ADAS Subroutine v2bnmod

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      SUBROUTINE V2BNMOD(IPOSNT , JDENS  , JTE    , NREP   , F1     ,
     &                   F2     , F3     , BNCALC , BNACT  , XPOP   ,
     &                   IMAX   , DENSH  , DENS   , DENSP  , TE     ,
     &                   TP     , BMENER , FLUX   , DEXPTE , ALFA   ,
     &                   S      , DSLPATH, NIMP   , ZIMPA  , ZEFF   ,
     &                   DNIMPA)

      IMPLICIT REAL*8 (A-H,O-Z)


C-----------------------------------------------------------------------
C
C  ****************** FORTRAN77 SUBROUTINE: V2BNMOD ********************
C
C  VERSION:  (ADAS91) - SEE SC CS COMMENTS FOR VERSION NO.
C
C  PURPOSE:  THIS CODE PERFORMS THE ACTUAL CALCULATIONS FOR ADAS 310
C            IT IS IN AN INCOMPLETE VERSION AND THESE COMMENTS DO NOT
C            YET FOLLOW THE STANDARD ADAS PATTERN.
C-----------------------------------------------------------------------
C       CALCULATION OF BN -1 CASE A,B
C
C       EXCIT. XSECT. OPTIONS:
C       ---------------------
C                       (A) VAN REGEMORTER   - ELECTRONS
C                       (B) IMPACT PARAMETER  - ELECTRONS
C                                               PROTONS
C                       (C) PERCIVAL-RICHARDS - ELECTRONS
C                                             - PROTONS & ZIMP IONS
C                       (D) VAINSHTEIN       - PROTONS & ZIMP IONS
C                       (E) SPECIAL LOW LEVEL - ELECTRONS
C                                             - PROTONS & ZIMP IONS
C       IONIS. XSECT. OPTIONS:
C       ---------------------
C                       (A) ECIP             - ELECTRONS
C                       (B) PERCIVAL-RICHARDS - PROTONS & ZIMP IONS
C                       (C) SPECIAL LOW LEVEL - ELECTRONS
C                                             - PROTONS & ZIMP IONS
C       CX RECOM. XSECT. OPTIONS:
C       ------------------------
C                       (A) SPECIAL          - H(1S) DONOR
C
C
C  NOTES
C  -----
C     (A) SPECIAL LOW LEVEL DATA ACCESSED BY SPECIFIC ION ROUTINE
C
C        ION   ROUTINE   ACCESSED FILE              ACQUIS. ROUTINE
C        ---   -------   -------------              ---------------
C        H0    NSUPH1    IONATOM.DATA(H)                 QH
C                        HLIKE.DATA(AGG1984)             -
C
C
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C        (B) SPECIAL CHARGE EXCHANGE DATA FROM  CHEXDATA.DATA
C
C          ION    DONOR    ROUTINE    DATA MEMBER    ACQUIS. ROUTINE
C          ---    -----    -------    -----------    ---------------
C          H0     H(1S)    BNQCTB     H1NEW1             BNQCTB
C
C
C
C
C   INPUT
C       IPOSNT   = 0  BYPASS
C                = 1  LEAVE W1.NE.0 AND FORCE DENSH.EQ.0
C                = 2  FORCE W1.EQ.0 AND FORCE DENSH.EQ.0
C                = 3  LEAVE W1.NE.0 AND LEAVE DENSH.NE.0
C                = 4  FORCE W1.EQ.0 AND LEAVE DENSH.NE.0
C                = 5  BYPASS
C       JDENS    = DENSITY    SELECTOR
C       JTE      = TEMPERATURE SELECTOR
C       NREP(I)  = PRINCIPAL QUANTUM NUMBER OF ITH REPRESENTATIVE LEVEL
C       XPOP(I)  = POPULATIONS OF REPRESENTATIVE LEVELS
C       IMAX     = NUMBER OF REPRESENTATIVE LEVELS
C       DENSH    = NEUTRAL HYDROGEN DENSITY IN BEAM  (CM-3)
C       DENS     = ELECTRON DENSITY  (CM-3)
C       DENSP    = PROTON/DEUTERON DENSITY  (CM-3)
C       TE       = ELECTRON TEMPERATURE (K)
C       TP       = PROTON/DEUTERON TEMPERATURE (K)   (SAME FOR ZIMP IONS)
C       BMENER   = NEUTRAL BEAM PARTICLE ENERGY  (EV/AMU)
C       FLUX     = NEUTRAL BEAM FLUX  (CM-2 SEC-1)
