ADAS4XX
FORTRAN

BND404A

```
       SUBROUTINE BND404A(ITYPE  ,
     &                    NUTMAX , NUDMAX , NUZMAX , NUMMAX ,
     &                    MAXT   , MAXD   ,
     &                    IZL    , IZH    , IZ0    ,
     &                    TEK    , DENSA  ,
     &                    METFRC ,
     &                    NGRD   ,
     &                    IST2   , IST5   , IWRITE , DATE,
     &                    DSNIN)
       IMPLICIT NONE
C
C-----------------------------------------------------------------------
C
C ************ FORTRAN 77 SUBROUTINE BND404A **************************
C
C   VERSION 1.0
C
C   PURPOSE:
C           TO FETCH DATA FROM RESOLVED ADF10 FILES, SPLINE THEM
C           ONTO THE REQUESTED TEMPERATURE/DENSITY GRID, BUNDLE
C           THEM INTO UNRESOLVED DATA USING THE INPUT METASTABLE
C           FRACTIONS, AND WRITE THE RESULT TO ADF11 FILES.
C
C   CALLING ROUTINE / PROGRAM : LH404RU / ADAS404
C
C   DATA:
C
C           THE SOURCE DATA IS CONTAINED AS MEMBERS OF PARTITIONED
C           DATA SETS AS FOLLOWS:
C
C             1. JETUID.ACD<YR>.DATA
C             2. JETUID.SCD<YR>.DATA
C             3. JETUID.CCD<YR>.DATA
C             4. JETUID.PRB<YR>.DATA
C             5. JETUID.PRC<YR>.DATA
C
C           WHERE <YR> DENOTES TWO INTEGERS FOR THE YEAR SELECTED.
C
C   SUBROUTINE:
C
C   INPUT : (I*4)  ITYPE  - TYPE OF ADF10 DATA BEING READ (SEE ABOVE)
C   INPUT : (I*4)  NUTMAX - OUTPUT ELEMENT MASTER FILE
C                           MAXIMUM NUMBER OF TEMPERATURES
C   INPUT : (I*4)  NUDMAX - OUTPUT ELEMENT MASTER FILE
C                           MAXIMUM NUMBER OF DENSITIES
C   INPUT : (I*4)  NUZMAX - OUTPUT ELEMENT MASTER FILE
C                           MAXIMUM NUMBER OF CHARGE STATES
C   INPUT : (I*4)  NUMMAX - OUTPUT ELEMENT MASTER FILE
C                           MAXIMUM NUMBER OF METASTABLES
C   INPUT : (I*4)  MAXT   - OUTPUT ELEMENT MASTER FILE
C                           ACTUAL NUMBER OF TEMPERATURES
C   INPUT : (I*4)  MAXD   - OUTPUT ELEMENT MASTER FILE
C                           ACTUAL NUMBER OF DENSITIES
CX   INPUT : (C*()) DSNAME - ROOT NAME OF MASTER CONDENSED FILE
CX                           TO BE OPENED
C   INPUT : (I*4)  IZL    - LOWEST ION CHARGE TO READ
C   INPUT : (I*4)  IZH    - HIGHEST ION CHARGE TO READ
C   INPUT : (I*4)  IZ0    - NUCLEAR CHARGE TO READ
C   INPUT : (R*8)  DENSA()- OUTPUT ELEMENT MASTER FILE
C                           SET OF MAXD DENSITIES
C   INPUT : (R*8)  TEK()  - OUTPUT ELEMENT MASTER FILE
C                           SET OF MAXT TEMPERATURES
C   INPUT : (R*8)  METFRC(,,,) - METASTABLE POPULATION FRACTIONS,
C                           SPLINED ONTO THE OUTPUT TEMPERATURES
C                           AND DENSITIES
C                           1ST DIMENSION - DENSITY INDEX
C                           2ND DIMENSION - TEMPERATURE INDEX
C                           3RD DIMENSION - CHARGE STATE INDEX
C                           4TH DIMENSION - METASTABLE INDEX
C   INPUT : (I*4)  NGRD() - NUMBER OF GROUND STATES OF THE FIRST
C                           50 ISOELECTRONIC SEQUENCES
C   INPUT : (I*4)  IST2   - UNIT NUMBER FOR OUTPUT INFORMATION
C                           AND ERROR MESSAGES
C   INPUT : (I*4)  IST5   - UNIT NUMBER FOR READING MASTER CONDENSED
C                           FILE
C   INPUT : (I*4)  IWRITE - UNIT NUMBER FOR WRITING ADF11 DATA
C   INPUT : (C*8)  DATE   - CURRENT DATE
C
C   PARAMETER : (I*4)  NTDMAX - SIZE OF LOCAL WORKING SPACE
C                               (MUST BE GREATER THAN NUTMAX & NUDMAX)
C   PARAMETER : (I*4)  NDZ1V  - MASTER CONDENSED FILE
C                               MAXIMUM NUMBER OF CHARGE STATES
C   PARAMETER : (I*4)  NDTIN  - MASTER CONDENSED FILE
C                               MAXIMUM NUMBER OF TEMPERATURES
C   PARAMETER : (I*4)  NDDEN  - MASTER CONDENSED FILE
C                               MAXIMUM NUMBER OF DENSITIES
C
C         : (R*8)  DENSR()    - INPUT MASTER CONDENSED FILE
C                               SET OF IDE REDUCED DENSITIES
C         : (R*8)  TR()       - INPUT MASTER CONDENSED FILE
C                               SET OF ITE REDUCED TEMPERATURES
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```
C         : (R*8)  ZIPT()     - INPUT MASTER CONDENSED FILE
C                                 SET OF IZE RECOMBINING ION CHARGES
C         : (R*8)  AIPT(,,)   - INPUT MASTER CONDENSED FILE
C                                 RELEVANT RATE COEFFICIENTS
C                                 1ST DIMENSION - DENSITY INDEX
C                                 2ND DIMENSION - TEMPERATURE INDEX
C                                 3RD DIMENSION - CHARGE STATE INDEX
C         : (R*8)  EIA()      - INPUT MASTER CONDENSED FILE
C                                 SET OF IONISATION POTENTIALS (CM-1)
C
C         : (R*8)  ATTY(,)    - WORK SPACE FOR INTERPOLATION
C                               - STORES LOG10(INTERPOLATED VALUES)
C                                 1ST DIMENSION - TEMPERATURE
C                                 2ND DIMENSION - DENSITY
C         : (R*8)  ARRAY(,)   - STORES LOG10(INTERPOLATED VALUES)
C                                 1ST DIMENSION - TEMPERATURE
C                                 2ND DIMENSION - DENSITY
C         : (R*8)  WORK(,)    - SUM OF INTERPOLATED VALUES OVER
C                               METASTABLE STATES
C                                 1ST DIMENSION - TEMPERATURE
C                                 2ND DIMENSION - DENSITY
C
C     ROUTINES:
C     ---------
C         XXOPEN   -
C         XXTERM   -
C         XXSLEN   -
C         XXIN17   -  FETCH DATA FROM MASTER CONDENSED FILE
C         D4SPLN   -  INTERPOLATE CONDENSED MASTER FILE
C                     UPDATED VERSION OF D1SPLN
C
C-----------------------------------------
C AUTHOR:  LORNE D. HORTON
C          ROOM K1/1/58, JET JOINT UNDERTAKING
C
C   DATE:  23RD FEBRUARY 1996
C-----------------------------------------------------------------------
C UNIX-IDL PORT:
C
C VERSION: 1.1                          DATE: 11-11-96
C MODIFIED: WILLIAM OSBORN (TESSELLA SUPPORT SERVICES PLC)
C                - FIRST CONVERTED
C VERSION: 1.2                          DATE: 20-10-97
C MODIFIED: LORNE HORTON (JET)
C                - INCREASED SPACE FOR FILE NAME DIAGNOSTICS
C        - REMOVED ISWIT VARIABLES AND PASSED ITYPE TO
C                          D4SPLN INSTEAD
C        - ALLOWED LSWIT TO BE TRUE FOR ALL SCD'S, INCLUDING
C                  FROM METASTABLE STATES
C
C-----------------------------------------------------------------------
C
C
       INTEGER   ITYPE
       INTEGER   NUTMAX, NUDMAX, NUZMAX, NUMMAX
       INTEGER   MAXT, MAXD
       INTEGER   IZL, IZH, IZ0
       INTEGER   NGRD(50), IST2, IST5, IWRITE
       REAL*8    TEK(NUTMAX), DENSA(NUDMAX)
       REAL*8    METFRC(NUDMAX,NUTMAX,NUZMAX,NUMMAX)
       CHARACTER DSNAME*80, DATE*8
C
       INTEGER   NTDMAX, NDZ1V, NDTIN, NDDEN
       REAL*8    DMIN
       PARAMETER (NTDMAX = 40)
       PARAMETER (NDZ1V  = 20, NDTIN  = 24, NDDEN  = 24 )
       PARAMETER (DMIN = 1.0D-74)
C-----------------------------------------------------------------------
C      VARIABLES FOR DSNAME PARSING AND OPENING
C-----------------------------------------------------------------------
       LOGICAL   LEXIST
       INTEGER   INDS, NELEC, LS, L1, L2
       INTEGER   IBGN, IEND
       CHARACTER SEQUA*2, XFESYM*2,DSNIN(50,10)*80
       CHARACTER STRING*132
C-----------------------------------------------------------------------
C      VARIABLES FOR XXIN17
C-----------------------------------------------------------------------
       LOGICAL   LERROR , LSWIT
       INTEGER   IDE, ITE, IZE, IME, NPRNT
       REAL*8    DENSR(NDDEN) ,TR(NDTIN), ZIPT(NDZ1V)
       REAL*8    EIA(50)
       REAL*8    AIPT(NDDEN,NDTIN,NDZ1V)
C-----------------------------------------------------------------------
C      VARIABLES FOR D4SPLN
C-----------------------------------------------------------------------
       LOGICAL   LZRNG(1), LDRNG(NTDMAX), LTRNG(NTDMAX)
       INTEGER   IZ1
       REAL*8    TUSR(NTDMAX) , DUSR(NTDMAX)
       REAL*8    ARRAY(NTDMAX, NTDMAX)
       REAL*8    ATTY(NTDMAX, NTDMAX)
C-----------------------------------------------------------------------
C      MISCELLANEOUS COUNTERS, ETC.
C-----------------------------------------------------------------------
       INTEGER   I, IT, ID, IZ, IGRD, NGRDI, IPRT, JPRT, NPRTI
       REAL*8    WORK(NTDMAX, NTDMAX), FRAC
       INTEGER   ZERO, PIPEOU
       PARAMETER (PIPEOU = 6)
```

```
      DATA      ZERO/0/
C
C-----------------------------------------------------------------------
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BND404B

```
      SUBROUTINE BND404B(ITYPE  ,
     &                   NUTMAX , NUDMAX , NUZMAX , NUMMAX ,
     &                   MAXT   , MAXD   ,
     &                   IZL    , IZH    , IZ0    ,
     &                   TEK    , DENSA  ,
     &                   METFRC ,
     &                   NGRD   ,
     &                   IST2   , IST5   , IWRITE , DATE,
     &                   DSNIN)
      IMPLICIT NONE
C
C-----------------------------------------------------------------------
C
C ************ FORTRAN 77 SUBROUTINE BND404B ***************************
C
C   VERSION 1.0
C
C   PURPOSE:
C           TO FETCH DATA FROM RESOLVED ADF10 FILES, SPLINE THEM
C           ONTO THE REQUESTED TEMPERATURE/DENSITY GRID, BUNDLE
C           THEM INTO UNRESOLVED DATA USING THE INPUT METASTABLE
C           FRACTIONS, AND WRITE THE RESULT TO ADF11 FILES.
C
C   CALLING ROUTINE / PROGRAM : LH404RU / ADAS404
C
C   DATA:
C
C           THE SOURCE DATA IS CONTAINED AS MEMBERS OF PARTITIONED
C           DATA SETS AS FOLLOWS:
C
C             8. JETUID.PLT<YR>.DATA
C             9. JETUID.PLS<YR>.DATA
C
C           WHERE <YR> DENOTES TWO INTEGERS FOR THE YEAR SELECTED.
C
C   SUBROUTINE:
C
C   INPUT : (I*4)  ITYPE  - TYPE OF ADF10 DATA BEING READ (SEE ABOVE)
C   INPUT : (I*4)  NUTMAX - OUTPUT ELEMENT MASTER FILE
C                           MAXIMUM NUMBER OF TEMPERATURES
C   INPUT : (I*4)  NUDMAX - OUTPUT ELEMENT MASTER FILE
C                           MAXIMUM NUMBER OF DENSITIES
C   INPUT : (I*4)  NUZMAX - OUTPUT ELEMENT MASTER FILE
C                           MAXIMUM NUMBER OF CHARGE STATES
C   INPUT : (I*4)  NUMMAX - OUTPUT ELEMENT MASTER FILE
C                           MAXIMUM NUMBER OF METASTABLES
C   INPUT : (I*4)  MAXT   - OUTPUT ELEMENT MASTER FILE
C                           ACTUAL NUMBER OF TEMPERATURES
C   INPUT : (I*4)  MAXD   - OUTPUT ELEMENT MASTER FILE
C                           ACTUAL NUMBER OF DENSITIES
CX   INPUT : (C*()) DSNAME - ROOT NAME OF MASTER CONDENSED FILE
CX                           TO BE OPENED
C   INPUT : (I*4)  IZL    - LOWEST ION CHARGE TO READ
C   INPUT : (I*4)  IZH    - HIGHEST ION CHARGE TO READ
C   INPUT : (I*4)  IZ0    - NUCLEAR CHARGE TO READ
C   INPUT : (R*8)  DENSA()- OUTPUT ELEMENT MASTER FILE
C                           SET OF MAXD DENSITIES
C   INPUT : (R*8)  TEK()  - OUTPUT ELEMENT MASTER FILE
C                           SET OF MAXT TEMPERATURES
C   INPUT : (R*8)  METFRC(,,,) - METASTABLE POPULATION FRACTIONS,
C                           SPLINED ONTO THE OUTPUT TEMPERATURES
C                           AND DENSITIES
C                           1ST DIMENSION - DENSITY INDEX
C                           2ND DIMENSION - TEMPERATURE INDEX
C                           3RD DIMENSION - CHARGE STATE INDEX
C                           4TH DIMENSION - METASTABLE INDEX
C   INPUT : (I*4)  NGRD() - NUMBER OF GROUND STATES OF THE FIRST
C                           50 ISOELECTRONIC SEQUENCES
C   INPUT : (I*4)  IST2   - UNIT NUMBER FOR OUTPUT INFORMATION
C                           AND ERROR MESSAGES
C   INPUT : (I*4)  IST5   - UNIT NUMBER FOR READING MASTER CONDENSED
C                           FILE
C   INPUT : (I*4)  IWRITE - UNIT NUMBER FOR WRITING ADF11 DATA
C   INPUT : (C*8)  DATE   - CURRENT DATE
C
C   PARAMETER : (I*4)  NTDMAX - SIZE OF LOCAL WORKING SPACE
C                               (MUST BE GREATER THAN NUTMAX & NUDMAX)
C   PARAMETER : (I*4)  NDZ1V  - MASTER CONDENSED FILE
C                               MAXIMUM NUMBER OF CHARGE STATES
C   PARAMETER : (I*4)  NDTIN  - MASTER CONDENSED FILE
C                               MAXIMUM NUMBER OF TEMPERATURES
C   PARAMETER : (I*4)  NDDEN  - MASTER CONDENSED FILE
C                               MAXIMUM NUMBER OF DENSITIES
C   PARAMETER : (I*4)  NDMET  - MASTER CONDENSED FILE
C                               MAXIMUM NUMBER OF METASTABLES
C
C         : (R*8)  DENSR()    - INPUT MASTER CONDENSED FILE
C                               SET OF IDE REDUCED DENSITIES
C         : (R*8)  TR()       - INPUT MASTER CONDENSED FILE
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```
C                                  SET OF ITE REDUCED TEMPERATURES
C         : (R*8)  ZIPT()      - INPUT MASTER CONDENSED FILE
C                                  SET OF IZE RECOMBINING ION CHARGES
C         : (R*8)  AIPTM(,,)   - INPUT MASTER CONDENSED FILE
C                                  RATIO OF METASTABLE TO GROUND POP.
