GROUP TO BE Groupie**

**A MULTIPLE OF THE UNSHIELDED TOTAL CROSS SECTION WITHIN Groupie**

**THAT GROUP OR POWERS OF 10 - INPUT OPTION). Groupie**

**N - A POSITIVE INTEGER (0, 1, 2 OR 3). Groupie**

**Groupie**

**THE PROGRAM WILL USE ONE ENERGY DEPENDENT WEIGHTING SPECTRUM S(E) Groupie**

**AND 25 DIFFERENT BONDERENKO TYPE SELF-SHIELDING FACTORS (25 SIGMA0 Groupie**

**AND N COMBINATIONS) TO DEFINE 25 DIFFERENT AVERAGE CROSS SECTIONS, Groupie**

**FOR EACH REACTION, WITHIN EACH GROUP. Groupie**

**Groupie**

**THE 25 WEIGHTING FUNCTIONS USED ARE.... Groupie**

**(1) - UNSHIELDED CROSS SECTIONS (N=0) Groupie**

**(2-22)- PARTIALLY SHIELDED CROSS SECTIONS (N=1 ,VARIOUS SIGMA0) Groupie**

**THE VALUES OF SIGMA0 USED WILL BE EITHER, Groupie**

**(A) THE VALUES OF SIGMA0 THAT ARE USED VARY FROM 1024 Groupie**

**TIMES THE UNSHIELDED TOTAL CROSS SECTIONS IN STEPS OF 1/2 Groupie**

**DOWN TO 1/1024 TIMES THE UNSHIELDED TOTAL CROSS SECTION Groupie**

**(A RANGE OF OVER 1 MILLION, CENTERED ON THE UNSHIELDED Groupie**

**TOTAL CROSS SECTION WITHIN EACH GROUP). Groupie**

**(B) THE SAME CONSTANT VALUES OF SIGMA0 IN EACH GROUP. THE Groupie**

**VALUES OF SIGMA0 USED INCLUDE 40000, 20000, 10000, 7000, Groupie**

**4000, 2000, 1000, 700, 400, 200, 100, 70, 40, 20, 10, 7, Groupie**

**4, 2, 1, 0.7, 0.4 (A RANGE OF 100,000 SPANNING MORE THAN Groupie**

**THE RANGE OF SIGMA0 VALUES THAT MAY BE ENCOUNTERED IN Groupie**

**ACTUAL APPLICATIONS) Groupie**

**(23) - TOTALLY SHIELDED FLUX WEIGHTED CROSS SECTION Groupie**

**(N=1, SIGMA0=0) Groupie**

**(24) - TOTALLY SHIELDED CURRENT WEIGHTED CROSS SECTION Groupie**

**(N=2, SIGMA0=0) Groupie**

**(25) - TOTALLY SHIELDED COSINE SQUARED WEIGHTED CROSS SECTION Groupie**

**(N=3, SIGMA0=0) Groupie**

**Groupie**

**FOR ALL OTHER REACTIONS (EXCEPT TOTAL, ELASTIC, CAPTURE AND Groupie**

**FISSION) THE PROGRAM WILL USE THE ENERGY DEPENDENT WEIGHTING Groupie**

**SPECTRUM S(E) TO DEFINE THE UNSHIELDED (BONDERENKO N=0) Groupie**

**AVERAGED CROSS SECTION WITHIN EACH GROUP. Groupie**

**Groupie**

**CALCULATION OF RESONANCE INTEGRALS Groupie**

**---------------------------------- Groupie**

**IN A PURE ELASTIC ISOTROPICALLY SCATTERING MATERIAL WITH A Groupie**

**CONSTANT CROSS SECTION THE SPECTRUM WILL BE 1/E AND THERE WILL Groupie**

**BE NO SELF-SHIELDING. Groupie**

**Groupie**

**IN THIS CASE IF THE CROSS SECTION VARIES WITH ENERGY THE Groupie**

**SPECTRUM WILL STILL BE 1/E AND THE SELF-SHIELDING FACTOR WILL Groupie**

**BE EXACTLY 1/SIG-TOT(E) - WHERE SIG-TOT(E) = SIG-EL(E), SINCE Groupie**

**THERE IS ONLY SCATTERING. Groupie**

**Groupie**

**IF WE HAVE AN INFINITELY DILUTE AMOUNT OF A MATERIAL UNIFORMLY Groupie**

**MIXED WITH A PURE ELASTIC ISOTROPICALLY SCATTERING MATERIAL WITH Groupie**

**A CONSTANT CROSS SECTION THE STANDARD DEFINITION OF THE RESONANCE Groupie**

**INTEGRAL CAN BE USED TO DEFINE REACTION RATES FOR EACH REACTION. Groupie**

**Groupie**

**THE RESONANCE INTEGRAL IS DEFINED AS, Groupie**

**Groupie**

**RI = (INTEGRAL E1 TO E2) (SIGMA(E)\*S(E)\*WT(E)\*DE) Groupie**

**Groupie**

**WHERE NORMALLY, Groupie**

**S(E) = 1/E Groupie**

**WT(E) = 1 - NO SELF-SHIELDING Groupie**

**Groupie**

**FROM THE ABOVE DEFINITION OF GROUP AVERAGED CROSS SECTIONS THE Groupie**

**RESONANCE INTEGRAL IS, Groupie**

**Groupie**

**RI = AVERAGE \* (INTEGRAL E1 TO E2) (S(E)\*WT(E)\*DE) Groupie**

**Groupie**

**FOR A 1/E SPECTRUM AND NO SELF-SHIELDING THIS REDUCES TO, Groupie**

**Groupie**

**RI = AVERAGE\* LOG(E2/E1) Groupie**

**Groupie**

**IN ANY OTHER SITUATION, INCLUDING ABSORPTION AND/OR ENERGY Groupie**

**DEPENDENT CROSS SECTIONS, THE SPECTRUM WILL NOT BE 1/E - Groupie**

**ABSORPTION WILL TEND TO DECREASE THE SPECTRUM PROGRESSIVELY Groupie**

**MORE AT LOWER ENERGIES - ENERGY DEPENDENCE OF THE CROSS SECTION Groupie**

**WILL LEAD TO SELF-SHIELDING. Groupie**

**Groupie**

**HERE WE WILL NOT ATTEMPT TO PERFORM A DETAILED SPECTRUM