C       DEXPTE(I)= EXP(ATE/NREP(I)**2) FOR ITHE REPRESENTATIVE LEVEL
C       DSLPATH  = STRING CONTAINING PATH TO THE REQUIRED INPUT FILES
C                  CALLED BY NSUPH1.FOR
C
C   OUTPUT
C       F1       =
C       F2       =
C       F3       =
C       BNCALC   =
C       BNACT    =
C       ALPHA    =
C       S        =
C
C   INPUT SPECIFICATION FOR STREAM 51 DATA FILE
C
C       NUCCHG = NUCLEAR CHARGE
C       EXMEMB = DATA SET NAME OF EXPANSION FILE USED BY CLDLBN2
C       CXMEMB = DATA SET NAME FOR CHARGE EXCHANGE DATA TO BE USED BY
C                BNQCTB
C       IBLOCK = SUB-BLOCK SELECTOR FOR CXMEMB
C
C       JDENSM = NUMBER OF DENSITIES
C       JTEM   = NUMBER OF TEMPERATURES
C       TS     = EXTERNAL RADIATION FIELD TEMPERATURE (K)
C       W      = EXTERNAL RADIATION FIELD DILUTION FACTOR (HIGH LEVELS)
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C      Z      = RECOMBINING ION CHARGE  (Z1 IN USUAL NOTATION)
C      CION   = MULTIPLIER OF GROUND LEVEL ELECTRON IMPACT IONISATION
C               RATE COEFFICIENT
C      CPY    = MULTIPIER ON ELECTRON IMPACT EXCITATION RATE COEFFICIENT
C               FORM THE GROUND LEVEL
C      W1     = EXTERNAL RADIATION FIELD DILUTION FACTOR FOR PHOTO-IONI
C               SATION FORM THE GROUND LEVEL.
C
C      NIP    = RANGE OF DELTA N FOR IMPACT PARAMETER XSECTS. (LE.4)
C      INTD   = ORDER OF MAXWELL QUADRATURE FOR XSECTS. (LE.3)
C      IPRS   = 0   DEFAULT TO VAN REGEMORTER XSECTS. BEYOND NIP RANGE
C               1   USE PERCIVAL-RICHARDS XSECTS.     BEYOND NIP RANGE
C      ILOW   = 0   NO SPECIAL LOW LEVEL DATA ACCESSED
C               1      SPECIAL LOW LEVEL DATA ACCESSED
C      IONIP  = 0   NO ION IMPACT COLLISIONS INCLUDED
C               1      ION IMPACT EXCITATION AND IONISATION INCLUDED
C      NIONIP = RANGE OF DELTA N FOR ION IMPACT EXCITATION XSECTS.
C      ILPRS  = 0   DEFAULT TO VAINSHTEIN XSECTS.
C               1      USE LODGE-PERCIVAL-RICHARDS XSECTS.
C      IVDISP = 0   ION IMPACT AT THERMAL MAXWELLIAN ENERGIES
C               1      ION IMPACT AT DISPLACED THERMAL ENERGIES ACCORDING
C                      TO THE NEUTRAL BEAM ENERGY PARAMETER
C               *   IF(IVDISP=0 THEN SPECIAL LOW LEVEL DATA FOR ION
C                      IMPACT IS NOT SUBSTITUTED - ONLY VAINSHTEIN AND
C                      LODGE ET AL. OPTIONS ARE OPEN.  ELECTRON IMPACT
C                      DATA SUBSTITUTION DOES OCCUR.
C      1    = PLASMA Z EFFECTIVE
C      NOSCAN = 0   EXECUTE SCANNING VERSION OF CODE
C               1   EXECUTE SIMULTANEOUS IMPURITY NO SCAN RUN
C      NIMP   = NUMBER OF IMPURITIES (EXCL.H+) IN NO SCAN CASE
C  ROUTINES:
C         ROUTINE    SOURCE    BRIEF DESCRIPTION
C         -------------------------------------------------------------
C         MATINV     ADAS      MATRIX INVERSION WITH ACCOMPANYING
C                              SOLUTION OF LINEAR EQUATIONS
C         DIEL_310   ????
C
C
C
C ********* H.P.SUMMERS, JET                  11 APR 1990  **************
C *********                          ALT. 17 JUL 1991  SUB. RQINEW,
C                                                    RQLNEW, RQVNEW
C *********                          ALT. 10 JAN 1994  ALLOW MULTIPLE
C                                                    SIMULT.IMPURITY
C----------------------------------------------------------------------
C
C----------------------------------------------------------------------
C
C UPDATE: 19/01/94 - JONATHAN NASH - TESSELLA SUPPORT SERVICES PLC
C
C         THE FOLLOWING MODIFICATIONS HAVE BEEN MADE TO THE SUBROUTINE:
C
C         1) THE INPUT FILE UNIT NUMBER HAS BEEN CHANGED FROM 5 TO 51.