C                                  1ST DIMENSION - DENSITY INDEX
C                                  2ND DIMENSION - TEMPERATURE INDEX
C                                  3RD DIMENSION - CHARGE STATE INDEX
C                                  4TH DIMENSION - METASTABLE INDEX
C         : (R*8)  EIA()       - INPUT MASTER CONDENSED FILE
C                                  SET OF IONISATION POTENTIALS (CM-1)
C
C         : (R*8)  ATTY(,)     - WORK SPACE FOR INTERPOLATION
C                                - STORES LOG10(INTERPOLATED VALUES)
C                                  1ST DIMENSION - TEMPERATURE
C                                  2ND DIMENSION - DENSITY
C         : (R*8)  ARRAY(,)    - STORES LOG10(INTERPOLATED VALUES)
C                                  1ST DIMENSION - TEMPERATURE
C                                  2ND DIMENSION - DENSITY
C         : (R*8)  WORK(,)     - SUM OF INTERPOLATED VALUES OVER
C                                  METASTABLE STATES
C                                  1ST DIMENSION - TEMPERATURE
C                                  2ND DIMENSION - DENSITY
C
C     ROUTINES:
C     ---------
C         XXOPEN   -
C         XXTERM   -
C         XXIN80   -  FETCH DATA FROM MASTER CONDENSED FILE
C         D4SPLN   -  INTERPOLATE CONDENSED MASTER FILE
C                     UPDATED VERSION OF D1SPLN
C
C-----------------------------------------------
C AUTHOR:  LORNE D. HORTON
C          ROOM K1/1/58, JET JOINT UNDERTAKING
C
C   DATE:  21ST FEBRUARY 1996
C-----------------------------------------------------------------------
C UNIX-IDL PORT:
C
C VERSION: 1.1                          DATE: 11-11-96
C MODIFIED: WILLIAM OSBORN (TESSELLA SUPPORT SERVICES PLC)
C               - FIRST CONVERTED
C
C-----------------------------------------------------------------------
C
C VERSION: 1.2                          DATE: 20-10-97
C MODIFIED: LORNE HORTON (JET)
C               - INCREASED SPACE FOR DIAGNOSTIC PRINTS OF FILE NAMES
C       - ADDED D4OPEN TO SUPPRESS ERROR MESSAGES ON MISSING
C         FILES AND ALLOWED ZERO-FILLING
C       - REMOVED ISWIT VARIABLES AND PASSED ITYPE TO
C         D4SPLN INSTEAD
C       - TURNED LSWIT OFF FOR ALL CASES
C
C-----------------------------------------------------------------------
C
       INTEGER   ITYPE
       INTEGER   NUTMAX, NUDMAX, NUZMAX, NUMMAX
       INTEGER   MAXT, MAXD
       INTEGER   IZL, IZH, IZ0
       INTEGER   NGRD(50), IST2, IST5, IWRITE
       REAL*8    TEK(NUTMAX), DENSA(NUDMAX)
       REAL*8    METFRC(NUDMAX,NUTMAX,NUZMAX,NUMMAX)
       CHARACTER DSNAME*80, DATE*8
C
       INTEGER   NTDMAX, NDZ1V, NDTIN, NDDEN, NDMET
       REAL*8    DMIN
       PARAMETER (NTDMAX = 40)
       PARAMETER (NDZ1V  = 20, NDTIN  = 24, NDDEN  = 24 , NDMET = 4)
       PARAMETER (DMIN = 1.0D-74)
C-----------------------------------------------------------------------
C      VARIABLES FOR DSNAME PARSING AND OPENING
C-----------------------------------------------------------------------
       LOGICAL   LEXIST
       INTEGER   INDS, NELEC, LS, L1, L2
       CHARACTER SEQUA*2, XFESYM*2,DSNIN(50,10)*80
       CHARACTER STRING*132
C-----------------------------------------------------------------------
C      VARIABLES FOR XXIN80
C-----------------------------------------------------------------------
       LOGICAL   LERROR , LSWIT
       INTEGER   IDE, ITE, IZE, IME, NPRNT
       INTEGER   IMETR(NDMET), IPRNT(NDMET), IPSYS(NDMET)
       REAL*8    DENSR(NDDEN) ,TR(NDTIN), ZIPT(NDZ1V)
       REAL*8    EIA(50)
       REAL*8    AIPTM(NDDEN,NDTIN,NDZ1V,NDMET)
       CHARACTER CSTRGA(NDMET)*12
C-----------------------------------------------------------------------
C      VARIABLES FOR D4SPLN
C-----------------------------------------------------------------------
       LOGICAL   LSWITX
       LOGICAL   LZRNG(1), LDRNG(NTDMAX), LTRNG(NTDMAX)
       INTEGER   IZ1
       REAL*8    TUSR(NTDMAX) , DUSR(NTDMAX)
       REAL*8    ARRAY(NTDMAX, NTDMAX)
       REAL*8    ATTY(NTDMAX, NTDMAX)
C-----------------------------------------------------------------------
```

```
C      MISCELLANEOUS COUNTERS, ETC.
C-----------------------------------------------------------------------
       INTEGER   I, IT, ID, IZ, IGRD, NGRDI
       REAL*8    WORK(NTDMAX, NTDMAX)
       INTEGER   ZERO, PIPEOU
       PARAMETER (PIPEOU = 6)
       DATA      ZERO/0/
C
C-----------------------------------------------------------------------
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CNV404A

```
       SUBROUTINE CNV404A(ITYPE  , ISWIT  ,
     &                    NUTMAX , NUDMAX , NUZMAX , NUMMAX ,
     &                    MAXT   , MAXD   ,
     &                    IZL    , IZH    , IZ0    ,
     &                    TEK    , DENSA  ,
     &                    NGRD   ,
     &                    IST2   , IST5   , IWRITE , DATE,
     &                    DSNIN  , OPEN17)
       IMPLICIT NONE
C
C-----------------------------------------------------------------------
C
C ************ FORTRAN 77 SUBROUTINE BND404A **************************
C
C   VERSION 1.0
C
C   PURPOSE:
C           TO FETCH DATA FROM RESOLVED ADF10 FILES, SPLINE THEM
C           ONTO THE REQUESTED TEMPERATURE/DENSITY GRID, AND
C           WRITE THE RESULT TO ADF11 FILES.
C
C   CALLING ROUTINE / PROGRAM : LH404RR / ADAS404
C
C   DATA:
C
C           THE SOURCE DATA IS CONTAINED AS MEMBERS OF PARTITIONED
C           DATA SETS AS FOLLOWS:
C
C             1. JETUID.ACD<YR>.DATA
C             2. JETUID.SCD<YR>.DATA
C             3. JETUID.CCD<YR>.DATA
C             4. JETUID.PRB<YR>.DATA
C             5. JETUID.PRC<YR>.DATA
C             6. JETUID.QCD<YR>.DATA
C             7. JETUID.XCD<YR>.DATA
C
C           WHERE <YR> DENOTES TWO INTEGERS FOR THE YEAR SELECTED.
C
C   SUBROUTINE:
C
C   INPUT : (I*4)  ITYPE  - TYPE OF ADF10 DATA BEING READ (SEE ABOVE)
C   INPUT : (I*4)  ISWIT  - SWITCH FOR INTERPOLATION TYPE
C   INPUT : (I*4)  NUTMAX - OUTPUT ELEMENT MASTER FILE
C                           MAXIMUM NUMBER OF TEMPERATURES
C   INPUT : (I*4)  NUDMAX - OUTPUT ELEMENT MASTER FILE
C                           MAXIMUM NUMBER OF DENSITIES
C   INPUT : (I*4)  NUZMAX - OUTPUT ELEMENT MASTER FILE
C                           MAXIMUM NUMBER OF CHARGE STATES
C   INPUT : (I*4)  NUMMAX - OUTPUT ELEMENT MASTER FILE
C                           MAXIMUM NUMBER OF METASTABLES
C   INPUT : (I*4)  MAXT   - OUTPUT ELEMENT MASTER FILE
C                           ACTUAL NUMBER OF TEMPERATURES
C   INPUT : (I*4)  MAXD   - OUTPUT ELEMENT MASTER FILE
C                           ACTUAL NUMBER OF DENSITIES
CX   INPUT : (C*()) DSNAME - ROOT NAME OF MASTER CONDENSED FILE
CX                           TO BE OPENED
C   INPUT : (I*4)  IZL    - LOWEST ION CHARGE TO READ
C   INPUT : (I*4)  IZH    - HIGHEST ION CHARGE TO READ
C   INPUT : (I*4)  IZ0    - NUCLEAR CHARGE TO READ
C   INPUT : (R*8)  DENSA()- OUTPUT ELEMENT MASTER FILE
C                           SET OF MAXD DENSITIES
C   INPUT : (R*8)  TEK()  - OUTPUT ELEMENT MASTER FILE
C                           SET OF MAXT TEMPERATURES
C   INPUT : (I*4)  NGRD() - NUMBER OF GROUND STATES OF THE FIRST
C                           50 ISOELECTRONIC SEQUENCES
C   INPUT : (I*4)  IST2   - UNIT NUMBER FOR OUTPUT INFORMATION
C                           AND ERROR MESSAGES
C   INPUT : (I*4)  IST5   - UNIT NUMBER FOR READING MASTER CONDENSED
C                           FILE
C   INPUT : (I*4)  IWRITE - UNIT NUMBER FOR WRITING ADF11 DATA
C   INPUT : (C*8)  DATE   - CURRENT DATE
C
C   PARAMETER : (I*4)  NTDMAX - SIZE OF LOCAL WORKING SPACE
C                               (MUST BE GREATER THAN NUTMAX & NUDMAX)
C   PARAMETER : (I*4)  NDZ1V  - MASTER CONDENSED FILE
C                               MAXIMUM NUMBER OF CHARGE STATES
C   PARAMETER : (I*4)  NDTIN  - MASTER CONDENSED FILE
C                               MAXIMUM NUMBER OF TEMPERATURES
C   PARAMETER : (I*4)  NDDEN  - MASTER CONDENSED FILE
C                               MAXIMUM NUMBER OF DENSITIES
C
C         : (R*8)  DENSR()    - INPUT MASTER CONDENSED FILE
```

```
C                                  SET OF IDE REDUCED DENSITIES
C         : (R*8)  TR()       - INPUT MASTER CONDENSED FILE
C                                  SET OF ITE REDUCED TEMPERATURES
C         : (R*8)  ZIPT()     - INPUT MASTER CONDENSED FILE
C                                  SET OF IZE RECOMBINING ION CHARGES
C         : (R*8)  AIPT(,,)   - INPUT MASTER CONDENSED FILE
C                                  RELEVANT RATE COEFFICIENTS
C                                  1ST DIMENSION - DENSITY INDEX
C                                  2ND DIMENSION - TEMPERATURE INDEX
C                                  3RD DIMENSION - CHARGE STATE INDEX
C         : (R*8)  EIA()      - INPUT MASTER CONDENSED FILE
C                                  SET OF IONISATION POTENTIALS (CM-1)
C
C         : (R*8)  ATTY(,)    - WORK SPACE FOR INTERPOLATION
C                               - STORES LOG10(INTERPOLATED VALUES)
C                                  1ST DIMENSION - TEMPERATURE
C                                  2ND DIMENSION - DENSITY
C         : (R*8)  ARRAY(,)   - STORES LOG10(INTERPOLATED VALUES)
C                                  1ST DIMENSION - TEMPERATURE
C                                  2ND DIMENSION - DENSITY
C
C     ROUTINES:
C     ---------
C         XXOPEN   -
C         XXTERM   -
C         XXIN17   -  FETCH DATA FROM MASTER CONDENSED FILE
C         D4SPLN   -  INTERPOLATE CONDENSED MASTER FILE
C                     UPDATED VERSION OF D1SPLN
C
C-----------------------------------------
C AUTHOR:  LORNE D. HORTON
C          ROOM K1/1/58, JET JOINT UNDERTAKING
C
C   DATE:   5TH AUGUST 1996
C-----------------------------------------------------------------------
C UNIX-IDL PORT:
C
C VERSION: 1.1                          DATE: 11-11-96
C MODIFIED: WILLIAM OSBORN (TESSELLA SUPPORT SERVICES PLC)
C               - FIRST CONVERTED
C VERSION: 1.2                          DATE: 20-10-97
C MODIFIED: LORNE HORTON (JET)
C               - INCREASED SPACE FOR FILE NAME DIAGNOSTICS
C
C-----------------------------------------------------------------------
C
       INTEGER   ITYPE, ISWIT, I4UNIT
       INTEGER   NUTMAX, NUDMAX, NUZMAX, NUMMAX
       INTEGER   MAXT, MAXD
       INTEGER   IZL, IZH, IZ0
       INTEGER   NGRD(50), IST2, IST5, IWRITE
       REAL*8    TEK(NUTMAX), DENSA(NUDMAX)
       CHARACTER DSNAME*80, DATE*8
C
       INTEGER   NTDMAX, NDZ1V, NDTIN, NDDEN
       REAL*8    DMIN, DMINL
       PARAMETER (NTDMAX = 40)
       PARAMETER (NDZ1V  = 20, NDTIN  = 24, NDDEN  = 24 )
       PARAMETER (DMIN = 1.0D-74, DMINL = -74.0)
       LOGICAL   OPEN17
C-----------------------------------------------------------------------
C      VARIABLES FOR DSNAME PARSING AND OPENING
C-----------------------------------------------------------------------
       LOGICAL   LEXIST
       INTEGER   INDS, NELEC, LS, L1, L2
       INTEGER   IBGN, IEND
       CHARACTER SEQUA*2, XFESYM*2,DSNIN(50,10)*80
       CHARACTER STRING*132
C-----------------------------------------------------------------------
C      VARIABLES FOR XXIN17
C-----------------------------------------------------------------------
       LOGICAL   LERROR , LSWIT
       INTEGER   IDE, ITE, IZE, IME, NPRNT
       REAL*8    DENSR(NDDEN) ,TR(NDTIN), ZIPT(NDZ1V)
       REAL*8    EIA(50)
       REAL*8    AIPT(NDDEN,NDTIN,NDZ1V)
C-----------------------------------------------------------------------
C      VARIABLES FOR D4SPLN
C-----------------------------------------------------------------------
       LOGICAL   LSWITX
       LOGICAL   LZRNG(1), LDRNG(NTDMAX), LTRNG(NTDMAX)
       INTEGER   ISWITX, IZ1
       REAL*8    TUSR(NTDMAX) , DUSR(NTDMAX)
       REAL*8    ARRAY(NTDMAX, NTDMAX)
       REAL*8    ATTY(NTDMAX, NTDMAX)
C-----------------------------------------------------------------------
C      MISCELLANEOUS COUNTERS, ETC.
C-----------------------------------------------------------------------
       INTEGER   I, IT, ID, IZ, IGRD, NGRDI, IPRT, JPRT, NPRTI
       INTEGER   NOUTER, NINNER, IOUT, IINN
       INTEGER   ZERO, PIPEOU
       PARAMETER (PIPEOU = 6)
       DATA      ZERO/0/
C
C-----------------------------------------------------------------------
```

CNV404B

```
      SUBROUTINE CNV404B(ITYPE  , ISWIT  ,
     &                   NUTMAX , NUDMAX , NUZMAX , NUMMAX ,
     &                   MAXT   , MAXD   ,
     &                   IZL    , IZH    , IZ0    ,
     &                   TEK    , DENSA  ,
     &                   NGRD   ,
     &                   IST2   , IST5   , IWRITE , DATE,
     &                   DSNIN  , OPEN17)
        IMPLICIT NONE
C
C-----------------------------------------------------------------------
C
C ************ FORTRAN 77 SUBROUTINE BND404B **************************
C
C   VERSION 1.0
C
C   PURPOSE:
C           TO FETCH DATA FROM RESOLVED ADF10 FILES, SPLINE THEM
C           ONTO THE REQUESTED TEMPERATURE/DENSITY GRID, AND
C           WRITE THE RESULT TO ADF11 FILES.