Groupie**

**CALCULATION TO ACCOUNT FOR ABSORPTION. Groupie**

**Groupie**

**HOWEVER, WE WILL EXTEND THE DEFINITION OF THE RESONANCE INTEGRAL Groupie**

**TO ACCOUNT FOR SELF-SHIELDING EFFECTS BY ALLOWING FOR INCLUSION Groupie**

**OF SELF-SHIELDING EFFECTS IN THE DEFINITION OF GROUP AVERAGES Groupie**

**AND THEN DEFINING THE RESONANCE INTEGRAL AS, Groupie**

**Groupie**

**RI = AVERAGE\* LOG(E2/E1) Groupie**

**Groupie**

**IN ORDER TO CALCULATE RESONANCE INTEGRALS YOU MUST FOLLOW THESE Groupie**

**STEPS, Groupie**

**Groupie**

**1) SELECT A 1/E SPECTRUM - ON FIRST LINE OF INPUT PARAMETERS. Groupie**

**2) SELECT THE ENERGY BOUNDARIES - NORMALLY ONLY 1 GROUP FROM Groupie**

**0.5 EV UP TO 20 MEV - HOWEVER, YOU ARE FREE TO SELECT ANY Groupie**

**ENERGY RANGE THAT YOU WISH - YOU MAY EVEN SELECT MORE THAN Groupie**

**1 GROUP MERELY BY SPECIFYING MORE THAN 1 GROUP AS INPUT - Groupie**

**THIS CAN BE USED TO DEFINE THE CONTRIBUTIONS TO THE RESONANCE Groupie**

**INTEGRAL FROM INDIVIDUAL ENERGY RANGES. Groupie**

**3) SELECT THIS OPTION FOR THE UNSHIELDED AND/OR SHIELDED OUTPUT Groupie**

**LISTING - ON THE SECOND LINE OF INPUT PARAMETERS. Groupie**

**Groupie**

**WHEN THIS OPTION IS USED THE PROGRAM WILL CALCULATE GROUP AVERAGED Groupie**

**CROSS SECTIONS - AS DEFINED ABOVE - PRIOR TO OUTPUT THE RESULTS Groupie**

**WILL MERELY BE MULTIPLIED BY THE WIDTH OF THE GROUP ASSUMING YOU Groupie**

**HAVE SELECTED A 1/E SPECTRUM - THERE IS NO CHECK ON THIS - THE Groupie**

**PROGRAM MERELY MULTIPLIES THE GROUP AVERAGED CROSS SECTIONS BY, Groupie**

**Groupie**

**LOG(E2/E1) - WHERE E2 AND E1 ARE THE GROUP ENERGY BOUNDARIES. Groupie**

**Groupie**

**WARNING - IT IS UP TO YOU TO INSURE THAT YOU FOLLOW EXACTLY THE Groupie**

**STEPS OUTLINED ABOVE IF YOU WISH TO OBTAIN MEANINGFUL Groupie**

**RESULTS. Groupie**

**Groupie**

**NOTE - OUTPUT IN THE ENDF/B FORMAT IS ALWAYS GROUP AVERAGED CROSS Groupie**

**SECTIONS, REGARDLESS OF WHETHER YOU ASK FOR AVERAGED CROSS Groupie**

**SECTIONS OR RESONANCE INTEGRALS - THIS IS BECAUSE DATA IN Groupie**

**THE ENDF/B FORMAT IS EXPLICITLY DEFINED TO BE CROSS Groupie**

**SECTIONS. Groupie**

**Groupie**

**RESONANCE INTEGRAL OUTPUT CAN ONLY BE OBTAINED IN THE Groupie**

**LISTING FORMATS. Groupie**

**Groupie**

**MINIMUM TOTAL CROSS SECTION TREATMENT Groupie**

**------------------------------------- Groupie**

**SINCE THE BONDARENKO SELF-SHIELDING DEPENDS ON 1/TOTAL CROSS Groupie**

**SECTION, THE ALGORITHM WILL BECOME NUMERICALLY UNSTABLE IF THE Groupie**

**TOTAL CROSS SECTION IS NEGATIVE (AS OCCURS IN MANY ENDF/B Groupie**

**EVALUATIONS). IF THE TOTAL IS LESS THAN SOME MINIMUM ALLOWABLE Groupie**

**VALUE (DEFINE BY OKMIN, PRESENTLY 1 MILLI-BARN) AN ERROR MESSAGE Groupie**

**WILL BE PRINTED AND FOR THE SELF-SHIELDING CALCULATION ALL ENERGY Groupie**

**INTERVALS IN WHICH THE TOTAL IS LESS THAN THE MINIMUM WILL BE Groupie**

**IGNORED. Groupie**

**Groupie**

**NOTE, FOR THE UNSHIELDED CALCULATIONS ALL CROSS SECTIONS WILL BE Groupie**

**CONSIDERED WHETHER THEY ARE POSITIVE OR NEGATIVE. THEREFORE IF Groupie**

**THE TOTAL CROSS SECTION IS NEGATIVE OR LESS THAN THE MINIMUM Groupie**

**VALUE THERE MAY BE AN INCONSISTENCY BETWEEN THE UNSHIELDED AND Groupie**

**THE SELF-SHIELDED CROSS SECTIONS. IF THE TOTAL CROSS SECTION IS Groupie**

**NEGATIVE AND SELF-SHIELDED CROSS SECTIONS ARE CALCULATED THE Groupie**

**PROGRAM WILL PRINT AN ERROR MESSAGE INDICATING THAT THE SELF- Groupie**

**SHIELDED RESULTS ARE UNRELIABLE AND SHOULD NOT BE USED. THEREFORE Groupie**

**IN THIS CASE THE PROGRAM WILL NOT ATTEMPT TO MODIFY THE UNSHIELDED Groupie**

**RESULTS TO ELIMINATE THE EFFECT OF NEGATIVE CROSS SECTIONS, SINCE Groupie**

**THE UNSHIELDED RESULTS ARE THE ONLY ONES WHICH TRULY REFLECT THE Groupie**

**ACTUAL INPUT. Groupie**

**Groupie**

**RESOLVED RESONANCE REGION Groupie**

**------------------------- Groupie**

**IN THE RESOLVED RESONANCE REGION (ACTUALLY EVERYWHERE BUT IN THE Groupie**

**UNRESOLVED RESONANCE REGION) THE CROSS SECTIONS OUTPUT BY LINEAR- Groupie**

**RECENT-SIGMA1 WILL BE ACTUAL ENERGY DEPENDENT CROSS SECTIONS AND Groupie**

**THE CALCULATIONS BY THIS PROGRAM WILL YIELD ACTUAL SHIELDED AND Groupie**

**UNSHIELDED CROSS SECTIONS. Groupie**

**Groupie**

**UNRESOLVED RESONANCE REGION Groupie**

**--------------------------- Groupie**

**IN THE UNRESOLVED RESONANCE REGION PROGRAM RECENT USES THE Groupie**

**UNRESOLVED RESONANCE PARAMETERS TO CALCULATE INFINITELY DILUTE Groupie**

**AVERAGE CROSS SECTIONS. THIS PROGRAM WILL MERELY READ THIS Groupie**

**INFINITELY DILUTE DATA AS IF IT WERE ENERGY DEPENDENT DATA AND Groupie**

**GROUP AVERAGE IT. AS SUCH THIS PROGRAM WILL PRODUCE THE CORRECT Groupie**

**UNSHIELDED CROSS SECTION IN THE UNRESOLVED RESONANCE REGION, BUT Groupie**

**IT WILL NOT PRODUCE THE CORRECT SELF-SHIELDING EFFECTS. Groupie**

**Groupie**

**ACCURACY OF RESULTS Groupie**

**------------------- Groupie**

**ALL INTEGRALS ARE PERFORMED ANALYTICALLY. THEREFORE NO ERROR IS Groupie**

**INTRODUCED DUE TO THE USE OF TRAPAZOIDAL OR OTHER INTEGRATION Groupie**

**SCHEME. THE TOTAL ERROR THAT CAN BE ASSIGNED TO THE RESULTING Groupie**

**AVERAGES IS JUST THAT DUE TO THE ERROR IN THE CROSS SECTIONS Groupie**

**AND ENERGY DEPENDENT WEIGHTING SPECTRUM. GENERALLY SINCE THE Groupie**

**THE ENERGY DEPENDENT WEIGHTING SPECTRUM APPEARS IN BOTH THE Groupie**

**NUMERATOR AND THE DENOMINATOR THE AVERAGES RAPIDLY BECOME Groupie**

**INSENSITIVE TO THE WEIGHTING SPECTRUM AS MORE GROUPS ARE USED. Groupie**

**SINCE THE WEIGHTING SPECTRUM IS LOADED IN THE PAGING SYSTEM THE Groupie**

**USER CAN DESCRIBE THE SPECTRUM TO ANY REQUIRED ACCURACY USING Groupie**

**ANY NUMBER OF ENERGY VS. SPECTRUM PAIRS. Groupie**

**Groupie**

**MULTI-BAND PARAMETERS Groupie**

**--------------------- Groupie**

**MULTI-BAND PARAMETERS ARE CALCULATED FOR THE TOTAL, ELASTIC, Groupie**

**CAPTURE AND FISSION REACTIONS. WITH THE NUMBER OF GROUPS THAT Groupie**

**ARE NORMALLY USED (SEE BUILT IN GROUP STRUCTURES) ALL OTHER Groupie**

**REACTIONS RESULT IN A NEGLIGABLE AMOUNT OF SELF-SHIELDING. AS Groupie**

**SUCH THEIR EQUIVALENT BAND CROSS SECTION WILL MERELY BE THEIR Groupie**

**UNSHIELDED VALUE WITHIN EACH BAND. Groupie**

**Groupie**

**FOR ANY GIVEN EVALUATION, WITHIN ANY GIVEN GROUP THIS PROGRAM Groupie**

**WILL GENERATE THE MINIMUM NUMBER OF BANDS REQUIRED WITHIN THAT Groupie**

**GROUP. AS OUTPUT TO THE COMPUTER READABLE DISK FILE THE BAND Groupie**

**PARAMETERS FOR EACH EVALUATION WILL BE FORMATTED TO HAVE THE Groupie**

**SAME NUMBER OF BANDS IN ALL GROUPS (WITH ZERO WEIGHT FOR SOME Groupie**

**BANDS WITHIN ANY GROUP). THE USER MAY DECIDE TO HAVE OUTPUT Groupie**

**EITHER WITH THE MINIMUM NUMBER OF BANDS REQUIRED FOR EACH Groupie**

**EVALUATION (E.G. 2 BANDS FOR HYDROGEN AND 4 BANDS FOR U-233) OR Groupie**

**THE SAME NUMBER OF BANDS FOR ALL EVALUATIONS (E.G. 4 BANDS FOR Groupie**

**BOTH HYDROGEN AND U-233). Groupie**

**Groupie**

**FOR 2 OR FEWER BANDS THE PROGRAM USES AN ANALYTIC EXPRESSION Groupie**

**TO DEFINE ALL MULTI-BAND PARAMETERS. FOR MORE THAN 2 BANDS THE Groupie**

**PROGRAM PERFORMS A NON-LINEAR FIT TO SELECT THE MULTI-BAND Groupie**

**PARAMETERS THAT MINIMIZE THE MAXIMUM FRACTIONAL ERROR AT ANY Groupie**

**POINT ALONG THE ENTIRE SELF-SHIELDING CURVE. THE NUMBER OF BANDS Groupie**

**REQUIRED WITHIN ANY GIVEN GROUP IS DEFINED BY INSURING THAT THE Groupie**

**MULTI-BAND PARAMETERS CAN BE USED TO ACCURATELY DEFINE SELF- Groupie**

**SHIELDED CROSS SECTIONS ALONG THE ENTIRE SELF-SHIELDING CURVE Groupie**

**FROM SIGMA0 = 0 TO INFINITY. THE USER MAY DEFINE THE ACCURACY Groupie**

**REQUIRED. Groupie**

**Groupie**

**ENDF/B FORMATTED UNSHIELDED AVERAGES Groupie**

**------------------------------------ Groupie**

**UNSHIELDED MULTI-GROUP AVERAGED CROSS SECTIONS FOR ALL REACTIONS Groupie**