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C
C          2) THE SIZES OF 'EXMEMB' AND 'CXMEMB' HAVE BEEN INCREASED
C             AS THEY NOW CONTAIN THE FULL DATA SET NAMES RATHER THAN
C             JUST THE MEMBER NAMES.
C
C          3) A PARAMETER FLAG HAS BEEN ADDED TO SWITCH ON/OFF
C             DIAGNOSTIC PRINTING (UNIT 6).
C
C  NOTES:  NO ATTEMPT HAS BEEN MADE TO RESTRUCTURE THE ROUTINE. RATHER
C          THE MINIMUM AMOUNT OF WORK TO INTEGRATE THE ROUTINE INTO
C          ADAS310 HAS BEEN COMPLETED.
C
C UNIX-IDL PORT:
C
C VERSION: 1.1                        DATE: 12-12-95
C MODIFIED: TIM HAMMOND (TESSELLA SUPPORT SERVICES PLC)
C                  - FIRST VERSION
C                  - REPLACED ALL HOLLERITH CONSTANTS H0 ANF H1 WITH
C                    H<SPACE>
C                  - REPLACED HOLLERITH CONSTANTS WITH STANDARD STRINGS
C                    IN FORMAT STATEMENTS 117, 128 AND 129.
C                  - TIDIED UP PARTS OF THE COMMENTS AND CODE
C                  - ADDED STRING DSLPATH TO BE USED TO CONSTRUCT UNIX
C                    STYLE FILENAMES IN NSUPH1.FOR
C
C VERSION: 1.2                        DATE: 24-01-96
C MODIFIED: TIM HAMMOND (TESSELLA SUPPORT SERVICES PLC)
C                  - ADDED NBENG TO INPUT LIST AND CALL TO BNQCTB
C
C VERSION: 1.3                        DATE: 24-01-96
C MODIFIED: TIM HAMMOND (TESSELLA SUPPORT SERVICES PLC)
C                  - REVERSED ABOVE CHANGE
C
C VERSION: 1.4                        DATE: 27-09-96
C MODIFIED: WILLIAM OSBORN + HUGH SUMMERS
C                  - REMOVED MISTAKEN TEST FOR 1.LE.0.0D0 IN
C                    THE CASE OF MULTIPLE IMPURITIES.
C VERSION: 1.5
C MODIFIED: HARVEY ANDERSON
C                  - IMPROVED THE HANDLING OF MULTIPLE IMPURITIES TO
C                    INCLUDE HYDROGEN.
C                  - ALTERED THE CALLING STRUCTURE OF THIS ROUTINE TO
C                    ALLOW ADDITIONAL VARIABLES TO BE PASSED TO RUN310.
C                  - INCREASED THE SIZE OF THE ARRAYS DENSA, DENPA, TEA
C                    AND TPA FROM 10 TO 25.
C
C VERSION : 1.6
C DATE    : 04-04-2000
C MODIFIED: RICHARD MARTIN
C                  - CHANGED NAME OF DIEL SUBROUTINE TO DIEL_310
C
C VERSION : 1.7
C DATE    : 22-02-2005
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C MODIFIED: Martin O'Mullane
C                 - A real*8 parameter of cldlbn2 which was passed as an
C                   integer (1) to cldlbn2 is changed to a double (1.0D0).
C                 - Direct debug output stream to unit 0.
C                 - Remove IBM error underflow and errset routines.
C
C VERSION : 1.8
C DATE    : 27-06-2007
C MODIFIED: Martin O'Mullane
C                 - Add lpass as argument to cldlbn2. Set to .TRUE.
C
C-------------------------------------------------------------------
      CHARACTER*80      DSLPATH
      INTEGER           IMAX,        IPOSNT,      JDENS,       JTE
      INTEGER           NIMP,        NREP(31)
      REAL*8            ALFA,        BMENER,      BNACT(30)
      REAL*8            BNCALC(30),  DENS,        DENSH,       DENSP
      REAL*8            DEXPTE(550), DNIMPA(10),  F1(30),      F2(30)
      REAL*8            F3(30),      FLUX,        S,           TE
      REAL*8            TP,          XPOP(2),     ZEFF
      REAL*8            ZIMPA(10)
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