C
C   CALLING PROGRAM LH404RR
C
C   DATA:
C
C           THE SOURCE DATA IS CONTAINED AS MEMBERS OF PARTITIONED
C           DATA SETS AS FOLLOWS:
C
C             8. JETUID.PLT<YR>.DATA
C             9. JETUID.PLS<YR>.DATA
C
C           WHERE <YR> DENOTES TWO INTEGERS FOR THE YEAR SELECTED.
C
C   SUBROUTINE:
C
C   INPUT : (I*4)  ITYPE  - TYPE OF ADF10 DATA BEING READ (SEE ABOVE)
C   INPUT : (I*4)  ISWIT  - SWITCH FOR INTERPOLATION TYPE
C   INPUT : (I*4)  NUTMAX - OUTPUT ELEMENT MASTER FILE
C                           MAXIMUM NUMBER OF TEMPERATURES
C   INPUT : (I*4)  NUDMAX - OUTPUT ELEMENT MASTER FILE
C                           MAXIMUM NUMBER OF DENSITIES
C   INPUT : (I*4)  NUZMAX - OUTPUT ELEMENT MASTER FILE
C                           MAXIMUM NUMBER OF CHARGE STATES
C   INPUT : (I*4)  NUMMAX - OUTPUT ELEMENT MASTER FILE
C                           MAXIMUM NUMBER OF METASTABLES
C   INPUT : (I*4)  MAXT   - OUTPUT ELEMENT MASTER FILE
C                           ACTUAL NUMBER OF TEMPERATURES
C   INPUT : (I*4)  MAXD   - OUTPUT ELEMENT MASTER FILE
C                           ACTUAL NUMBER OF DENSITIES
CX   INPUT : (C*()) DSNAME - ROOT NAME OF MASTER CONDENSED FILE
CX                           TO BE OPENED
C   INPUT : (I*4)  IZL    - LOWEST ION CHARGE TO READ
C   INPUT : (I*4)  IZH    - HIGHEST ION CHARGE TO READ
C   INPUT : (I*4)  IZ0    - NUCLEAR CHARGE TO READ
C   INPUT : (R*8)  DENSA()- OUTPUT ELEMENT MASTER FILE
C                           SET OF MAXD DENSITIES
C   INPUT : (R*8)  TEK()  - OUTPUT ELEMENT MASTER FILE
C                           SET OF MAXT TEMPERATURES
C   INPUT : (I*4)  NGRD() - NUMBER OF GROUND STATES OF THE FIRST
C                           50 ISOELECTRONIC SEQUENCES
C   INPUT : (I*4)  IST2   - UNIT NUMBER FOR OUTPUT INFORMATION
C                           AND ERROR MESSAGES
C   INPUT : (I*4)  IST5   - UNIT NUMBER FOR READING MASTER CONDENSED
C                           FILE
C   INPUT : (I*4)  IWRITE - UNIT NUMBER FOR WRITING ADF11 DATA
C   INPUT : (C*8)  DATE   - CURRENT DATE
C
C   PARAMETER : (I*4)  NTDMAX - SIZE OF LOCAL WORKING SPACE
C                               (MUST BE GREATER THAN NUTMAX & NUDMAX)
C   PARAMETER : (I*4)  NDZ1V  - MASTER CONDENSED FILE
C                               MAXIMUM NUMBER OF CHARGE STATES
C   PARAMETER : (I*4)  NDTIN  - MASTER CONDENSED FILE
C                               MAXIMUM NUMBER OF TEMPERATURES
C   PARAMETER : (I*4)  NDDEN  - MASTER CONDENSED FILE
C                               MAXIMUM NUMBER OF DENSITIES
C   PARAMETER : (I*4)  NDMET  - MASTER CONDENSED FILE
C                               MAXIMUM NUMBER OF METASTABLES
C
C         : (R*8)  DENSR()    - INPUT MASTER CONDENSED FILE
C                               SET OF IDE REDUCED DENSITIES
C         : (R*8)  TR()       - INPUT MASTER CONDENSED FILE
C                               SET OF ITE REDUCED TEMPERATURES
C         : (R*8)  ZIPT()     - INPUT MASTER CONDENSED FILE
C                               SET OF IZE RECOMBINING ION CHARGES
C         : (R*8)  AIPTM(,,)  - INPUT MASTER CONDENSED FILE
C                               RATIO OF METASTABLE TO GROUND POP.
C                               1ST DIMENSION - DENSITY INDEX
C                               2ND DIMENSION - TEMPERATURE INDEX
C                               3RD DIMENSION - CHARGE STATE INDEX
C                               4TH DIMENSION - METASTABLE INDEX
C         : (R*8)  EIA()      - INPUT MASTER CONDENSED FILE
C                               SET OF IONISATION POTENTIALS (CM-1)
C
C         : (R*8)  ATTY(,)    - WORK SPACE FOR INTERPOLATION
```

```
C                             - STORES LOG10(INTERPOLATED VALUES)
C                                 1ST DIMENSION - TEMPERATURE
C                                 2ND DIMENSION - DENSITY
C         : (R*8)  ARRAY(,)   - STORES LOG10(INTERPOLATED VALUES)
C                                 1ST DIMENSION - TEMPERATURE
C                                 2ND DIMENSION - DENSITY
C
C     ROUTINES:
C     ---------
C         XXOPEN   -
C         XXTERM   -
C         XXIN80   -  FETCH DATA FROM MASTER CONDENSED FILE
C         D4SPLN   -  INTERPOLATE CONDENSED MASTER FILE
C                     UPDATED VERSION OF D1SPLN
C
C-------------------------------------------
C AUTHOR:  LORNE D. HORTON
C          ROOM K1/1/58, JET JOINT UNDERTAKING
C
C   DATE:   5TH AUGUST 1996
C-----------------------------------------------------------------------
C UNIX-IDL PORT:
C
C VERSION: 1.1                              DATE: 11-11-96
C MODIFIED: WILLIAM OSBORN (TESSELLA SUPPORT SERVICES PLC)
C               - FIRST CONVERTED
C
C-----------------------------------------------------------------------
C
C VERSION: 1.2                              DATE: 20-10-97
C MODIFIED: LORNE HORTON (JET)
C               - INCREASED SPACE FOR DIAGNOSTIC PRINTS OF FILE NAMES
C       - ADDED D4OPEN TO SUPPRESS ERROR MESSAGES ON MISSING
C         FILES AND ALLOWED ZERO-FILLING
C
C-----------------------------------------------------------------------
C
       INTEGER   ITYPE, ISWIT, I4UNIT
       INTEGER   NUTMAX, NUDMAX, NUZMAX, NUMMAX
       INTEGER   MAXT, MAXD
       INTEGER   IZL, IZH, IZ0
       INTEGER   NGRD(50), IST2, IST5, IWRITE
       REAL*8    TEK(NUTMAX), DENSA(NUDMAX)
       CHARACTER DSNAME*80, DATE*8, DSNIN(50,10)*80
C
       INTEGER   NTDMAX, NDZ1V, NDTIN, NDDEN, NDMET
       REAL*8    DMIN, DMINL
       PARAMETER (NTDMAX = 40)
       PARAMETER (NDZ1V  = 20, NDTIN  = 24, NDDEN  = 24 , NDMET = 4)
       PARAMETER (DMIN = 1.0D-74, DMINL = -74.0)
       LOGICAL   OPEN17
C-----------------------------------------------------------------------
C      VARIABLES FOR DSNAME PARSING AND OPENING
C-----------------------------------------------------------------------
       LOGICAL   LEXIST
       INTEGER   INDS, NELEC, LS, L1, L2
       CHARACTER SEQUA*2, XFESYM*2
       CHARACTER STRING*132
C-----------------------------------------------------------------------
C      VARIABLES FOR XXIN80
C-----------------------------------------------------------------------
       LOGICAL   LERROR , LSWIT
       INTEGER   IDE, ITE, IZE, IME, NPRNT
       INTEGER   IMETR(NDMET), IPRNT(NDMET), IPSYS(NDMET)
       REAL*8    DENSR(NDDEN) ,TR(NDTIN), ZIPT(NDZ1V)
       REAL*8    EIA(50)
       REAL*8    AIPTM(NDDEN,NDTIN,NDZ1V,NDMET)
       CHARACTER CSTRGA(NDMET)*12
C-----------------------------------------------------------------------
C      VARIABLES FOR D4SPLN
C-----------------------------------------------------------------------
       LOGICAL   LSWITX
       LOGICAL   LZRNG(1), LDRNG(NTDMAX), LTRNG(NTDMAX)
       INTEGER   ISWITX, IZ1
       REAL*8    TUSR(NTDMAX) , DUSR(NTDMAX)
       REAL*8    ARRAY(NTDMAX, NTDMAX)
       REAL*8    ATTY(NTDMAX, NTDMAX)
C-----------------------------------------------------------------------
C      MISCELLANEOUS COUNTERS, ETC.
C-----------------------------------------------------------------------
       INTEGER   I, IT, ID, IZ, IGRD, NGRDI
       INTEGER   ZERO, PIPEOU
       PARAMETER (PIPEOU = 6)
       DATA      ZERO/0/
C
C-----------------------------------------------------------------------
```

D1OUT0

```
       SUBROUTINE D1OUT0( IWRITE   , ISWIT  , LOSEL  , LFSEL  ,
     &                    TITLE    , TITLX  , TITLM  , DATE   ,
     &                    IMSEL    , ITDVAL , LPARTL , LPOWER ,
     &                    ENAME    , ESYMB  ,
     &                    IZ0      , IZ1    , NEL    ,
```

```
     &                    CHEAD    ,
     &                    CLASS    , CPROJ  , CYEAR  , CELEM  ,
     &                    IPRNT    , IPSYS  , CSTRGA ,
     &                    LZRNG    , LTRNG  , LDRNG  ,
     &                    TKEL     , TEV    , TRED   ,
     &                    DUSER             , DRED   ,
     &                    AOUT     , DSFULL ,
     &                    KPLUS1   , COEF
     &                  )
       IMPLICIT NONE
C-----------------------------------------------------------------------
C
C  ****************** FORTRAN77 SUBROUTINE: D1OUT0 *********************
C
C  PURPOSE:  TO  PRINT DATA CONCERNING THE SELECTED COLL-DIEL COEFFTS
C
C  CALLING PROGRAM: ADAS401
C
C  SUBROUTINE:
C
C  INPUT : (I*4)  IWRITE  = OUTPUT UNIT FOR RESULTS
C  INPUT : (I*4)  ISWIT   = DATA TYPE SELECTOR (1 -> 8)
C                           (SEE 'ADAS401' FOR CASES 1 -> 7,
C                            CASE 8 IMPLIES METSTABLE POPULATIONS)
C  OUTPUT: (L*4)  LOSEL   = .TRUE.  => INTERPOLATED VALUES FITTED
C                         = .FALSE. => INTERPOLATED VALUES NOT FITTED
C  INPUT : (L*4)  LFSEL   = .TRUE.  => MINIMAX POLYNOMIAL FITTED
C                           .FALSE. => MINIMAX POLYNOMIAL NOT FITTED
C                           (IF LOSEL=.FALSE. => LFSEL=.FALSE.)
C
C  INPUT : (C*40) TITLE   = IDENTIFYING TITLE FOR PROGRAM RUN (VIA ISPF)
C  INPUT : (C*80) TITLX   = INFORMATION STRING CONTAINING: INPUT DATA
C                           FILE-NAME, SELECTED DENSITY and MET. INDEX
C  INPUT : (C*80) TITLM   = DIAGNOSTIC LINE INFORMATION FROM 'MINIMAX'
C  INPUT : (C*8)  DATE    = CURRENT DATE (AS 'DD/MM/YY')
C
C  INPUT : (I*4)  IMSEL   = INDEX OF SELECTED METASTABLE STATE
C                           (ONLY USED IF (LPARTL.AND.LPOWER) -
C                            EQUALS ONE OTHERWISE).
C  INPUT : (I*4)  ITDVAL  = USER ENTERED VALUES -
C                            NUMBER OF TEMPERATURE/DENSITY PAIRS READ
C  INPUT : (L*4)  LPARTL  = .TRUE.  => PARTIAL  CONDENSED FILE READ IN
C                           .FALSE. => STANDARD CONDENSED FILE READ IN
C  INPUT : (L*4)  LPOWER  = .TRUE.  => LINE POWER  FILE READ IN
C                           .FALSE. => COEFFICIENT FILE READ IN
C
C  INPUT : (C*12) ENAME   = NAME   OF ELEMENT UNDER ANALYSIS
C  INPUT : (C*2)  ESYMB   = SYMBOL OF ELEMENT UNDER ANALYSIS
C
C  INPUT : (I*4)  IZ0     = NUCLEAR CHARGE OF ELEMENT UNDER ANALYSIS
C  INPUT : (I*4)  IZ1     = RECOMBINING ION CHARGE UNDER ANALYSIS
C  INPUT : (I*4)  NEL     = NUMBER OF ELECTRONS IN SELECTED SEQUENCE
C
C  INPUT : (C*80) CHEAD   = HEADER FOR CLASS BEING ANALYSED.
C
C  INPUT : (C*3)  CLASS   = CLASS OF DATA SET BEING ANALYSED.
C                           ('ACD','SCD','CCD','PRB','PRC','PLT','PLS')
C  INPUT : (C*8)  CPROJ   = PROJECT UNDER WHICH INPUT DATA IS STORED
C  INPUT : (C*2)  CYEAR   = YEAR OF INPUT DATA (2 CHARACTER ABBREV.)
C  INPUT : (C*2)  CELEM   = ISO-ELECTRONIC SEQUENCE ELEMENT NAME
C          (C*80) DSFULL  = INPUT DATA SET NAME (FULL MVS DSN)
C
C  INPUT : (I*4)  IPRNT   = PARENT INDEX FOR SELECTED 'METASTABLE' INDEX
C                           NOT USED FOR STANDARD MASTER CONDENSED FILES
C  INPUT : (I*4)  IPSYS   = SPIN SYSTEM  FOR SELECTED 'METASTABLE' INDEX
C                           NOT USED FOR STANDARD MASTER CONDENSED FILES
C  INPUT : (C*12) CSTRGA  = SELECTED METASTABLE LEVEL DESIGNATION
C                           NOT USED FOR STANDARD MASTER CONDENSED FILES
C
C  INPUT : (L*4)  LZRNG   =  .TRUE.  => OUTPUT 'AOUT()' VALUES    INTER-
C                                       POLATED FOR THE USER REQUESTED
C                                       CHARGE-STATE 'IZ1'.
C                            .FALSE. => OUTPUT 'AOUT()' VALUES    EXTRA-
C                                       POLATED FOR THE USER REQUESTED
C                                       CHARGE-STATE 'IZ1'.
C  INPUT : (L*4)  LTRNG() =  .TRUE.  => OUTPUT 'AOUT()' VALUE WAS INTER-
C                                       POLATED  FOR  THE  USER  ENTERED
C                                       ELECTRON TEMPERATURE 'TRED()'.
C                            .FALSE. => OUTPUT 'AOUT()' VALUE WAS EXTRA-
C                                       POLATED  FOR  THE  USER  ENTERED
C                                       ELECTRON TEMPERATURE 'TRED()'.
C                            DIMENSION: TEMPERATURE DENSITY PAIR INDEX
C  INPUT : (L*4)  LDRNG() = .TRUE.  => OUTPUT 'AOUT()' VALUE WAS INTER-
C                                       POLATED  FOR  THE  USER  ENTERED
C                                       ELECTRON DENSITY 'DRED()'.
C                            .FALSE. => OUTPUT 'AOUT()' VALUE WAS EXTRA-
C                                       POLATED  FOR  THE  USER  ENTERED
C                                       ELECTRON DENSITY 'DRED()'.