**MAY BE OBTAINED IN THE ENDF/B FORTRAN IN EITHER HISTOGRAM Groupie**

**(INTERPOLATION LAW 1) OR LINEARLY INTERPOLABLE (INTERPOLATION Groupie**

**LAW 2) FORM. SEE INPUT BELOW FOR DETAILS. Groupie**

**Groupie**

**MIXTURES OF MATERIALS AND RESONANCE OVERLAP Groupie**

**------------------------------------------- Groupie**

**THE SELF-SHIELDED CROSS SECTIONS FOR THE INDIVIDUAL CONSTITUENTS Groupie**

**OF ANY MIXTURE CAN BE CALCULATED BY THIS PROGRAM BY REALIZING THAT Groupie**

**THIS PROGRAM ESSENTIALLY ONLY USES THE TOTAL CROSS SECTION AS A Groupie**

**WEIGHTING FUNCTION TO ACCOUNT FOR SELF-SHIELDING EFFECTS. FOR A Groupie**

**MIXTURE IT IS THEREFORE ONLY NECESSARY TO USE THE TOTAL CROSS Groupie**

**SECTION FOR THE MIXTURE IN PLACE OF THE ACTUAL TOTAL CROSS SECTION Groupie**

**FOR EACH CONSTITUENT AND TO RUN THIS PROGRAM. THIS CAN BE DONE BY Groupie**

**FIRST RUNNING PROGRAM MIXER TO CALCULATE THE ENERGY DEPENDENT Groupie**

**TOTAL CROSS SECTION FOR ANY COMPOSITE MIXTURE. NEXT, SUBSTITUTE Groupie**

**THIS COMPOSITE TOTAL CROSS SECTION FOR THE ACTUAL TOTAL CROSS Groupie**

**SECTION OF EACH CONSTITUENT (IN EACH ENDF/B FORMATTED EVALUATION). Groupie**

**FINALLY, RUN THIS PROGRAM TO CALCULATE THE SELF-SHIELDED CROSS Groupie**

**SECTION FOR EACH CONSTITUENT, PROPERLY ACCOUNTING FOR RESONANCE Groupie**

**OVERLAP BETWEEN THE RESONANCES OF ALL OF THE CONSTITUENTS OF THE Groupie**

**MIXTURE. DURING THE SAME RUN THESE SELF-SHIELDED CROSS SECTIONS Groupie**

**CAN IN TURN BE USED TO CALCULATE FULLY CORRELATED MULT-BAND Groupie**

**Groupie**

**MULTI-BAND PARAMETER OUTPUT FORMAT Groupie**

**---------------------------------- Groupie**

**FOR VERSIONS 92-2 AND LATER VERSIONS THE MULTI-BAND PARAMETERS Groupie**

**ARE OUTPUT IN A SIMPLE CHARACTER FORMAT, THAT CAN BE TRANSFERRED Groupie**

**AND USED ON VIRTUALLY ANY COMPUTER. Groupie**

**Groupie**

**THE BINARY FORMAT USED IN EARLIER VERSIONS OF THIS CODE IS NO Groupie**

**LONGER USED. Groupie**

**Groupie**

**CONTACT THE AUTHOR IF YOU WOULD LIKE TO RECEIVE A SIMPLE PROGRAM Groupie**

**TO READ THE CHARACTER FORMATTED MULTI-BAND PARAMETER FILE AND Groupie**

**CREATE A BINARY, RANDOM ACCESS FILE FOR USE ON VIRTUALLY ANY Groupie**

**COMPUTER. Groupie**

**Groupie**

**THE FORMAT OF THE CHARACTER FILE IS, Groupie**

**Groupie**

**RECORD COLUMNS FORMAT DESCRIPTION Groupie**

**1 1-72 18A4 LIBRARY DESCRIPTION (AS READ) Groupie**

**2 1-11 I11 MATERIAL ZA Groupie**

**12-22 I11 NUMBER GROUPS Groupie**

**23-33 I11 NUMBER OF BANDS Groupie**

**34-44 E11.4 TEMPERATURE (KELVIN) Groupie**

**45-55 1X,10A1 HOLLERITH DESCRIPTION OF ZA Groupie**

**3 1-11 E11.4 ENERGY (EV) - GROUP BOUNDARY. Groupie**

**12-22 E11.4 TOTAL (FIRST BAND) Groupie**

**23-33 E11.4 ELASTIC Groupie**

**34-44 E11.4 CAPTURE Groupie**

**35-55 E11.4 FISSION Groupie**

**4 1-11 ----- BLANK Groupie**

**12-22 E11.4 TOTAL (SECOND BAND) Groupie**

**23-33 E11.4 ELASTIC Groupie**

**34-44 E11.4 CAPTURE Groupie**

**35-55 E11.4 FISSION Groupie**

**Groupie**

**LINES 3 AND 4 ARE REPEATED FOR EACH GROUP. THE LAST LINE FOR EACH Groupie**

**MATERIAL (ZA) IS, Groupie**

**Groupie**

**N 1-11 E11.4 ENERGY (EV) - UPPER ENERGY LIMIT OF Groupie**

**LAST GROUP. Groupie**

**Groupie**

**FOR EXAMPLE, A 175 GROUP, 2 BAND FILE, FOR EACH MATERIAL WILL Groupie**

**CONTAIN 352 LINES = 1 HEADER LINE, 175 \* 2 LINES OF PARAMETERS, Groupie**

**AND 1 FINAL LINE WITH THE UPPER ENERGY LIMIT Groupie**

**OF THE LAST GROUP. Groupie**

**Groupie**

**INPUT FILES Groupie**

**----------- Groupie**

**UNIT DESCRIPTION Groupie**

**---- ----------- Groupie**

**2 INPUT DATA (BCD - 80 CHARACTERS/RECORD) Groupie**

**10 ORIGINAL ENDF/B DATA (BCD - 80 CHARACTERS/RECORD) Groupie**

**Groupie**

**OUTPUT FILES Groupie**

**------------ Groupie**

**UNIT DESCRIPTION Groupie**

**---- ----------- Groupie**

**3 OUTPUT REPORT (BCD - 80 CHARACTERS/RECORD) Groupie**

**11 MULTI-GROUP ENDF/B