======================================================================= 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 OUT9, 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 OUT9 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**

 **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

 --------------------------- Groupie

 Dermott E. Cullen Groupie

 1466 Hudson Way Groupie

 Livermore, CA 94550 Groupie

 U.S.A. Groupie

 Telephone 925-443-1911 Groupie

 E. Mail RedCullen1@Comcast.net Groupie

 Website http://home.comcast.net/~redcullen1 Groupie

 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 (2015-2) \*\*\*\*\*\*\*\*\*\*\*\*\*\*\* 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 1000. 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

 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 1000 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 1000 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 D11.4 TEMPERATURE (KELVIN) Groupie

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

 3 1-11 D11.4 ENERGY (EV) - GROUP BOUNDARY. Groupie

 12-22 D11.4 TOTAL (FIRST BAND) Groupie

 23-33 D11.4 ELASTIC Groupie

 34-44 D11.4 CAPTURE Groupie

 35-55 D11.4 FISSION Groupie

 4 1-11 ----- BLANK Groupie

 12-22 D11.4 TOTAL (SECOND BAND) Groupie

 23-33 D11.4 ELASTIC Groupie

 34-44 D11.4 CAPTURE Groupie

 35-55 D11.4 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 D11.4 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

 31 MULTI-BAND PARAMETERS CHARACTER FILE - OPTIONAL Groupie

 (BCD - 80 CHARACTERS/RECORD) Groupie

 32 SELF-SHIELDED CROSS SECTION LISTING - OPTIONAL Groupie

 (BCD - 120 CHARACTERS/RECORD) Groupie

 33 MULTI-BAND PARAMETER LISTING - OPTIONAL Groupie

 (BCD - 120 CHARACTERS/RECORD) Groupie

 34 UNSHIELDED CROSS SECTION LISTING - OPTION Groupie

 (BCD - 120 CHARACTERS/RECORD) Groupie

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

 11 MULTI-GROUP ENDF/B DATA - OPTIONAL Groupie

 (BCD - 80 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

 8 (SCRATCH) Groupie

 9 (SCRATCH) Groupie

 10 ENDFB.IN Groupie

 11 ENDFB.OUT Groupie

 12 (SCRATCH) Groupie

 13 (SCRATCH) Groupie

 14 (SCRATCH) Groupie

 31 MULTBAND.TAB Groupie

 32 SHIELD.LST Groupie

 33 MULTBAND.LST Groupie

 34 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 34 AND 11 ARE OPTIONALLY USED DEPENDING ON THE Groupie

 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

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

 FROM INPUT FILE (N GROUPS REQUIRE Groupie

 N+1 GROUP BOUNDARIES). CURRENT Groupie

 PROGRAM MAXIMUM IS 1000 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

 =-11 - TART 616 GROUPS TO 20 MEV Groupie

 =-12 - TART 700 GROUPS TO 1 GEV Groupie

 =-13 - SAND-II 665 GROUPS TO 18 MEV Groupie

 =-14 - SAND-II 685 GROUPS TO 20 MEV Groupie

 =-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

 1 23-33 I11 MULTI-BAND SELECTOR Groupie

 = 0 - NO MULTI-BAND CALCULATIONS Groupie

 = 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

 = 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

 = -2 - MAXWELLIAN - UP TO 0.1 EV Groupie

 1/E - 0.1 EV TO 67 KEV Groupie

 FISSION - ABOVE 67 KEV Groupie

 05/01/20-----------------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 D11.4 MULTI-BAND CONVERGENCE CRITERIA. 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

 < 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

 = 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 6D11.4 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 D11.4 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 6D11.4 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 1000 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 6D11.4 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/V 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

 ======================================================================= Groupie