C                            DIMENSION: TEMPERATURE DENSITY PAIR INDEX
C
C  INPUT : (R*8)  TKEL()  = USER ENTERED VALUES -
C                           SET OF 'ITDVAL' TEMPERATURES. (KELVIN)
C                           DIMENSION: TEMPERATURE/DENSITY PAIR INDEX
C  INPUT : (R*8)  TEV()   = USER ENTERED VALUES -
C                           SET OF 'ITDVAL' TEMPERATURES. (EV)
C                           DIMENSION: TEMPERATURE/DENSITY PAIR INDEX
C  INPUT : (R*8)  TRED()  = USER ENTERED VALUES -
C                           SET OF 'ITDVAL' TEMPERATURES. (K/Z1**2)
```

```
C                             DIMENSION: TEMPERATURE/DENSITY PAIR INDEX
C
C  INPUT : (R*8)  DUSER() = USER ENTERED VALUES -
C                           SET OF 'ITDVAL' ELECTRON DENSITIES (CM-3)
C                           DIMENSION: TEMPERATURE/DENSITY PAIR INDEX
C  INPUT : (R*8)  DRED()  = USER ENTERED VALUES -
C                           SET OF 'ITDVAL' ELECTRON DENSITIES (/Z1**7)
C                           DIMENSION: TEMPERATURE/DENSITY PAIR INDEX
C
C  INPUT : (R*8)  AOUT()  = SPLINE INTERPOLATED OR  EXTRAPOLATED  COEF-
C                           FICIENTS/POWERS FOR THE USER ENTERED TEMP./
C                           DENSITY PAIRS. (DATA TYPE GIVEN BY 'ISWIT')
C                           DIMENSION: TEMPERATURE/DENSITY PAIR INDEX
C
C  INPUT : (I*4)  KPLUS1  = NUMBER OF MINIMAX COEFFICIENTS
C  INPUT : (R*8)  COEF()  = COEFFICIENTS OF FITTED MINIMAX POLYNOMIAL
C
C          (I*4)  IZ      = RECOMBINED ION CHARGE (= 'IZ1' - 1).
C          (I*4)  I       = GENERAL USE - ARRAY ELEMENT INDEX
C
C          (L*4)  LRATE   = .TRUE.  => 'AOUT' = RATE-COEFFT. (ISWIT<4).
C                           .FALSE. => 'AOUT' = POWER        (ISWIT>3).
C
C          (C*1)  C1T     = '*' IF RATE-COEFFICIENT WAS EXTRAPOLATED FOR
C                           THE CURRENT ELECTRON TEMPERATURE. (IT EQUALS
C                           ' ' IF IT WAS INTERPOLATED.)
C          (C*1)  C1D     = '*' IF RATE-COEFFICIENT WAS EXTRAPOLATED FOR
C                           THE CURRENT ELECTRON DENSITY.     (IT EQUALS
C                           ' ' IF IT WAS INTERPOLATED.)
C          (C*80) CADAS   = ADAS HEADER: INCLUDES RELEASE, PROGRAM, TIME
C
C ROUTINES:
C          ROUTINE    SOURCE    BRIEF DESCRIPTION
C          ------------------------------------------------------------
C          XXADAS     ADAS      GATHERS ADAS HEADER INFORMATION
C
C AUTHOR  : PAUL E. BRIDEN (TESSELLA SUPPORT SERVICES PLC)
C           K1/0/37
C           JET EXT. 2520
C
C DATE:    17/06/91
C
C UPDATE:  22/11/91 - PE BRIDEN: 1) 'LOSEL' ADDED TO ARGUMENT LIST.
C                                2) IF 'LOSEL'=.FALSE. OUTPUT NOTE
C                                   STATING NO INTERPOLATED DATA.
C
C UNIX PORT:
C
C VERSION: 1.1                          DATE: 06-09-95
C MODIFIED: TIM HAMMOND (TESSELLA SUPPORT SERVICES PLC)
C               - FIRST RELEASE
C
C VERSION: 1.2                            DATE: 24-10-95
C MODIFIED: TIM HAMMOND (TESSELLA SUPPORT SERVICES PLC)
C                - REMOVED UNUSED VARIABLES
C
C VERSION: 1.3                          DATE: 13-05-96
C MODIFIED: TIM HAMMOND
C               - REMOVED HOLLERITH CONSTANTS FROM OUTPUT
C
C-----------------------------------------------------------------------
      INTEGER    IWRITE        , ISWIT          , IMSEL        ,
     &           ITDVAL        , IZ0            , IZ1          ,
     &           NEL           , IPRNT          , IPSYS        ,
     &           KPLUS1
      INTEGER    IZ            , I
C-----------------------------------------------------------------------
      LOGICAL    LOSEL         , LFSEL          , LPARTL       ,
     &           LPOWER        , LZRNG
      LOGICAL    LRATE
C-----------------------------------------------------------------------
      CHARACTER  TITLE*(*)     , TITLX*(*)      , TITLM*(*)    ,
     &           ESYMB*2       , CYEAR*2        , CELEM*2      ,
     &           CLASS*3       , CPROJ*8        , DATE*8       ,
     &           CSTRGA*12     , ENAME*12       , CHEAD*80
      CHARACTER  DSFULL*80
      CHARACTER  C1T*1         , C1D*1          , CADAS*80
C-----------------------------------------------------------------------
      REAL*8     TKEL(ITDVAL)  , TEV(ITDVAL)    , TRED(ITDVAL) ,
     &           DUSER(ITDVAL) , DRED(ITDVAL)   , AOUT(ITDVAL) ,
     &           COEF(KPLUS1)
C-----------------------------------------------------------------------
      LOGICAL    LTRNG(ITDVAL) , LDRNG(ITDVAL)
C-----------------------------------------------------------------------
      SAVE       CADAS
C-----------------------------------------------------------------------
      DATA       CADAS /' '/
C-----------------------------------------------------------------------
```

D1OUTG

```
      SUBROUTINE D1OUTG( ISWIT  , LGHOST ,
     &                   NTDMAX , NDTIN  , NDZ1V  ,
     &                   TITLE  , TITLX  , TITLM  , DATE   ,
```

```
     &                    GTIT1  ,
     &                    ESYMB  , IZ0    , IZ1    , NEL    ,
     &                    CHEAD  ,
     &                    CLASS  , CPROJ  , CYEAR  , CELEM  ,
     &                    LPARTL , LPOWER ,
     &                    IPRNT  , IPSYS  , CSTRGA ,
     &                    DENSR  ,
     &                    ZIPT   , IZE    ,
     &                    TR     ,          APLOT  , ITE    ,
     &                    TRED   , DRED   , AOUT   , ITDVAL ,
     &                    TREDM  ,          AOUTM  , NMX    ,
     &                    LGRD1  , LDEF1  , LOSEL  , LFSEL  ,
     &                    XMIN   , XMAX   , YMIN   , YMAX
     &                  )
      IMPLICIT NONE
C-----------------------------------------------------------------------
C
C  ****************** FORTRAN77 SUBROUTINE: D1OUTG *********************
C
C  PURPOSE:  COMMUNICATES GRAPHICS DATA TO IDL
C            (SELECTED BY 'ISWIT'):
C
C            1) INPUT DATA AT SELECTED DENSITY
C            2) MODEL DATA AT SPECIFIED TEMPERATURE/DENSITY PAIR VALUES
C
C  CALLING PROGRAM: ADAS401
C
C  SUBROUTINE:
C
C  INPUT : (I*4)  ISWIT   = DATA TYPE SELECTOR (1 -> 10)
C                           (SEE 'ADAS401' FOR CASES 1 -> 9,
C                            CASE 10 IMPLIES METSTABLE POPULATIONS)
C  I/O   : (L*4)  LGHOST  = .TRUE.  => GHOST80 INITIALISED
C                           .FALSE. => GHOST80 NOT INITIALISED
C
C  INPUT : (I*4)  NTDMAX  = USER ENTERED VALUES -
C                            MAXIMUM NUMBER OF TEMPERATURE DENSITY PAIRS
C  INPUT : (I*4)  NDTIN   = INPUT MASTER CONDENSED FILE -
C                            MAXIMUM NUMBER OF REDUCED TEMPERATURES
C  INPUT : (I*4)  NDZ1V   = INPUT MASTER CONDENSED FILE -
C                            MAXIMUM NUMBER OF CHARGE STATES
C
C  INPUT : (C*40) TITLE   = IDENTIFYING TITLE FOR PROGRAM RUN (VIA ISPF)
C  INPUT : (C*80) TITLX   = INFORMATION STRING CONTAINING: INPUT DATA
C                           FILE-NAME, SELECTED DENSITY and MET. INDEX
C  INPUT : (C*80) TITLM   = DIAGNOSTIC LINE INFORMATION FROM 'MINIMAX'
C  INPUT : (C*8)  DATE    = CURRENT DATE (AS 'DD/MM/YY')
C
C  INPUT : (C*40) GTIT1   = ISPF ENTERED TITLE FOR GRAPH
C
C  INPUT : (C*2)  ESYMB   = SYMBOL OF ELEMENT UNDER ANALYSIS
C  INPUT : (I*4)  IZ0     = NUCLEAR CHARGE OF ELEMENT UNDER ANALYSIS
C  INPUT : (I*4)  IZ1     = RECOMBINING ION CHARGE UNDER ANALYSIS
C  INPUT : (I*4)  NEL     = NUMBER OF ELECTRONS IN SELECTED SEQUENCE
C
C  INPUT : (C*80) CHEAD   = HEADER FOR CLASS BEING ANALYSED.
C
C  INPUT : (C*3)  CLASS   = CLASS OF DATA SET BEING ANALYSED.
C                           ('ACD','SCD','CCD','PRB','PRC','PLT','PLS')
C  INPUT : (C*8)  CPROJ   = PROJECT UNDER WHICH INPUT DATA IS STORED
C  INPUT : (C*2)  CYEAR   = YEAR OF INPUT DATA (2 CHARACTER ABBREV.)
C  INPUT : (C*2)  CELEM   = ISO-ELECTRONIC SEQUENCE ELEMENT NAME
C
C  INPUT : (L*4)  LPARTL  = .TRUE.  => INPUT DATA SET PARTIAL  TYPE
C                           .FALSE. => INPUT DATA SET STANDARD TYPE
C  INPUT : (L*4)  LPOWER  = .TRUE.  => INPUT DATA SET POWER    TYPE
C                           .FALSE. => INPUT DATA SET COEFFT.  TYPE
C
C  INPUT : (I*4)  IPRNT   = PARENT INDEX FOR SELECTED 'METASTABLE' INDEX
C                           NOT USED FOR STANDARD MASTER CONDENSED FILES
C  INPUT : (I*4)  IPSYS   = SPIN SYSTEM  FOR SELECTED 'METASTABLE' INDEX
C                           NOT USED FOR STANDARD MASTER CONDENSED FILES
C  INPUT : (C*12) CSTRGA  = SELECTED METASTABLE LEVEL DESIGNATION
C                           NOT USED FOR STANDARD MASTER CONDENSED FILES
C
C  INPUT : (R*8)  DENSR   = SELECTED REDUCED DENSITY UNDER ANALYSIS
C
C  INPUT : (R*8)  ZIPT()  = INPUT MASTER CONDENSED FILE -
C                           SET OF 'IZE' INPUT RECOMBINING ION CHARGES
C                           DIMENSION: CHARGE STATE INDEX
C  INPUT : (I*4)  IZE     = INPUT MASTER CONDENSED FILE -
C                            NUMBER OF CHARGE STATES READ
C
C  INPUT : (R*8)  TR()    = INPUT MASTER CONDENSED FILE -
C                           SET OF 'ITE' REDUCED TEMPERATURES (K/Z1**2)
C                           DIMENSION: TEMPERATURE  INDEX
C  INPUT : (R*8)  APLOT(,)= INPUT MASTER CONDENSED FILE -
C                           RELEVANT COEFFICIENT/POWER DATA FOR 'ISWIT'
C                           FOR FIXED DENSITY 'DENSR' AND META. INDEX
C                           1st DIMENSION: TEMPERATURE  INDEX ('TR()')
C                           2nd DIMENSION: CHARGE STATE INDEX ('ZIPT()')
C  INPUT : (I*4)  ITE     = INPUT MASTER CONDENSED FILE -
C                            NUMBER OF REDUCED TEMPERATURES READ
C
C  INPUT : (R*8)  TRED()  = USER ENTERED VALUES -
C                           SET OF 'ITDVAL' REDUCED TEMPS. (K/Z1**2)
C                           DIMENSION: TEMPERATURE/DENSITY PAIR INDEX
C  INPUT : (R*8)  DRED()  = USER ENTERED VALUES -
```

```
C                           SET OF 'ITDVAL' REDUCED DENSITIES (/Z1**7)
C                           DIMENSION: TEMPERATURE/DENSITY PAIR INDEX
C  INPUT : (R*8)  AOUT()  = USER ENTERED VALUES -
C                           RELEVANT COEFFICIENT/POWER DATA FOR 'ISWIT'
C                           DIMENSION: TEMPERATURE/DENSITY PAIR INDEX
C  INPUT : (I*4)  ITDVAL  = USER ENTERED VALUES -
C                            NUMBER OF TEMPERATURE/DENSITY PAIRS READ
C
C  INPUT : (R*8)  TREDM() = MINIMAX: 'NMX' SELECTED REDUCED TEMPERATURES
C                           DIMENSION: TEMPERATURE INDEX
C  INPUT : (R*8)  AOUTM() = MINIMAX: RELEVANT RATE COEFFT/POWER DATA FOR
C                           FOR 'ISWIT' AT TEMPERATURE 'TREDM()'
C                           DIMENSION: TEMPERATURE INDEX
C  INPUT : (I*4)  NMX     = MINIMAX: NUMBER OF MINIMAXGENERATED COEFFTS
C
C  INPUT : (L*4)  LGRD1   = .TRUE.  => PUT GRAPH IN GRID FILE
C                           .FALSE. => DO NOT PUT GRAPH IN GRID FILE
C  INPUT : (L*4)  LDEF1   = .TRUE.  => USE DEFAULT GRAPH SCALING
C                           .FALSE. => DO NOT USE DEFAULT GRAPH SCALING
C  INPUT : (L*4)  LOSEL   = .TRUE.  => INTERPOLATED VALUES FITTED
C                           .FALSE. => INTERPOLATED VALUES NOT FITTED
C  INPUT : (L*4)  LFSEL   = .TRUE.  => MINIMAX POLYNOMIAL FITTED.
C                           .FALSE. => MINIMAX POLYNOMIAL NOT FITTED.
C                           (IF LOSEL=.FALSE. -> LFSEL=.FALSE.)
C
C  INPUT : (R*8)  XMIN    = GRAPH: LOWER LIMIT FOR TEMPERATURE (REDUCED)
C  INPUT : (R*8)  XMAX    = GRAPH: UPPER LIMIT FOR TEMPERATURE (REDUCED)
C  INPUT : (R*8)  YMIN    = GRAPH: LOWER LIMIT FOR RELEVANT COEFFTS.
C                                  ((erg) cm**3/s)
C  INPUT : (R*8)  YMAX    = GRAPH: UPPER LIMIT FOR RELEVANT COEFFTS.