DATA - OPTIONAL Groupie**

**(BCD - 80 CHARACTERS/RECORD) Groupie**

**16 PLOTTAB FORMATTED SELF-SHIELDING RESULTS Groupie**

**(BCD - 80 CHARACTERS/RECORD) Groupie**

**31 MULTI-BAND PARAMETERS CHARACTER FILE - OPTIONAL Groupie**

**(BCD - 80 CHARACTERS/RECORD) Groupie**

**32 UNRESOLVED FSELF-SHIELDED PSEUDO ENDF FORMAT - OPTIONAL Groupie**

**(BCD - 120 CHARACTERS/RECORD) Groupie**

**33 SELF-SHIELDED CROSS SECTION LISTING - OPTIONAL Groupie**

**(BCD - 120 CHARACTERS/RECORD) Groupie**

**34 MULTI-BAND PARAMETER LISTING - OPTIONAL Groupie**

**(BCD - 120 CHARACTERS/RECORD) Groupie**

**35 UNSHIELDED CROSS SECTION LISTING - OPTION Groupie**

**(BCD - 120 CHARACTERS/RECORD) Groupie**

**Groupie**

**SCRATCH FILES Groupie**

**------------- Groupie**

**UNIT FILENAME DESCRIPTION Groupie**

**---- -------- ----------- Groupie**

**8 ENERGY DEPENDENT WEIGHTING SPECTRUM Groupie**

**(BINARY - 40080 WORDS/BLOCK) Groupie**

**9 TOTAL CROSS SECTION Groupie**

**(BINARY - 40080 WORDS/BLOCK) Groupie**

**12 ELASTIC CROSS SECTION - ONLY FOR SELF-SHIELDING CALCULATION Groupie**

**(BINARY - 40080 WORDS/BLOCK) Groupie**

**13 CAPTURE CROSS SECTION - ONLY FOR SELF-SHIELDING CALCULATION Groupie**

**(BINARY - 40080 WORDS/BLOCK) Groupie**

**14 FISSION CROSS SECTION - ONLY FOR SELF-SHIELDING CALCULATION Groupie**

**(BINARY - 40080 WORDS/BLOCK) Groupie**

**Groupie**

**OPTIONAL STANDARD FILE NAMES (SEE SUBROUTINES FILIO1 AND FILIO2) Groupie**

**---------------------------------------------------------------- Groupie**

**UNIT FILE NAME Groupie**

**---- ---------- Groupie**

**2 GROUPIE.INP Groupie**

**3 GROUPIE.LST Groupie**

**---------------------- Groupie**

**8 (SCRATCH) Groupie**

**9 (SCRATCH) Groupie**

**10 ENDFB.IN Groupie**

**11 ENDFB.OUT Groupie**

**12 (SCRATCH) Groupie**

**13 (SCRATCH) Groupie**

**14 (SCRATCH) Groupie**

**-----2019/6/23 - New Filenames (added ZAzzzaaa at Beginning)----------- Groupie**

**-----------(OLD)-------------(NEW)------------------------------------- Groupie**

**16 PLOTTAB.CUR ZAzzzaaa.PLOT.CUR Groupie**

**31 MULTBAND.TAB ZAzzzaaa.MULTBAND.TAB Groupie**

**32 ZAzzzaaa.URR.ENDF Groupie**

**33 SHIELD.LST ZAzzzaaa.SHIELD.LST Groupie**

**34 MULTBAND.LST ZAzzzaaa.MULTBAND.LST Groupie**

**35 UNSHIELD.LST ZAzzzaaa.UNSHIELD.LST Groupie**

**Groupie**

**I/O UNITS USED Groupie**

**-------------- Groupie**

**UNITS 2, 3 8, 9 AND 10 WILL ALWAYS BE USED. Groupie**

**UNITS 31 THROUGH 35, 11 AND 16 ARE OPTIONALLY USED DEPENDING Groupie**

**ON THE OUTPUT REQUESTED. Groupie**

**UNITS 12, 13 AND 14 WILL ONLY BE USED IF SELF-SHIELDED OR Groupie**

**MULTIBAND OUTPUT IS REQUESTED. Groupie**

**Groupie**

**INPUT CARDS Groupie**

**----------- Groupie**

**CARD COLS. FORMAT DESCRIPTION Groupie**

**---- ----- ------ ----------- Groupie**

**1 1-11 I11 SELECTION CRITERIA (0=MAT, 1=ZA) Groupie**

**1 12-22 I11 NUMBER OF GROUPS. Groupie**

**--------------------------2019/6/23 -11 (TART 616 groups) required for Groupie**

**Unresolved Resonance Region Self-Shielding Groupie**

**calculation. Groupie**

**=.GT.0 - ARBITRARY GROUP BOUNDARIES ARE READ Groupie**

**FROM INPUT FILE (N GROUPS REQUIRE Groupie**

**N+1 GROUP BOUNDARIES). CURRENT Groupie**

**PROGRAM MAXIMUM IS 20,000 GROUPS. Groupie**

**BUILT-IN OPTIONS INCLUDE.... Groupie**

**= 0 - TART 175 GROUPS Groupie**

**= -1 - ORNL 50 GROUPS Groupie**

**= -2 - ORNL 126 GROUPS Groupie**

**= -3 - ORNL 171 GROUPS Groupie**

**= -4 - SAND-II 620 (665) GROUPS TO 18 MEV Groupie**

**= -5 - SAND-II 640 (685) GROUPS TO 20 MEV Groupie**

**= -6 - WIMS 69 GROUPS Groupie**

**= -7 - GAM-I 68 GROUPS Groupie**

**= -8 - GAM-II 99 GROUPS Groupie**

**= -9 - MUFT 54 GROUPS Groupie**

**=-10 - ABBN 28 GROUPS Groupie**

**Current TART Standard =-11 - TART 616 GROUPS TO 20 MEV Groupie**

**(-11 is required for =-12 - TART 700 GROUPS TO 1 GEV Groupie**

**unresolved resonance =-13 - SAND-II 665 GROUPS TO 18 MEV