C                                  ((erg) cm**3/s)
C
C           (I*4)  L2      = PARAMETER = 2
C
C           (R*4)  GHZERO  = PARAMETER = VALUE BELOW WHICH GHOST80
C                            TAKES NUMBERS AS BEING ZERO = 1.0E-36
C           (R*4)  YDMIN   = PARAMETER = MINIMUM ALLOWED Y-VALUE FOR
C                            PLOTTING. (USED FOR DEFAULT GRAPH SCALING)
C                            (SET TO 'GHZERO'/ZERO TO REMOVE)
C
CX          (I*4)  I4UNIT  = FUNCTION (SEE ROUTINE SECTION BELOW)
CX          (I*4)  IKEY    = NUMBER OF 'KEY()' VALUES TO BE OUTPUT
CX          (I*4)  ICOUNT  = NUMBER OF POINTS PLOTTED FOR GRAPH CURVE
C           (I*4)  IZ      = ARRAY SUBSCRIPT USED FOR CHARGE STATES
C           (I*4)  I       = GENERAL USE ARRAY SUBSCRIPT
C
C
C           (C*88) ISPEC   = GRAPH TITLE (INCORPORATES 'TITLE')
C           (C*80) CADAS   = ADAS HEADER: INCLUDES RELEASE, PROGRAM, TIME
C           (C*12) DNAME   = '      DATE: '
C           (C*9)  KEY0    = '    KEY: '
C           (C*9)  MNMX0   = 'MINIMAX: '
C           (C*8)  ADAS0   = 'ADAS   :'
C           (C*9)  DTYPE   = 'DATA   :'
C           (C*8)  CMODEL  = ' (MODEL)'
C           (C*27) KEY()   = DESCRIPTIVE KEY FOR GRAPH (3 TYPES)
C           (C*1)  GRID    = DUMMY NAME VARIABLE FOR USE WITH GHOST80
C           (C*1)  PIC     = DUMMY NAME VARIABLE FOR USE WITH GHOST80
C           (C*3)  C3BLNK  = BLANK 3 BYTE STRING
CX          (C*7)  C7      = GENERAL USE 7 BYTE STRING
CX          (C*9)  C9      = GENERAL USE 9 BYTE STRING
CX          (C*6)  ZCHARS  = PLOTTED CURVE KEY: " Z1=??"
CX          (C*14) C14     = GENERAL USE 14 BYTE STRING
CX          (C*24) C24     = GENERAL USE 24 BYTE STRING
C           (C*34) XTIT    = X-AXIS UNITS/TITLE
C           (C*23) YTIT()  = Y-AXIS UNITS/TITLE, DEPENDENT ON 'ISWIT'.
C                            DIMENSION: 'ISWIT'
C           (C*31) STRG01  = DESCRIPTIVE STRING FOR ISO-ELEC. SEQUENCE
C           (C*31) STRG02  = DESCRIPTIVE STRING FOR DATA SET PROJECT
C           (C*31) STRG03  = DESCRIPTIVE STRING FOR CLASS OF DATA
C           (C*31) STRG04  = DESCRIPTIVE STRING FOR YEAR OF DATA
C           (C*31) STRG05  = DESCRIPTIVE STRING FOR TYPE OF DATA
C           (C*31) STRG06  = DESCRIPTIVE STRING FOR PARENT REF.
C           (C*31) STRG07  = DESCRIPTIVE STRING FOR SPIN SYSTEM REF.
C           (C*31) STRG08  = DESCRIPTIVE STRING FOR DESIGNATION
C           (C*31) STRG09  = DESCRIPTIVE STRING FOR DENSITY PLOTTED
C           (C*31) STRG10  = DESCRIPTIVE STRING FOR ELEMENT
C           (C*31) STRG11  = DESCRIPTIVE STRING FOR NUCLEAR CHARGE
C           (C*31) STRG12  = DESCRIPTIVE STRING FOR RECOMBINING ION CHGE
C           (C*31) STRG13  = DESCRIPTIVE STRING FOR NO. OF ELECTRONS
C           (C*36) HEAD1   = HEADING FOR INPUT FILE INFORMATION
C           (C*36) HEAD2   = HEADING FOR MODEL INFORMATION
C           (C*44) HEAD3A  = FIRST  HEADER FOR TEMPERATURE/DENSITY INFO.
C           (C*44) HEAD3B  = SECOND HEADER FOR TEMPERATURE/DENSITY INFO.
C
C
C ROUTINES:
C           ROUTINE     SOURCE    BRIEF DESCRIPTION
C           ------------------------------------------------------------
CX          I4UNIT      ADAS      GET UNIT NUMBER FOR OUTPUT OF MESSAGES
C
C NOTE:     MINIMAX  CURVE  IS  FITTED  THROUGH  USER  ENTERED  SPLINED
C           TEMPERATURE/DENSITY PAIR VALUES.
C
C AUTHOR:   PAUL E. BRIDEN (TESSELLA SUPPORT SERVICES PLC)
C           K1/0/37
C           JET EXT. 2520
C
```

```
C DATE:     17/06/91
C
C UPDATE:   07/08/91 - PE BRIDEN: INTRODUCED SUBROUTINE 'XXGSEL'
C
C UPDATE:   22/11/91 - PE BRIDEN: 1) ADDED ARGUMENT 'LOSEL' TO D1OUTG
C                                 2) WHEN FINDING DEFAULT GRAPH LIMITS
C                                    IGNORE MODEL DATA IF NOT USED.
C                                 3) ONLY SEND MODEL INFO TO GRAPH IF
C                                    IT EXISTS.
C                                 4) ADDED VARIABLE C24 + OTHER MINOR
C                                    CHANGES.
C
C UPDATE:  25/11/91 - PE BRIDEN: MADE FILNAM/PICSAV ARGUMENT LIST
C                                COMPATIBLE WITH GHOST VERSION 8.
C
C UPDATE:  23/04/93 - PE BRIDEN - ADAS91: ADDED I4UNIT FUNCTION TO WRITE
C                                         STATEMENTS FOR SCREEN MESSAGES
C
C UPDATE:  24/05/93 - PE BRIDEN - ADAS91: CHANGED I4UNIT(0)-> I4UNIT(-1)
C
C UPDATE:  12/08/93 - HP SUMMERS  - EXTENDED ISWIT RANGE AND ADJUSTED
C
C UNIX PORT:
C
C VERSION: 1.1                          DATE: 24-10-95
C MODIFIED: TIM HAMMOND (TESSELLA SUPPORT SERVICES PLC)
C               - FIRST RELEASE
C
C-----------------------------------------------------------------------
C
C-----------------------------------------------------------------------
C-----------------------------------------------------------------------
      INTEGER    L2
C-----------------------------------------------------------------------
      REAL*4     GHZERO           , YDMIN
C-----------------------------------------------------------------------
      PARAMETER( L2     = 2       )
C-----------------------------------------------------------------------
      PARAMETER( GHZERO = 1.0E-36 , YDMIN = 1.0E-32 )
C-----------------------------------------------------------------------
      INTEGER    ISWIT            ,
     &           NTDMAX           , NDTIN           , NDZ1V        ,
     &           IZ0              , IZ1             , NEL          ,
     &           IPRNT            , IPSYS           ,
     &           ITE              , IZE             , ITDVAL       ,
     &           NMX
      INTEGER    IZ               , I
      INTEGER    ITEMP
      INTEGER    PIPEOU         , PIPEIN,    ONE              , ZERO
      PARAMETER (PIPEOU=6       , PIPEIN=5,   ONE=1    , ZERO=0)
C-----------------------------------------------------------------------
      REAL*8     DENSR            ,
     &           XMIN             , XMAX            ,
     &           YMIN             , YMAX
C-----------------------------------------------------------------------
      LOGICAL    LGHOST           , LPARTL          , LPOWER       ,
     &           LGRD1            , LDEF1           ,
     &           LOSEL            , LFSEL
C-----------------------------------------------------------------------
      CHARACTER  ESYMB*2          , CYEAR*2         , CELEM*2      ,
     &           CLASS*3          , CPROJ*8         , DATE*8       ,
     &           CSTRGA*12        , TITLE*40        , GTIT1*40     ,
     &           TITLX*80         , TITLM*80        , CHEAD*80
      CHARACTER  GRID*1           , PIC*1           , C3BLNK*3     ,
     &           ADAS0*8      ,
     &           CMODEL*8         , KEY0*9          , MNMX0*9      ,
     &           DTYPE*9        ,
     &           DNAME*12         ,
     &           XTIT*34          , CADAS*80        , ISPEC*88
      CHARACTER  STRG01*31        , STRG02*31       , STRG03*31    ,
     &           STRG04*31        , STRG05*31       , STRG06*31    ,
     &           STRG07*31        , STRG08*31       , STRG09*31    ,
     &           STRG10*31        , STRG11*31       , STRG12*31    ,
     &           STRG13*31        , HEAD1*36        , HEAD2*36     ,
     &                              HEAD3A*44       , HEAD3B*44
C-----------------------------------------------------------------------
      REAL*8     TR(NDTIN)        , ZIPT(NDZ1V)     ,
     &           TRED(NTDMAX)     , DRED(NTDMAX)    , AOUT(NTDMAX) ,
     &           TREDM(NMX)                         , AOUTM(NMX)
      REAL*8     APLOT(NDTIN,NDZ1V)
C-----------------------------------------------------------------------
      CHARACTER  YTIT(10)*23      , KEY(3)*27
C-----------------------------------------------------------------------
      SAVE       ISPEC            , CADAS
C
C-----------------------------------------------------------------------
C
      DATA ISPEC(1:48)
     &           /'COLLISIONAL-DIELECTRONIC COEFFT VS TEMPERATURE: '/
      DATA DNAME/'      DATE: '/
      DATA XTIT/'REDUCED TEMPERATURE (kelvin/Z1**2)'/
      DATA YTIT(1)/' ACD (CM**3 SEC-1)     '/
      DATA YTIT(2)/' SCD (CM**3 SEC-1)     '/
      DATA YTIT(3)/' CCD (CM**3 SEC-1)     '/
      DATA YTIT(4)/' PRB (ERG CM**3 SEC-1) '/
      DATA YTIT(5)/' PRC (ERG CM**3 SEC-1) '/
      DATA YTIT(6)/' QCD (CM**3 SEC-1)     '/
      DATA YTIT(7)/' XCD (CM**3 SEC-1)     '/
```

```
      DATA YTIT(8)/' PLT (ERG CM**3 SEC-1) '/
      DATA YTIT(9)/' PLS (ERG CM**3 SEC-1) '/
      DATA YTIT(10)/' METASTABLE POPULATION '/
      DATA ADAS0  /'ADAS   :'/       ,
     &     DTYPE  /'DATA   : '/
     &     MNMX0  /'MINIMAX: '/      ,
     &     KEY0   /'KEY    : '/      ,
     &     KEY(1) /'(LONG DASH - INPUT DATA)  ('/ ,
     &     KEY(2) /'CROSSES/FULL LINE - SPLINE)'/ ,
     &     KEY(3) /'  (SHORT DASH - MINIMAX)   '/
      DATA GRID   /' '/   ,
     &     PIC    /' '/   ,
     &     C3BLNK /'   '/ ,
     &     CADAS  /' '/
      DATA CMODEL /' (MODEL)'/
      DATA HEAD1 /'------ INPUT FILE INFORMATION ------'/           ,
     &     HEAD2 /'--------- MODEL INFORMATION --------'/            ,
     &     HEAD3A/'-- MODEL TEMPERATURE/DENSITY RELATIONSHIP --' / ,
     &     HEAD3B/'INDEX     REDUCED TEMP.     REDUCED DENSITY ' /
      DATA STRG01/' ISO-ELECTRONIC SEQUENCE     = '/ ,
     &     STRG02/' PROJECT                     = '/ ,
     &     STRG03/' CLASS                       = '/ ,
     &     STRG04/' YEAR                        = '/ ,
     &     STRG05/' TYPE                        = '/ ,
     &     STRG06/' PARENT REFERENCE            = '/ ,
     &     STRG07/' SPIN SYSTEM REFERENCE       = '/ ,
     &     STRG08/' DESIGNATION                 = '/ ,
     &     STRG09/' REDUCED DENSITY PLOTTED     = '/ ,
     &     STRG10/' ELEMENT SYMBOL              = '/ ,
     &     STRG11/' Z0: NUCLEAR CHARGE          = '/ ,
     &     STRG12/' Z1: RECOMBINING ION CHARGE  = '/ ,
     &     STRG13/' NUMBER OF ELECTRONS         = '/
C
C-----------------------------------------------------------------------
```

D1SPLN

```
      SUBROUTINE D1SPLN( ISWIT  , LSWIT  ,
     &                   NTDMAX ,
     &                   NDDEN  , NDTIN  , NDZ1V  ,
     &                   ITDVAL ,
     &                   IDE    , ITE    , IZE    ,
     &                   DUSR   , TUSR   , IZ1    ,
     &                   DENSR  , TR     , ZIPT   ,
     &                   EIA    , AIPT   ,
     &                   LZRNG  , LDRNG  , LTRNG  ,
     &                   AOUT
     &                 )
      IMPLICIT NONE
C-----------------------------------------------------------------------
C
C  ****************** FORTRAN77 SUBROUTINE: D1SPLN *********************
C
C  PURPOSE: TO INTERPOLATE/EXTRAPOLATED DATA FROM MASTER CONDENSED  FILE
C           TO THE USER ENTERED TEMPERATURE/DENSITY PAIRS FOR THE SELEC-
C           TED RECOMBINING ION CHARGE.
C
C  CALLING PROGRAM: ADAS401
C
C  DATA:
C
C           THE  SOURCE  DATA IS CONTAINED AS  MEMBERS  OF  PARTITIONED
C           DATA SETS AS FOLLOWS:
C
C             1. JETUID.ACD<YR>.DATA
C             2. JETUID.SCD<YR>.DATA
C             3. JETUID.CCD<YR>.DATA
C             4. JETUID.PRB<YR>.DATA
C             5. JETUID.PRC<YR>.DATA
C             6. JETUID.PRB<YR>.DATA
C             7. JETUID.PRC<YR>.DATA
C             8. JETUID.PLT<YR>.DATA
C             9. JETUID.PLS<YR>.DATA
C            10. JETUID.MET<YR>.DATA
C
C           WHERE <YR> DENOTES TWO INTEGERS FOR THE YEAR SELECTED.
C
C           THE PARTICULAR TYPE OPENED (1-10) IS SELECTED BY 'ISWIT'
C
C
C  SUBROUTINE:
C
C  INPUT : (I*4)  ISWIT   = DATA TYPE SELECTOR (SEE ABOVE) (1 -> 10)
C  INPUT : (L*4)  LSWIT   = .TRUE.  => SET OF 'EIA' VALUES PRESENT IN
C                                      MASTER CONDENSED FILE.
C                           .FALSE  => SET OF 'EIA' VALUES NOT PRESENT
C                                      IN MASTER CONDENSED FILE.
C
C  INPUT : (I*4)  NTDMAX  = USER ENTERED VALUES -
C                           MAXIMUM NUMBER OF TEMPERATURE/DENSITY PAIRS
C
C  INPUT : (I*4)  NDDEN   = INPUT MASTER CONDENSED FILE -
C                           MAXIMUM NUMBER OF REDUCED DENSITIES
C  INPUT : (I*4)  NDTIN   = INPUT MASTER CONDENSED FILE -
```

```
C                                MAXIMUM NUMBER OF REDUCED TEMPERATURES
C  INPUT : (I*4)  NDZ1V   = INPUT MASTER CONDENSED FILE -
C                           MAXIMUM NUMBER OF CHARGE STATES
C
C  INPUT : (I*4)  ITDVAL  = USER ENTERED VALUES -
C                           NUMBER OF TEMPERATURE/DENSITY PAIRS ENTERED
C
C  INPUT : (I*4)  IDE     = INPUT MASTER CONDENSED FILE -
C                           NUMBER OF REDUCED DENSITIES READ
C  INPUT : (I*4)  ITE     = INPUT MASTER CONDENSED FILE -
C                           NUMBER OF REDUCED TEMPERATURES READ
C  INPUT : (I*4)  IZE     = INPUT MASTER CONDENSED FILE -
C                           NUMBER OF CHARGE STATES READ
C
C  INPUT : (R*8)  DUSR()  = USER ENTERED VALUES -
C                           SET OF 'ITDVAL' ENTERED ELECTRON DENSITIES
C                           (UNITS: CM**-3)
C                           DIMENSION: TEMPERATURE/DENSITY PAIR INDEX
C  INPUT : (R*8)  TUSR()  = USER ENTERED VALUES -
C                           SET OF'ITDVAL' ENTERED ELECTRON TEMPERATURES
C                           (UNITS: KELVIN)
C                           DIMENSION: TEMPERATURE/DENSITY PAIR INDEX
C  INPUT : (I*4)  IZ1     = USER ENTERED VALUE -
C                           RECOMBINING ION CHARGE
C
C  INPUT : (R*8)  DENSR() = INPUT MASTER CONDENSED FILE -
C                           SET OF 'IDE' REDUCED DENSITIES (CM-3/Z1**7)
C  INPUT : (R*8)  TR()    = INPUT MASTER CONDENSED FILE -
C                           SET OF 'ITE' REDUCED TEMPERATURES (K/Z1**2)
C  INPUT : (R*8)  ZIPT()  = INPUT MASTER CONDENSED FILE -
C                           SET OF 'IZE' INPUT RECOMBINING ION CHARGES
C
C  INPUT : (R*8)  EIA()   = INPUT MASTER CONDENSED FILE -
C                           IONISATION RATE COEFFTS. - (UNITS: RYDBERGS)
C                           DIMENSION: ION CHARGE
C  INPUT : (R*8)  AIPT(,,)= INPUT MASTER CONDENSED FILE -
C                           RELEVANT COEFFICIENT/POWER DATA FOR 'ISWIT'.
C                           1ST DIMENSION: DENSITY INDEX     ('DENSR()')
C                           2ND DIMENSION: TEMPERATURE INDEX  ('TR()')
C                           3RD DIMENSION: CHARGE STATE INDEX ('ZIPT()')
C
C  OUTPUT: (L*4)  LZRNG(1) = .TRUE.  => 'AOUT()' VALUES FOR CHARGE-
C                                       STATE 'IZ1' INTERPOLATED.
C                          = .FALSE. => 'AOUT()' VALUE  FOR CHARGE-
C                                       STATE 'IZ1' EXTRAPOLATED.
C  OUTPUT: (L*4)  LDRNG()  = .TRUE.  => 'AOUT()' VALUE FOR DENSITY
C                                       INDEX INTERPOLATED.
C                          = .FALSE. => 'AOUT()' VALUE FOR DENSITY
C                                       INDEX EXTRAPOLATED.
C                           DIMENSION: DENSITY INDEX
C  OUTPUT: (L*4)  LTRNG()  = .TRUE.  => 'AOUT()' VALUE FOR TEMPERATURE
C                                       INDEX INTERPOLATED.
C                          = .FALSE. => 'AOUT()' VALUE FOR TEMPERATURE
C                                       INDEX EXTRAPOLATED.
C                           DIMENSION: TEMPERATURE INDEX
C
C  OUTPUT: (R*8)  AOUT()   = EXTRAPOLATED/INTERPOLATED  DATA  FOR  EACH
C                            USER ENTERED TEMPERATURE/DENSITY PAIR.
C                            DIMENSION: TEMPERATURE/DENSITY PAIR INDEX.
C
C          (I*4)  NUDIM   = PARAMETER = MUST BE GREATER THAN OR EQUAL TO
C                                       'NTDMAX'.
C
C          (I*4)  NDMAX1  = 'NDDEN'
C          (I*4)  NTMAX1  = 'NDTIN'
C          (I*4)  NZMAX1  = 'NDZ1V'
C          (I*4)  NDMAX2  = 'NUDIM'
C          (I*4)  NTMAX2  = 'NUDIM'
C          (I*4)  ITD     = GENERAL USE ARRAY SUBSCRIPT INDEX
C
C          (R*8)  ATTY(,) = WORKING SPACE FOR 3-WAY SPLINE ITERPOLATION
C                           ( STORES LOG10(INTERPOLATED VALUES) )
C                            1ST DIMENSION: TEMPERATURE
C                            2ND DIMENSION: DENSITY
C
C NOTE:
C
C ROUTINES:
C          ROUTINE    SOURCE    BRIEF DESCRIPTION
C          ------------------------------------------------------------
C          DXSPL1     ADAS      1ST PART OF 3-WAY SPLINE OF INPUT DATA
C          DXSPL2     ADAS      2ND PART OF 3-WAY SPLINE OF INPUT DATA
C          DXSPL3     ADAS      3RD PART OF 3-WAY SPLINE OF INPUT DATA
C
C AUTHOR:  PAUL E. BRIDEN (TESSELLA SUPPORT SERVICES PLC)
C          K1/0/37
C          JET EXT. 2516
C
C DATE:    17/06/91
C
C UNIX PORT:
C
C VERSION: 1.1                          DATE: 06-09-95
C MODIFIED: TIM HAMMOND (TESSELLA SUPPORT SERVICES PLC)
C             -  FIRST RELEASE
C
C VERSION: 1.2                          DATE: 15-04-96
C MODIFIED: TIM HAMMOND/PAUL BRIDEN
```

```
C             -  CORRECT BUG: SET NDMAX2 AND NTMAX2 TO NUDIM AND NOT
C                NTDMAX.
C
C-----------------------------------------------------------------------
C
C-----------------------------------------------------------------------
      INTEGER    NUDIM
C-----------------------------------------------------------------------
      PARAMETER( NUDIM = 40              )
C-----------------------------------------------------------------------
      INTEGER    ISWIT                   ,
     &           NTDMAX                  ,
     &           NDDEN                   , NDTIN         , NDZ1V       ,
     &           ITDVAL                  ,
     &           IDE                     , ITE           , IZE         ,
     &           IZ1
      INTEGER    NDMAX1                  , NTMAX1        , NZMAX1      ,
     &           NDMAX2                  , NTMAX2        , ITD
C-----------------------------------------------------------------------
      LOGICAL    LSWIT                   , LZRNG(1)
C-----------------------------------------------------------------------
      REAL*8     DUSR(NTDMAX)            , TUSR(NTDMAX)  ,
     &           DENSR(NDDEN)            , TR(NDTIN)     , ZIPT(NDZ1V) ,
     &           EIA(50)                 , AOUT(NTDMAX)
      REAL*8     ATTY(NUDIM,NUDIM)
      REAL*8     AIPT(NDDEN,NDTIN,NDZ1V)
C-----------------------------------------------------------------------
      LOGICAL    LDRNG(NTDMAX)           , LTRNG(NTDMAX)
C-----------------------------------------------------------------------
```

D1TITL

```
      SUBROUTINE D1TITL( IMSEL  , DSFULL ,
     &                   IPRNT  , IPSYS  ,
     &                   CELEM  , CYEAR  , CLASS  ,
     &                   TITLX
     &                 )
      IMPLICIT NONE
C-----------------------------------------------------------------------
C
C  ****************** FORTRAN77 SUBROUTINE: D1TITL *********************
C
C  PURPOSE:  TO CREATE THE DESCRIPTIVE TITLE FOR SELECTED DATA.
C
C  CALLING PROGRAM: ADAS401
C
C  SUBROUTINE:
C
C
C  INPUT : (I*4)  IMSEL    = INDEX OF SELECTED METASTABLE STATE
C                            (ONLY USED IF (LPARTL.AND.LPOWER) -
C                             EQUALS ONE OTHERWISE).
C  INPUT : (C*80) DSFULL   = FULL MVS INPUT DATA SET NAME
C
C  INPUT : (I*4)  IPRNT   = PARENT INDEX FOR SELECTED 'METASTABLE' INDEX
C                           NOT USED FOR STANDARD MASTER CONDENSED FILES
C  INPUT : (I*4)  IPSYS   = SPIN SYSTEM  FOR SELECTED 'METASTABLE' INDEX
C                           NOT USED FOR STANDARD MASTER CONDENSED FILES
C
C  INPUT : (C*2)  CELEM   = ISO-ELECTRONIC SEQUENCE ELEMENT NAME
C  INPUT : (C*2)  CYEAR   = YEAR OF INPUT DATA (2 CHARACTER ABBREV.)
C
C  INPUT : (C*3)  CLASS   = CLASS OF DATA SET BEING ANALYSED.
C                           ('ACD','SCD','CCD','PRB','PRC','PLT','PLS')
C
C  OUTPUT: (C*80) TITLX    = SELECTED DATA-BLOCK: DESCRIPTIVE TITLE
C
C          (C*1)  CPRNT    = 'IPRNT' AS CHARACTER
C          (C*1)  CPSYS    = 'IPSYS' AS CHARACTER
C          (C*2)  CMSEL    = 'IMSEL' AS CHARACTER
C
C ROUTINES: NONE
C
C AUTHOR:  PAUL E. BRIDEN (TESSELLA SUPPORT SERVICES PLC)
C          K1/0/37
C          JET EXT. 2520
C
C DATE:    17/06/91
C
C UNIX PORT:
C
C VERSION: 1.1                          DATE: 06-09-95
C MODIFIED: TIM HAMMOND (TESSELLA SUPPORT SERVICES PLC)
C               - FIRST RELEASE
C
C-----------------------------------------------------------------------
C-----------------------------------------------------------------------
      INTEGER    IMSEL          , IPRNT          , IPSYS
C-----------------------------------------------------------------------
      CHARACTER  DSFULL*80      ,
     &           CELEM*2         , CYEAR*2        , CLASS*3    ,
     &           TITLX*80
      CHARACTER  CMSEL*2         , CPRNT*1        , CPSYS*1
C-----------------------------------------------------------------------
```

D2DATA

```
       SUBROUTINE D2DATA( DSFULL , TITLF  , IFAIL  , LRESO ,IPRT, IGRND
     &                  , IZ0    , IZ1    , ICLASS , ITMAX  , IEVCUT
     &                  , ITDIMD , ITMAXD , IDMAXD , IZMAXD
     &                  , DTEV   , DDENS
     &                  , DTEVD  , DDENSD , DRCOFD , ZDATA
     &                  , DRCOFI , YEAR
     &                  )
       IMPLICIT REAL*8(A-H,O-Z)
C
C-----------------------------------------------------------------------
C
C PURPOSE : TO EXTRACT 'SANC0' COLLISIONAL DIELECTRONIC DATA
C
C NOTE    : THE SOURCE DATA IS CONTAINED AS SEQUENTIAL DATASETS
C           AS FOLLOWS:
C
C                   (1) JETUID.ACD<YR>#<IEL).DATA
C                   (2) JETUID.SCD<YR>#<IEL>.DATA
C                   (3) JETUID.CCD<YR>#<IEL>.DATA
C                   (4) JETUID.PRB<YR>#<IEL>.EV<CUT>.DATA
C                   (5) JETUID.PLT<YR>#<IEL>.EV<CUT>.DATA
C                   (6) JETUID.PRC<YR>#<IEL>.EV<CUT>.DATA
C                   (7) JETUID.PLS<YR>#<IEL>.DATA
C
C       WHERE, <YR>  = TWO INTEGERS  FOR THE YEAR SELECTED
C              <IEL> = ELEMENT NAME
C              <CUT> = ENERGY CUT-OFF (EV)
C
C              IF <CUT> = 0 THEN .EV<CUT> IS DELETED FROM ABOVE FILES.
C
C INPUT  : (C*2)  YEAR      = YEAR OF DATA
C          (C*2)  YEARDF    = DEFAULT YEAR OF DATA IF REQUESTED YEAR
C                             DOES NOT EXIST.
C          (I*4)  IZ0       = NUCLEAR CHARGE
C          (I*4)  IZ1       = MINIMUM ION CHARGE + 1
C          (I*4)  ICLASS    = CLASS OF DATA (1 - 6)
C          (I*4)  ITMAX     = NUMBER OF ( DTEV() , DDENS() ) PAIRS
C          (I*4)  IEVCUT    = ENERGY CUT-OFF (EV)
C          (R*8)  DTEV()    = DLOG10(ELECTRON TEMPERATURES (EV))
C          (R*8)  DDENS()   = DLOG10(ELECTRON DENSITIES (CM-3))
C          (I*4)  IPRT      = INDEX OF PARENT STATE
C          (I*4)  IGRND     = INDEX OF GROUND STATE
C          (L*4)  LRESO     = FLAG WHETHER RESOLVED DATA
C
C OUTPUT : (C*120) TITLF     = INFORMATION STRING
C          (I*4)  ITDIMD    = MAXIMUM NUMBER OF DATA TEMP & DENS
C          (I*4)  ITMAXD    = NUMBER OF DATA DTEVD()
C          (I*4)  IDMAXD    = NUMBER OF DATA DDENS()
C          (I*4)  IZMAXD    = NUMBER OF DATA ZDATA()
C          (I*4)  ITDIMD    = MAXIMUM NUMBER OF DATA TEMP & DENS
C          (I*4)  ZDATA()   = Z1 CHARGES IN DATASET
C          (I*4)  IFAIL     = -1   IF ROUTINE SUCCESSFUL BUT THE DEFAULT
C                                  YEAR FOR THE DATA WAS USED.
C                             = 0    IF ROUTINE SUCCESSFUL - DATA FOT THE
C                                  REQUESTED YEAR USED.
C                             = 1    IF ROUTINE OPEN STATEMENT FAILED
C          (R*8)  DTEVD()   = DLOG10(DATA ELECTRON TEMPERATURES (EV))
C          (R*8)  DDENSD()  = DLOG10(DATA ELECTRON DENSITIES (CM-3))
C          (R*8)  DRCOFD()  = DLOG10(DATA RATE COEFFICIENTS (CM-3/S))
C          (R*8)  DRCOFI()  = INTERPOLATION OF DRCOFD(,,) FOR
C                             DTEV() & DDENS()
C
C PROGRAM: (C*2)  SEQUA()   = ION NAMES FOR A PARTICULAR IZ0
C          (C*6)  USERID    = USER ID UNDER WHICH ADAS DATA IS STORED
C          (C*30) DSNAME    = FILE NAME ( SEE ABOVE TYPES )
C          (C*80) STRING    = GENERAL VARIABLE
C          (C*80) BLANK     = BLANK STRING
C          (C*2)  YEARSV    = LAST YEAR USED IN THIS ROUTINE
C          (I*4)  IREAD     = INPUT STREAM FOR OPEN STATEMENT
C          (I*4)  IZ0SV     = LAST IZ0 USED IN THIS ROUTINE
C          (I*4)  ICLSV     = LAST ICLASS USED IN THIS ROUTINE
C          (I*4)  INDXZ1    = LOCATION OF IZ1 IN ZDATA()
C          (I*4)  LCK       = MUST BE GREATER THAN 'ITMAXD' & 'IDMAXD'
C                             & 'ITMAX' - ARRAY SIZE FOR SPLINE CALCS.
C          (R*8)  A()       = GENERAL ARRAY
C          (R*8)  DRCOF0(,) = INTERPOLATION OF DRCOFD(,,) W.R.T DTEV()
C          (L*8)  LEXIST    = TRUE --- FILE TO OPEN EXISTS ELSE NOT
C
C PE BRIDEN = ADDED VARIABLES (14/01/91)
C
C          (I*4)  L1      = PARAMETER = 1
C          (I*4)  IOPT    = DEFINES THE BOUNDARY DERIVATIVES FOR THE
C                             SPLINE ROUTINE 'XXSPLE', SEE 'XXSPLE'.
C
C          (L*4)  LSETX   = .TRUE.  => SET UP SPLINE PARAMETERS RELATING
C                                      TO X-AXIS.
C                           .FALSE. => DO NOT SET UP SPLINE PARAMETERS
C                                      RELATING TO X-AXIS.
C                                      (I.E. THEY WERE SET IN A PREVIOUS
C                                            CALL )
C                          (VALUE SET TO .FALSE. BY 'XXSPLE')
```

```
C
C
C          (R*8)  DY()    = SPLINE INTERPOLATED DERIVATIVES
C
C          (R*8 ADAS FUNCTION - 'R8FUN1' ( X -> X) )
C
C PE BRIDEN = ADDED VARIABLES (23/04/93)
C
C          (I*4 ADAS FUNCTION - 'I4UNIT' (OUTPUT STREAM))
C
C AUTHOR : JAMES SPENCE (TESSELLA SUPPORT SERVICES PLC)
C          K1/0/80
C          JET  EXT. 4866
C
C DATE   : 22/02/90
C
C DATE   : 21/08/90 PE BRIDEN - REVISION: SEQUA(43) CHANGED ('TE'->'TC')
C
C DATE   : 08/10/90 PE BRIDEN - REVISION: RENAMED SUBROUTINE
C
C DATE   : 12/11/90 PE BRIDEN - CORRECTION: MOVE THE SETTING OF 'INDXZ1'
C                                           TO AFTER THE  '20 CONTINUE'
C                                           STATEMENT.   ALSO SAVE  THE
C                                           VALUE OF 'IZ1MIN'.