Groupie**

**region self-shielding=-14 - SAND-II 685 GROUPS TO 20 MEV Groupie**

**calculations) =-15 - TART 666 GROUPS TO 200 MEV Groupie**

**=-16 - SAND-II 725 GROUPS TO 60 MEV Groupie**

**=-17 - SAND-II 755 GROUPS TO 150 MEV Groupie**

**=-18 - SAND-II 765 GROUPS TO 200 MEV Groupie**

**=-19 - UKAEA 1102 GROUPS TO 1 GeV Groupie**

**1 23-33 I11 MULTI-BAND SELECTOR Groupie**

**--------------------------2019/6/23 - ONLY 0 or 2 allowed = the = 1 Groupie**

**option has proven to give very poor results, Groupie**

**and therefore is no longer allowed. Groupie**

**= 0 - NO MULTI-BAND CALCULATIONS Groupie**

**No longer allowed = 1 - 2 BAND. CONSERVE AV(TOT), AV(1/TOT) Groupie**

**AND AV(1/TOT\*\*2) Groupie**

**= 2 - 2 BAND. CONSERVE AV(TOT), AV(1/TOT) Groupie**

**AND AV(1/(TOT+SIGMA0)) WHERE Groupie**

**SIGMA0 = AV(TOT) IN EACH GROUP Groupie**

**No longer allowed = 3-5- MULTI-BAND FIT. CONSERVE AV(TOT) AND Groupie**

**MINIMIZE FRACTIONAL ERROR FOR ENTIRE Groupie**

**SELF-SHIELDING CURVE (SIGMA0 = 0 TO Groupie**

**INFINITY) Groupie**

**IF THE SELECTOR IS POSITIVE (1 TO 5) THE Groupie**

**MINIMUM NUMBER OF BANDS WILL BE OUTPUT FOR Groupie**

**EACH ISOTOPE INDEPENDENTLY. IF THE SELECTOR Groupie**

**IS NEGATIVE (-1 TO -5) THE SAME NUMBER OF Groupie**

**BANDS (ABS(SELECTOR)) WILL BE OUTPUT FOR Groupie**

**ALL ISOTOPES. Groupie**

**1 34-44 I11 NUMBER OF POINTS USED TO DESCRIBE ENERGY Groupie**

**DEPENDENT WEIGHTING SPECTRUM S(E). Groupie**

**= 0 or 1 - Flat (Constant) Groupie**

**= -1 - 1/E at ALL energies Groupie**

**= -2 - MAXWELLIAN - UP TO 0.1 EV Groupie**

**1/E - 0.1 EV TO 67 KEV Groupie**

**FISSION - ABOVE 67 KEV Groupie**

**= > 1 - Read input table Groupie**

**2005/01/20---------------ADDED OPTION TO ALLOW TEMPERATURE OF THE Groupie**

**MAXWELLIAN TO BE CHANGED - SEE INPUT LINE 4, Groupie**

**COLUMNS 55 - 66. Groupie**

**= -1 - 1/E Groupie**

**= 0 OR 1- ENERGY INDEPENDENT (SO CALLED FLAT Groupie**

**WEIGHTING SPECTRUM). Groupie**

**= .GT.1 - READ THIS MANY POINTS FROM INPUT Groupie**

**TO DESCRIBE WEIGHTING SPECTRUM. Groupie**

**NO LIMIT TO THE NUMBER OF POINTS Groupie**

**USED TO DESCRIBE WEIGHTING. Groupie**

**1 45-55 E11.4 MULTI-BAND CONVERGENCE CRITERIA. Groupie**

**--------------------------2019/6/23 - No longer used now that code Groupie**

**is restricted to no more than 2 bands. Groupie**

**ONLY USED FOR 3 OR MORE BANDS. THE NUMBER OF Groupie**

**BANDS IN EACH GROUPS IS SELECTED TO INSURE Groupie**

**THAT THE ENTIRE SELF-SHIELDING CURVE CAN BE Groupie**

**REPRODUCED TO WITHIN THIS FRACTIONAL ERROR. Groupie**

**= .LT. 0.0001 - USE STANDARD 0.001 Groupie**

**(0.1 PER-CENT) Groupie**

**= .GE. 0.0001 - USE AS CONVERGENCE CRITERIA Groupie**

**1 56-66 I11 SIGMA-0 DEFINITION SELECTOR. Groupie**

**--------------------------2019/6/23 - For multi-band calculations Groupie**

**only 0 is alllowed = mulriples of unshielded Groupie**

**total in each group = This is required for Groupie**

**the BEST self-shielding results. Groupie**

**< 0 - 21 VALUES OF SIGMA0 ARE READ INPUT AND Groupie**

**INTERPRETED AS FIXED VALUES = SAME AS Groupie**

**= 1 DESCRIPTION BELOW Groupie**

**INPUT VALUES MUST ALL BE, Groupie**

**1) GREATER THAN 0 Groupie**

**2) IN DESCENDING VALUE ORDER Groupie**

**= 0 - SIGMA-0 WILL BE DEFINED AS A MULTIPLE Groupie**

**OF THE UNSHIELDED TOTAL CROSS SECTION Groupie**

**IN EACH GROUP (VALUES OF 1/1024 TO Groupie**

**1024 IN STEPS OF A FACTOR OF 2 WILL Groupie**

**BE USED AS THE MULTIPLIER). Groupie**

**= 1 - SIGMA-0 WILL BE DEFINED AS THE SAME Groupie**

**NUMBER OF BARNS IN EACH GROUP (VALUES Groupie**

**40000 TO 0.4 BARNS WILL BE USED. WITHIN Groupie**

**EACH DECADE VALUES OF 10, 7, 4, 2, 1 Groupie**

**BARNS WILL BE USED). Groupie**

**1 67-70 I4 High energy extension = definition of cross Groupie**

**section above highest tabulated energy. Groupie**

**--------------------------2019/6/23 - Ignored - will always use ENDF Groupie**

**Standard Definition = 0. Groupie**

**= 0 = cross section = 0 (standard ENDF/B) Groupie**

**= 1 = cross section = constant (equal to Groupie**

**value at highest tabulated energy). Groupie**

**2-4 1-66 6E11.4 SIGMA-0 Definition Groupie**

**--------------------------2019/6/23 - Only the GROUPIE standard = 0 Groupie**

**in allowed for Unresolved Resonance Region Groupie**

**Self-Shielding calculation Groupie**

**IF SIGMA-0 DEFINITION SELECTOR < 0, THE NEXT Groupie**

**4 LINES OF INPUT ARE THE 22 VALUES OF SIGMA0, Groupie**

**6 PER LINE. Groupie**

**2 1-72 A72 ENDF/B INPUT DATA FILENAME Groupie**

**(STANDARD OPTION = ENDFB.IN) Groupie**

**3 1-72 A72 ENDF/B OUTPUT DATA FILENAME Groupie**

**(STANDARD OPTION = ENDFB.OUT) Groupie**

**Groupie**

**THE FOURTH INPUT CARD IS USED TO SELECT ALL DESIRED OUTPUT MODES. Groupie**

**EACH OUTPUT DEVICE MAY BE TURNED OFF (0) OR ON (1). THEREFORE Groupie**

**THEREFORE EACH OF THE FOLLOWING INPUT PARAMETERS MAY BE EITHER Groupie**

**ZERO TO INDICATE NO OUTPUT OR NON-ZERO TO INDICATE OUTPUT. Groupie**

**Groupie**

**4 1-11 I11 SELF-SHIELDED CROSS SECTION LISTING Groupie**

**= 1 - CROSS SECTIONS Groupie**

**= 2 - RESONANCE INTEGRALS Groupie**

**4 12-22 I11 MULTI-BAND PARAMETER LISTING Groupie**

**4 23-33 I11 MULTI-BAND PARAMETERS COMPUTER READABLE Groupie**

**4 34-44 I11 UNSHIELDED CROSS SECTIONS IN ENDF/B FORMAT Groupie**

**= 1 - HISTOGRAM FORMAT (INTERPOLATION LAW 1) Groupie**

**= 2 - LINEAR-LINEAR (INTERPOLATION LAW 2) Groupie**

**4 45-55 I11 UNSHIELDED CROSS SECTIONS LISTING Groupie**

**= 1 - CROSS SECTIONS Groupie**

**= 2 - RESONANCE INTEGRALS Groupie**

**05/01/20 - ADDED THE BELOW OPTION Groupie**

**4 56-66 E11.4 IF THE STANDARD BUILT-IN SPECTRA IS USED, Groupie**

**INPUT LINE 1, COLUMNS 34-44 = 2, THIS FIELD Groupie**

**CAN BE USED TO OPTIONALLY CHANGE TEMPERATURE Groupie**

**OF THE MAXWELLIAN. Groupie**

**INPUT IS IN EV (0.0253 EV = ROOM TEMPERATURE) Groupie**

**= 0 - USE DEFAULT 0.0253 EV, ROOM TEMPERATURE Groupie**

**> 0 - USE THIS AS THE TEMPERATURE Groupie**

**RESTRICTION - TEMPERATURE CANNOT EXCEED Groupie**

**1000 EV. Groupie**

**Groupie**

**5 1-80 18A4 LIBRARY IDENTIFICATION. ANY TEXT THAT THE Groupie**

**USER WISHES TO IDENTIFY THE MULTI-BAND Groupie**

**PARAMETERS. THIS LIBRARY IDENTIFICATION IS Groupie**

**WRITTEN INTO THE COMPUTER READABLE MULTI-BAND Groupie**

**DATA FILE. Groupie**

**Groupie**

**6-N 1- 6 I6 LOWER MAT OR ZA LIMIT Groupie**

**7- 8 I2 LOWER MF LIMIT Groupie**

**9-11 I3 LOWER MT LIMIT Groupie**

**12-17 I11 UPPER MAT OR ZA LIMIT Groupie**

**18-19 I2 UPPER MF LIMIT Groupie**

**20-22 I3 UPPER MT LIMIT Groupie**

**UP TO 100 RANGES MAY BE SPECIFIED, ONE RANGE Groupie**

**PER LINE. THE LIST OF RANGES IS TERMINATED Groupie**

**BY A BLANK CARD. IF THE UPPER MAT OR ZA Groupie**

**LIMIT IS LESS THAN THE LOWER LIMIT THE UPPER Groupie**

**IS SET EQUAL TO THE LOWER LIMIT. IF THE UPPER Groupie**

**MF OR MT LIMIT IS ZERO IT WILL BE SET EQUAL Groupie**

**TO ITS MAXIMUM VALUE, 99 OR 999, RESPECTIVELY Groupie**

**IF THE FIRST REQUEST LINE IS BLANK IT WILL Groupie**

**TERMINATE THE LIST OF REQUESTS AND CAUSE ALL Groupie**

**DATA TO BE RETRIEVED (SEE EXAMPLE INPUT). Groupie**

**Groupie**

**VARY 1-66 6E11.4 ENERGY GROUP BOUNDARIES. ONLY REQUIRED IF Groupie**

**THE NUMBER OF GROUPS INDICATED ON THE FIRST Groupie**

**INPUT CARD IS POSITIVE. ALL ENERGIES MUST Groupie**

**BE IN ASCENDING ENERGY IN EV. THE PRESENT Groupie**

**LIMITS ARE 1 TO 20,000 GROUPS. FOR N GROUPS Groupie**

**N+1 BOUNDARIES WILL BE READ FROM THE Groupie**

**INPUT FILE, E.G. IF THE FIRST INPUT CARD Groupie**

**INDICATES 20 GROUPS, 21 ENERGY BOUNDARIES Groupie**

**WILL BE READ FROM THE INPUT FILE. Groupie**

**Groupie**

**VARY 1-66 6E11.4 ENERGY DEPENDENT WEIGHTING SPECTRUM. ONLY Groupie**

**REQUIRED IF THE NUMBER OF POINTS INDICATED Groupie**

**ON FIRST CARD