C
C DATE   : 14/01/91 PE BRIDEN - ADAS91:     CALLS TO NAG SPLINE ROUTINES
C                                           'E01BAF' & 'E02BBF' REPLACED
C                                           BY  CALLS   TO  ADAS  SPLINE
C                                           ROUTINE 'XXSPLE'.
C
C DATE   : 25/06/91 PE BRIDEN - CORRECTION: CHANGED FOLLOWING DIMENSION:
C                                            'DIMENSION DRCOFI(ITDIMD)'
C                                           TO
C                                            'DIMENSION DRCOFI(ITMAX)'
C
C DATE   : 07/08/91 PE BRIDEN - ADDED ERROR HANDLING IF THE OPEN STATE-
C                               MENT FAILS. (IFAIL=1 RETURNED)
C
C DATE   : 27/04/92 PE BRIDEN - ADDED DEFAULT YEAR FOR DATA IF REQUESTED
C                               YEAR DOES NOT EXIST. (ADDED 'YEARDF')
C                               INTRODUCED IFAIL = -1 IF DEFAULT YEAR
C                               WAS USED AND NOT THE REQUESTED YEAR.
C
C DATE   : 10/03/93 PE BRIDEN - ALLOWED INPUT DATA SETS TO BE ACCESSED
C                               FROM ANY USERID (DEFAULT = JETSHP)
C                               - INTRODUCED USERID VARIABLE AND CALL
C                                 TO XXUID.
C
C DATE   : 23/04/93 PE BRIDEN - ADDED I4UNIT FUNCTION TO WRITE
C                               STATEMENTS FOR SCREEN MESSAGES
C
C UPDATE:  24/05/93 - PE BRIDEN - ADAS91: CHANGED I4UNIT(0)-> I4UNIT(-1)
C
C UPDATE:  14/09/94 - PE BRIDEN - ADAS91: ADDED CHECK TO MAKE SURE THAT
C                                         ITMAX, ITMAXD AND IDMAXD ARE
C                                         IN RANGE (I.E. <= LCK).
C
C UPDATE:  16/08/96 - PE BRIDEN - ADAS91: MINOR MOD - IF DEFAULT DATA
C                                         IS NOT FOUND THEN ASSIGN TITLF
C                                         BEFORE EXITING WITH AN ERROR.
C
C-----------------------------------------------------------------------
C
C UNIX-IDL PORT:
C
C VERSION: 1.1                          DATE: 28-10-96
C MODIFIED: WILLIAM OSBORN (TESSELLA SUPPORT SERVICES PLC)
C                - FIRST CONVERTED
C
C VERSION: 1.2                          DATE: 14-02-97
C MODIFIED: RICHARD MARTIN
C                - CHANGED DEFINITION OF 'BLANKS' TO 80 CHARACTERS ONLY
C
C VERSION: 1.3                          DATE: 26-10-97
C MODIFIED: LORNE HORTON (JET)
C                - CHANGED EXTRAPOLATION ALGORITHM
C
C-----------------------------------------------------------------------
C-----------------------------------------------------------------------
C
       INTEGER   L1
C
       PARAMETER ( L1    =  1 )
       PARAMETER ( IREAD = 12 , LCK = 100, IDUMAX = 60 )
C
       INTEGER   IOPT
C
       DIMENSION DTEV(ITMAX)   , DDENS(ITMAX)
       DIMENSION DTEVD(ITDIMD) , DDENSD(ITDIMD) , ZDATA(ITDIMD)
       DIMENSION DRCOFD(ITDIMD,ITDIMD,ITDIMD)
       DIMENSION DRDUM(IDUMAX,IDUMAX)
       DIMENSION DRCOFI(ITMAX)
C
       DIMENSION SEQUA(50)
C
       DIMENSION A(LCK)
       REAL*8    DY(LCK)
       DIMENSION DRCOF0(LCK,LCK)
```

```
      LOGICAL   LINTRP(LCK)
C
      CHARACTER YEAR*2  , YEARSV*2  , TITLF*120  , EVCUT*6
      CHARACTER SEQUA*2 , STRING*80 , BLANKS*80
      CHARACTER DSFULL*80
C
      LOGICAL   LEXIST  , LSETX , LRESO
C
      EXTERNAL  R8FUN1
C
      SAVE      IZ1MIN
C
C-----------------------------------------------------------------------
C
      DATA  SEQUA/'H ','HE','LI','BE','B ','C ','N ','O ','F ','NE',
     &            'NA','MG','AL','SI','P ','S ','CL','AR','K ','CA',
     &            'SC','TI','V ','CR','MN','FE','CO','NI','CU','ZN',
     &            'GA','GE','AS','SE','BR','KR','RB','SR','Y ','ZR',
     &            'NB','MO','TC','RU','RH','PD','AG','CD','IN','SN'/
      DATA BLANKS/'
     &                           '/
C
      DATA YEARSV/'  '/
      DATA IZ0SV /0   /
      DATA ICLSV /0   /
      DATA IEVSV /0   /
C
```

D2OUT0

```
      SUBROUTINE D2OUT0( IWRITE   ,
     I                   TITLE    , FINFO , MINFO  ,
     I                   ICLASS   , Z0    , Z1     , Z     ,
     I                   ITMAX    , TEMP  , TEMPEV , TEMPR ,
     I                   DENS     , AOUT  ,
     I                   KPLUS1   , COEF
     I             )
      IMPLICIT REAL*8(A-H,O-Z)
C
C-----------------------------------------------------------------------
C
C PURPOSE : TO PRINT-OUT RESULTS REGARDING 'ADAS402'.
C
C INPUT   : (C*40) TITLE    = TITLE OF RUN
C           (C*120) FINFO    = INFORMATION STRING CONTAINING NAME OF
C                              OPEN DATASET
C           (C*80) MINFO    = DIAGNOSTIC LINE INFORMATION FROM 'MINIMAX'
C           (I*4)  IWRITE   = OUTPUT STREAM FOR RESULTS
C           (I*4)  ITMAX    = NUMBER OF TEMP/DENS PAIRS
C           (I*4)  KPLUS1   = NUMBER OF 'MINIMAX' COEFFICIENTS
C           (I*4)  ICLASS   = CLASS OF DATA
C           (R*8)  Z0       = NUCLEAR         CHARGE
C           (R*8)  Z1       = RECOMBINING ION CHARGE
C           (R*8)  Z        = RECOMBINED  ION CHARGE
C           (R*8)  TEMP()   = OUTPUT ELECTRON TEMPERATURES IN KELVIN
C           (R*8)  TEMPEV() = OUTPUT ELECTRON TEMPERATURES IN EV
C           (R*8)  TEMPR()  = REDUCED TEMPERATURE (TEMP IN KELVIN/Z1**2)
C           (R*8)  DENS()   = OUTPUT ELECTRON DENSITIES    IN CM-3
C           (R*8)  AOUT()   = INTERPOLATED DATA AT OUTPUT TEMPERATURE
C                             AND DENSITY PAIR
C           (R*8)  COEF()   = 'MINIMAX' COEFFICIENTS
C
C NOTES   :
C
C AUTHOR  : JAMES SPENCE (TESSELLA SUPPORT SERVICES PLC)
C           K1/0/80
C           JET  EXT. 4866
C
C DATE    : 16/02/90
C
C DATE    : 08/10/90 PE BRIDEN - REVISION: RENAMED SUBROUTINE
C
C DATE    : 16/11/90 PE BRIDEN - CORRECTION: CHANGED POWER COLUMN TITLE
C                                    FROM 'ERG CM3/S' TO 'WATT CM3'
C
C-----------------------------------------------------------------------
C
      DIMENSION TEMP(ITMAX)   , TEMPEV(ITMAX) , TEMPR(ITMAX)
      DIMENSION DENS(ITMAX)
      DIMENSION AOUT(ITMAX)
C
      DIMENSION COEF(KPLUS1)
C
      CHARACTER TITLE*(*) , FINFO*(*) , MINFO*(*)
C
C-----------------------------------------------------------------------
```

D2OUTG

```
       SUBROUTINE D2OUTG(TITLE,TITLF,TITLM,TR,RATA,ITE,ZIPT,IZMAX,
     & Z1,TRMX,RATMX,NMX,TRS,RATS,MAXT,IGOPT,ISWIT,XMIN,XMAX,YMIN,YMAX,
     & ICLASS)
       PARAMETER (NKDIM=60)
       IMPLICIT REAL*4(A-H,O-Z)
       INTEGER IVAL
       REAL*8 TR,RATA,ZIPT,Z1,TRMX,RATMX,TRS,RATS,XMIN,XMAX,YMIN,YMAX
       CHARACTER*40 ISPEC
       CHARACTER*15 GRTIT(2)
       CHARACTER*23 XTIT,YTIT
       CHARACTER TITLE*40, TITLF*120, TITLM*80, ZCHARS*9, CHARS*16
C-----------------------------------------------------------------------
C  GRAPHIC ROUTINE FOR USE BY ADAS402
C
C  PROVIDES COMPARATIVE GRAPH OF CONDENSED MASTER DATA     (SOLID CURVE)
C                                SPLINE INTERPOLATED DATA  (CROSSES)
C                                MINIMAX FIT TO DATA       (DASH CURVE )
C
C  PLOT IS LOG10(RATE COEFFT.(CM**3 SEC-1))  VERSUS LOG10(TE(K)/Z1**2))
C
C  ****** H.P. SUMMERS, JET              12 FEB 1990   **********
C
C UPDATE: P.E. BRIDEN, JET/TESSELLA      08 OCT 1990   **********
C         1) RE-NAMED SUBROUTINE
C
C UPDATE: P.E. BRIDEN, JET/TESSELLA      16 NOV 1990   **********
C         1) RE-POSITIONED SPLINE OUTPUT TITLE.
C         2) SWITCH OFF GHOST80 ERRORS WHEN PLOTTING
C
C UPDATE: P.E. BRIDEN, JET/TESSELLA      25 JAN 1991   **********
C         1) ARRAY DECLARATION: 'TRS(40)' INSTEAD OF 'TRS(60)'
C         2) ARRAY DECLARATION: 'RATS(40)' INSTEAD OF 'RATS(60)'
C
C UPDATE: P.E. BRIDEN, JET/TESSELLA      22 NOV 1991   **********
C         1) DECLARED GRID AND PIC AS CHARACTER*1 (BLANK)
C         2) MADE FILNAM/PICSAV ARGUMENT LIST COMPATIBLE WITH GHOST8
C
C-----------------------------------------------------------------------
C
C UNIX-IDL PORT:
C
C VERSION: 1.1                           DATE: 30-10-96
C MODIFIED: WILLIAM OSBORN (TESSELLA SUPPORT SERVICES PLC)
C               - FIRST CONVERTED
C             - COMMENTED OUT IBM SPECIFIC CODE AND REPLACED WITH PIPE
C               WRITES
C
C-----------------------------------------------------------------------
C-----------------------------------------------------------------------
       DIMENSION TR(NKDIM),RATA(NKDIM,NKDIM),ZIPT(NKDIM)
       DIMENSION TRMX(100),RATMX(100)
       DIMENSION TRS(40),RATS(40),XA4(100),YA4(100),YTIT(7)
       INTEGER PIPEOU
       PARAMETER ( PIPEOU = 6)
       CHARACTER GRID*1 ,PIC*1
       DATA ISPEC/'MASTER CONDENSED FILE DATA PLOTTING    '/
       DATA GRTIT(1)/'                '/
       DATA XTIT   /'  TE   (EV)          '/
       DATA YTIT(1)/'  ACD (CM**3 SEC-1)    '/
       DATA YTIT(2)/'  SCD (CM**3 SEC-1)    '/
       DATA YTIT(3)/'  CCD (CM**3 SEC-1)    '/
       DATA YTIT(4)/'  PRB (WATT CM**3)     '/
       DATA YTIT(5)/'  PLT (WATT CM**3)     '/
       DATA YTIT(6)/'  PRC (WATT CM**3)     '/
       DATA YTIT(7)/'  PLS (WATT CM**3)     '/
       DATA GRID/' '/,PIC/' '/
```

D2TDIN

```
SUBROUTINE D2TDIN( DSFULL
     &                , ITDIMD , ITMAXD , IDMAXD
     &                , TEMP   , DENS   , LRESO
     &                )
      IMPLICIT NONE
C
C-----------------------------------------------------------------------
C
C PURPOSE : TO EXTRACT TEMPERATURE AND DENSITY FROM ADF11 FILE FOR
C           DISPLAY ON ADAS402 PROCESSING SCREEN
C
C INPUT  : (C*80) DSFULL    = INPUT DATASET NAME
C          (I*4)  ITDIMD    = MAXIMUM NUMBER OF DATA TEMP & DENS
C          (L*4)  LRESO     = .TRUE. => RESOLVED DATASET
C                             .FALSE.=> UNRESOLVED DATASET
C
C OUTPUT : (I*4)  ITMAXD    = NUMBER OF DATA TEMPS
C          (I*4)  IDMAXD    = NUMBER OF DATA DENS
C          (R*8)  TEMP()    = DATA ELECTRON TEMPERATURES (EV)
C          (R*8)  DENS()    = DATA ELECTRON DENSITIES (CM-3)
C
C PROGRAM:
C
C-----------------------------------------------------------------------
```

```
C
C UNIX-IDL PORT:
C
C VERSION: 1.1                          DATE: 29-10-96
C MODIFIED: WILLIAM OSBORN (TESSELLA SUPPORT SERVICES PLC)
C               - FIRST WRITTEN
C
C-----------------------------------------------------------------------
C-----------------------------------------------------------------------
C
      LOGICAL LRESO
C
      INTEGER   IREAD, ITDIMD
      PARAMETER ( IREAD = 12 )
C
      REAL*8    TEMP(ITDIMD)  , DENS(ITDIMD)
C
      INTEGER   IZMAX , IDMAXD , ITMAXD , IZ1MIN , IZ1MAX, ID, IT
C
      CHARACTER DSFULL*80, STRING*80
C-----------------------------------------------------------------------
```

D4DATA

```
SUBROUTINE D4DATA( TITLE , DATE  , UIDIN  , USERID ,
     &                   ISWIT , NIND  , YEAR   , SELTAB , REPTAB ,
     &                   NDZ   , NDDEN , NDTIN  ,
     &                   IZ0   , IZ1   , NEL1   , IZ2    , NEL2   ,
     &                   T     , TL    , MAXT   ,
     &                   DENSA , DENSL , MAXD   ,
     &                   ATTY  , ARRAY , ZINTRP , DINTRP , TINTRP ,
     &                   DSNIN , DSNO  , OPEN17
     &                 )
      IMPLICIT NONE
C-----------------------------------------------------------------------
C
C  ****************** FORTRAN77 SUBROUTINE: D4DATA *********************
C
C  PURPOSE: TO OPEN/ACQUIRE DATA FROM STD.MASTER CONDENSED COLLISIONAL-
C           DIELECTRONIC   FILES,   OBTAIN  INTERPOLATED   COLLISIONAL-
C           DIELECTRONIC RECOMBINATION AND IONISATION COEFFICIENTS, AND
C           PREPARE ELEMENT MASTER FILE IF REQUIRED.
C
C  CALLING PROGRAM: ADAS404
C
C  DATA:
C
C       INPUT:
C       ------
C           THE  SOURCE  DATA IS CONTAINED AS  MEMBERS  OF  PARTITIONED
C           DATA SETS AS FOLLOWS:
C
C             1. JETUID.ACD<YR>.DATA
C             2. JETUID.SCD<YR>.DATA
C             3. JETUID.CCD<YR>.DATA
C             4. JETUID.PRB<YR>.DATA
C             5. JETUID.PRC<YR>.DATA
C             6. JETUID.PLT<YR>.DATA
C             7. JETUID.PLS<YR>.DATA
C
C           WHERE <YR> DENOTES TWO INTEGERS FOR THE YEAR SELECTED.