IS MORE THAN ONE. DATA IS Groupie**

**GIVEN IN (ENERGY, WEIGHT) PAIRS, UP TO 3 Groupie**

**PAIRS PER CARD, USING ANY NUMBER OF CARDS Groupie**

**REQUIRED. ENERGIES MUST BE IN ASCENDING Groupie**

**ORDER IN EV. THE SPECTRUM VALUES MUST BE Groupie**

**NON-NEGATIVE. THE ENERGY RANGE OF SPECTRUM Groupie**

**MUST AT LEAST SPAN THE ENERGY RANGE OF THE Groupie**

**ENERGY GROUPS. SINCE SPECTRUM IS STORED IN Groupie**

**PAGING SYSTEM THERE IS NO LIMIT TO NUMBER Groupie**

**OF POINTS THAT CAN BE USED TO DESCRIBE THE Groupie**

**WEIGHTING SPECTRUM. Groupie**

**Groupie**

**EXAMPLE INPUT NO. 1 Groupie**

**------------------- Groupie**

**REQUEST DATA BY MAT AND PROCESS ALL DATA (ALL MAT BETWEEN 1 AND Groupie**

**9999). USE THE TART 175 GROUP STRUCTURE, GENERATE 2 BAND Groupie**

**PARAMETERS (THE FOR ALL ISOTOPES) TO 0.1 PER-CENT ACCURACY Groupie**

**IN THE SELF-SHIELDING CURVE. OUTPUT ALL LISTING, COMPUTER Groupie**

**READABLE AND ENDF/B FORMAT GROUP AVERAGES. Groupie**

**Groupie**

**EXPLICITLY SPECIFY THE STANDARD FILENAMES. Groupie**

**Groupie**

**THE FOLLOWING 7 INPUT LINES ARE REQUIRED. Groupie**

**Groupie**

**0 0 -2 0 1.00000-03 0 Groupie**

**ENDFB.IN Groupie**

**ENDFB.OUT Groupie**

**1 1 1 1 1 Groupie**

**TART 175 GROUP, 2 BAND LIBRARY TO 0.1 PER-CENT ACCURACY Groupie**

**1 1 1 9999 0 0 Groupie**

**(BLANK CARD TERMINATES REQUEST LIST) Groupie**

**Groupie**

**EXAMPLE INPUT NO. 2 Groupie**

**------------------- Groupie**

**THE SAME EXAMPLE 1, AS ABOVE, ONLY THE ENDF/B DATA WILL BE READ Groupie**

**FROM \ENDFB6\SIGMA1\K300\ZA092238 (U-238 AT 300 KELVIN) AND Groupie**

**WRITTEN TO \ENDFB6\GROUPIE\K300\ZA092238 Groupie**

**Groupie**

**THE FOLLOWING 7 INPUT LINES ARE REQUIRED. Groupie**

**Groupie**

**0 0 -2 0 1.00000-03 0 Groupie**

**\ENDFB6\SIGMA1\K300\ZA092238 Groupie**

**\ENDFB6\GROUPIE\K300\ZA092238 Groupie**

**1 1 1 1 1 Groupie**

**TART 175 GROUP, 2 BAND LIBRARY TO 0.1 PER-CENT ACCURACY Groupie**

**1 1 1 9999 0 0 Groupie**

**(BLANK CARD TERMINATES REQUEST LIST) Groupie**

**Groupie**

**EXAMPLE INPUT NO. 3 Groupie**

**------------------- Groupie**

**PROCESS ALL DATA. USE 1/E WEIGHTING IN ORDER TO CALCULATE Groupie**

**UNSHIELDED ONE GROUP CROSS SECTIONS OVER THE ENERGY RANGE 0.5 EV Groupie**

**TO 1 MEV (NOTE THAT THE RESULTS ARE SIMPLY PROPORTIONAL TO THE Groupie**

**RESONANCE INTEGRAL FOR EACH REACTION). OUTPUT UNSHIELDED LISTING. Groupie**

**Groupie**

**LEAVE THE DEFINITION OF THE FILENAMES BLANK - THE PROGRAM WILL Groupie**

**THEN USE STANDARD FILENAMES. Groupie**

**Groupie**

**THE FOLLOWING 7 INPUT CARDS ARE REQUIRED. Groupie**

**Groupie**

**0 0 1 -1 0 Groupie**

**(USE STANDARD FILENAME = ENDFB.IN) Groupie**

**(USE STANDARD FILENAME = ENDFB.OUT) Groupie**

**0 0 0 0 1 Groupie**

**RESONANCE INTEGRAL CALCULATION (FROM 0.5 EV TO 1 MEV) Groupie**

**(RETRIEVE ALL DATA, TERMINATE REQUEST LIST) Groupie**

**5.00000-01 1.00000+06 Groupie**

**Groupie**

**EXAMPLE INPUT NO. 4 Groupie**

**------------------- Groupie**

**THIS EXAMPLE USES A USER DEFINED GROUP STRUCTURE AND WEIGHTING Groupie**

**FUNCTION - THESE ARE NOT REALISTIC IN TERMS OF ACTUAL ENERGIES Groupie**

**AND WEIGHTS - THEY ARE ONLY INTENDED TO ILLUSTRATE THE ORDER OF Groupie**

**THE INPUT PARAMETERS. Groupie**

**Groupie**

**0 11 0 6 0 Groupie**

**RECENT.OUT Groupie**

**GROUPIE.OUT Groupie**

**1 1 1 1 1 Groupie**

**Example with users defined groupus and spectrum weighting Groupie**

**1 1 1 999999999 Groupie**

**(blabk line terminates request list) Groupie**

**1.00000-05 1.00000-04 1.00000-03 1.00000-02 1.00000-01 1.00000+00 grou Groupie**

**1.00000+01 1.00000+02 1.00000+03 1.00000+04 1.00000+05 1.00000+06 grou Groupie**

**1.00000-05 1.0 1.00000-02 0.1 1.00000+00 0.01 weig Groupie**

**1.00000+02 0.001 1.00000+04 0.0001 1.00000+06 0.000001 weig Groupie**

**Groupie**

**======================================================================= Groupie**