C           IF <YR> IS BLANK THEN THE CURRENT RECOMMENDED DATA SETS ARE
C           USED
C
C           'JETUID' IS GIVEN BY 'UIDIN'
C
C           THE PARTICULAR TYPE OPENED (1-7) IS SELECTED BY 'ISWIT'
C
C           THE MEMBERS OF THE PARTITIONED DATA SETS ARE  <SE>
C           WHERE <SE> IS THE ONE OR TWO LETTER ION SEQUENCE CODE
C
C           THIS PROGRAM ASSESSES ONLY STANDARD MASTER CONDENSED FILES.
C           ----------------------------------------------------------
C
C
C      OUTPUT:
C      -------
C           THE OUTPUT ELEMENT MASTER DATA IS IN SEQUENTIAL FILES AS
C           FOLLOWS:
C
C             1. JETUID.ACD<YR>#<EL>.DATA
C             2. JETUID.SCD<YR>#<EL>.DATA
C             3. JETUID.CCD<YR>#<EL>.DATA
C             4. JETUID.PRB<YR>#<EL>.DATA
C             5. JETUID.PRC<YR>#<EL>.DATA
C             6. JETUID.PLT<YR>#<EL>.DATA
C             7. JETUID.PLS<YR>#<EL>.DATA
C
C           WHERE <YR> IS AS ABOVE AND  <EL> IS THE ELEMENT SYMBOL
C
C           'JETUID' IS GIVEN BY 'USERID'
C
C  SUBROUTINE:
C
```

```
C  INPUT : (C*32) TITLE    = USER ENTERED PROGRAM RUN TITLE
C  INPUT : (C*8)  DATE     = CURRENT DATE (AS 'DD/MM/YY')
C  INPUT : (C*6)  UIDIN    = PROJECT UID FOR INPUT CONDENSED DATA FILE
C  INPUT : (C*6)  USERID   = USER ID FOR OUTPUT INC. ELEMENT MASTER FILE
C
C  INPUT : (I*4)  ISWIT    = DATA TYPE SELECTOR (SEE ABOVE) (1 -> 7)
C  INPUT : (I*4)  NIND     = NUMBER OF STAGES BEGINNING WITH LOWEST TO
C                            BE SKIPPED.   IT IS ASSUMED THAT DATA FOR
C                            THESE STAGES WILL BE SUPPLIED SEPARATELY.
C                            (DESIGNED FOR NEUTRAL STATE).
C  INPUT : (C*2)  YEAR     = REFERENCE  YEAR  (ABBREVIATED)  OF   INPUT
C                            MASTER CONDENSED COLL.-DIEL. COEFFTS. FILE.
C  INPUT : (L*4)  SELTAB   = .TRUE.  => PREPARE ELEMENT MASTER FILE
C                           .FALSE. => DO NOT PREPARE ELEM. MASTER FILE
C  INPUT : (L*4)  REPTAB   = .TRUE.  => REPLACE EXISTING ELEMENT MASTER
C                                       FILES.
C                          = .FALSE. => DO NOT REPLACE EXISTING ELEMENT
C                                       MASTER FILES.
C                             ('REPTAB' IS IGNORED IF 'SELTAB'=.FALSE.)
C
C  INPUT : (I*4)  NDZ      = NUMBER OF CHARGE STATES
C  INPUT : (I*4)  NDDEN    = MAXIMUM NUMBER OF INPUT DENSITIES
C  INPUT : (I*4)  NDTIN    = MAXIMUM NUMBER OF INPUT TEMPERATURES
C
C  INPUT : (I*4)  IZ0      = ELEMENT NUCLEAR CHARGE
C                                  (DETERMINES OUTPUT FILE NAME)
C  INPUT : (I*4)  IZ1      = MINIMUM ALLOWED IONIC CHARGE + 1
C                             (ACCORDING TO AVAILABLE NO. OF SEQUENCES
C                              STORED IN FILES FOR 'YEAR')
C  INPUT : (I*4)  NEL1     = NUMBER OF ELECTRONS IN STATE 'IZ1'
C  INPUT : (I*4)  IZ2      = MAXIMUM ALLOWED IONIC CHARGE + 1
C  INPUT : (I*4)  NEL2     = NUMBER OF ELECTRONS IN STATE 'IZ2'
C
C  INPUT : (R*8)  T()      = SET OF 'MAXT' ELECTRON TEMPERATURES: KELVIN
C  INPUT : (R*8)  TL()     = LOG10('T()')
C  INPUT : (I*4)  MAXT     = NUMBER OF TEMPERATURES (<= 'NDTIN' )
C
C  INPUT : (R*8)  DENSA()  = SET OF 'MAXD' ELECTRON DENSITIES: CM-3
C  INPUT : (R*8)  DENSL()  = LOG10 ('DENSA()')
C  INPUT : (I*4)  MAXD     = NUMBER OF DENSITIES (<= 'NDDEN' )
C
C  OUTPUT: (R*8)  ATTY(,) = WORKING SPACE FOR 3-WAY SPLINE ITERPOLATION
C                           ( STORES LOG10(INTERPOLATED VALUES) )
C                            1ST DIMENSION: TEMPERATURE
C                            2ND DIMENSION: DENSITY
C  OUTPUT: (R*8)  ARRAY(,,)= LOG10(INTERPOLATED DATA) FOR:
C                             1ST ARRAY DIMENSION - ION CHARGE/STAGE
C                             2ND ARRAY DIMENSION - TEMPERATURE
C                             3RD ARRAY DIMENSION - DENSITY
C  OUTPUT: (L*4)  ZINTRP() = .TRUE.  => 'ARRAY(,,)' VALUE FOR CHARGE-
C                                       STATE INTERPOLATED.
C                           = .FALSE. => 'ARRAY(,,)' VALUE FOR CHARGE-
C                                       STATE EXTRAPOLATED.
C                           1ST DIMENSION: CHARGE-STATE INDEX
C  OUTPUT: (L*4)  DINTRP(,)= .TRUE.  => 'ARRAY(,,)' VALUE FOR DENSITY
C                                       INDEX AND CHARGE INTERPOLATED.
C                           = .FALSE. => 'ARRAY(,,)' VALUE FOR DENSITY
C                                       INDEX AND CHARGE EXTRAPOLATED.
C                            1ST DIMENSION: DENSITY INDEX
C                            2ND DIMENSION: CHARGE-STATE INDEX
C  OUTPUT: (L*4)  TINTRP(,)= .TRUE.  =>'ARRAY(,,)' VALUE FOR TEMPERATURE
C                                      INDEX AND CHARGE INTERPOLATED.
C                           = .FALSE. =>'ARRAY(,,)' VALUE FOR TEMPERATURE
C                                       INDEX AND CHARGE EXTRAPOLATED.
C                            1ST DIMENSION: TEMPERATURE INDEX
C                            2ND DIMENSION: CHARGE-STATE INDEX
C  OUTPUT: (C*80) DSNO()  = OUPUT MASTER FILE NAME FOR EACH DATA TYPE
C
C  OUTPUT: (C*80) DSNIN(,)= INPUT FILE NAME FOR EACH DATA TYPE AND
C                           CHARGE
C
C          (I*4)  NKDIM   = PARAMETER =
C                           MAXIMUM  ARRAY  DIMENSIONS  FOR  CONDENSED
C                           MASTER FILE DATA FOR A GIVEN CHARGE STATE.
C          (I*4)  IUNT12  = PARAMETER = UNIT FOR READING DATA = 12
C
C          (R*8)  LOGMIN  = PARAMETER = MINIMUM LOG VALUE ALLOWED
C
C          (C*2)  XFESYM  = FUNCTION - (SEE ROUTINES SECTION BELOW)
C          (C*30) DSNAME  = INPUT MASTER CONDENSED FILE DATA SET NAME
C          (C*30) DSNOUT  = OUTPUT ELEMENT MASTER FILE DATA SET NAME
C          (C*2)  SEQUA   = ELEMENT SYMBOL FOR GIVEN NUCLEAR CHARGE
C          (C*3)  CDTYP() = INPUT MASTER CONDENSED FILE TYPE  USED  FOR
C                           CONSTRUCTING 'DSNAME'/'DSNOUT'. () = 'ISWIT'
C
C          (L*4)  LEXIST  = .TRUE.  => STANDARD MASTER CONDENSED FILE
C                                      EXISTS.
C                           .FALSE. => STANDARD MASTER CONDENSED FILE
C                                      DOES NOT EXIST.
C          (L*4)  LERROR  = .TRUE.  => ERROR FOUND IN READING STANDARD
C                                      MASTER CONDENSED FILE.
C                           .FALSE  =>NO ERROR FOUND IN READING STANDARD
C                                      MASTER CONDENSED FILE.
C          (L*4)  LSWIT   = .TRUE.  => SET OF 'EIA' VALUES PRESENT IN
C                                      MASTER CONDENSED FILE.
C                           .FALSE  => SET OF 'EIA' VALUES NOT PRESENT
C                                      IN MASTER CONDENSED FILE.
C
```

```
C          (I*4)  I4UNIT  = FUNCTION (SEE ROUTINE SECTION BELOW)
C          (I*4)  IZSTRT  = 'IZ1'
C          (I*4)  IZSTOP  = 'IZ2'
C          (I*4)  NZMAX   = 'NDZ'
C          (I*4)  NDMAX   = 'NDDEN'
C          (I*4)  NTMAX   = 'NDTIN'
C          (I*4)  ID      = ARRAY SUBSCRIPT USED FOR DENSITY VALUES
C          (I*4)  IS      = ARRAY SUBSCRIPT USED FOR SEQUENCE VALUES.
C                           REPRESENTS NUCLEAR CHARGE FOR ISO-ELECTRONIC
C                           SEQUENCE ELEMENT.
C                           (IMPLIES NUCLEAR CHARGE 'IS'-LIKE SEQUENCE)
C          (I*4)  IT      = ARRAY SUBSCRIPT USED FOR TEMPERATURE VALUES
C          (I*4)  IDE     = NUMBER OF REDUCED DENSITIES READ FROM INPUT
C                           MASTER CONDENSED FOR SEQUENCE 'IS'.
C          (I*4)  ITE     = NO. OF REDUCED TEMPERATURES READ FROM INPUT
C                           MASTER CONDENSED FOR SEQUENCE 'IS'.
C          (I*4)  IZE     = NO. OF CHARGE STATES GIVEN IN THE INPUT
C                           MASTER CONDENSED FOR SEQUENCE 'IS'.
C          (I*4)  IZF     = ELEMENT RECOMBINING ION CHARGE (IZ0+1-IS)
C          (I*4)  LS      = NON-BLANK LENGTH OF 'SEQUA'.
C          (I*4)  LD1     = VALUE  FOR  FIRST  DIMENSION OF 'ARRAY(,,)'
C                           (REPRESENTS STAGE/ION CHARGE)
C
C          (R*8)  ZIPT()  = SET OF 'IZE' INPUT RECOMBINING ION CHARGES
C                           READ FROM CONDENSED MASTER FILE.
C          (R*8)  TR()    = SET OF 'ITE'  INPUT  REDUCED  TEMPERATURES
C                           (K/Z1**2) READ FROM CONDENSED MASTER FILE.
C          (R*8)  DENSR() = SET OF 'IDE' INPUT REDUCED DENSITIES (CM-3/
C                           Z1**7) READ FROM CONDENSED MASTER FILE.
C          (R*8)  AIPT(,,)= CONDENSED MASTER FILE DATA. COLL-DIEL COEFF.
C                           1ST DIMENSION: REDUCED DENSITY ('DENSR()')
C                           2ND DIMENSION: REDUCED TEMPERATURE ('TR()')
C                           3RD DIMENSION: CHARGE STATE ('ZIPT()')
C          (R*8)  EIA()   = IONISATION RATE COEFFICIENTS: ()=ION CHARGE
C                           (UNITS: PRIOR TO 'XXCEIA' CALL: WAVE NUMBERS
C                                   AFTER CALL TO 'XXCEIA': RYDBERGS )
C NOTE:
C          STREAM HANDLING:
C                  STREAM 12 IS USED FOR READING CONDENSED MASTER FILES
C                  STREAM 13 IS USED FOR WRITING  ELEMENT  MASTER FILES
C
C          THIS SUBROUTINE IS A STRUCTURED AND AMENDED VERSION OF  THE
C          SUBROUTINE 'EIONST' WRITTEN BY H.P. SUMMERS, JET  (VERSION:
C          2 NOV 1989 / 1FEB 1990).
C
C ROUTINES:
C          ROUTINE    SOURCE    BRIEF DESCRIPTION
C          ------------------------------------------------------------
C          D4OUTF     ADAS      OUTPUT OF ELEMENT MASTER FILE
C          DXSPL1     ADAS      1ST PART OF 3-WAY SPLINE OF INPUT DATA
C          DXSPL2     ADAS      2ND PART OF 3-WAY SPLINE OF INPUT DATA
C          DXSPL3     ADAS      3RD PART OF 3-WAY SPLINE OF INPUT DATA
C          XXOPEN     ADAS      INQUIRE AND OPEN A DATA SET
C          XXINST     ADAS      FETCH   DATA   FROM   STANDARD  MASTER
C                               CONDENSED FILE.
C          XXCEIA     ADAS      CONVERT ION. RATE COEF. FROM WAVE NOS TO
C                               RYDBERGS AND EXTRAPOLATE MISSING VALUES
C          XFESYM     ADAS      CHARACTER*2 FUNCTION -
C                               FETCH ELEMENT SYMBOL FOR GIVEN NUCLEAR
C                               CHARGE
C          XXTERM     ADAS      TERMINATES PROGRAM WITH MESSAGE
C          I4UNIT     ADAS      FETCH UNIT NUMBER FOR OUTPUT OF MESSAGES
C
C
C AUTHOR:  PAUL E. BRIDEN (TESSELLA SUPPORT SERVICES PLC)
C          K1/0/81
C          JET EXT. 4569
C
C DATE:    08/10/90
C
C DATE:    26/10/90 - PE BRIDEN (JET/TESSELLA) - MINIMUM LOG10 VALUE
C                     ALLOWED WAS SET EQUAL TO 'LOGMIN'.  I.E. GIVES
C                     LOWER LIMIT FOR 'ARRAY(,,)'.
C
C UPDATE:  29/01/91 - PE BRIDEN - ADAS91 -INTRODUCED 'TINTRP' & 'DINTRP'
C                                      - AMENDED ARGUMENT LIST
C                                      - AMENDED ARGUMENT LISTS FOR
C                                        'D4SPL2' AND 'D4SPL3'.
C
C UPDATE:  30/01/91 - PE BRIDEN - ADAS91 -INTRODUCED 'ZINTRP'
C
C UPDATE:  13/02/91 - PE BRIDEN - ADAS91 - REPLACED XXESYM WITH XFESYM
C
C UPDATE:  21/02/91 - PE BRIDEN - ADAS91: INTRODUCED 'IZSTRT' , 'IZSTOP'
C                                  'NZMAX', 'NDMAX' AND 'NTMAX' TO  STOP
C                                 ICA MESSAGES BEING GENERATED.
C
C UPDATE:  05/03/91 - PE BRIDEN - ADAS91: ADDED CALL TO 'XXOPEN' BEFORE
C                                         AMENDED 'XXINST'.
C
C UPDATE:  20/03/91 - PE BRIDEN - ADAS91: MAJOR   CHANGES   TO   SPLINE
C                                         ROUTINES 'D4SPL?' -> 'DXSPL?'.
C                                         DENSA() ADDED TO ARGUMENT LIST
C
C UPDATE:  23/04/93 - PE BRIDEN - ADAS91: ADDED I4UNIT FUNCTION TO WRITE
C                                         STATEMENTS FOR SCREEN MESSAGES
C
C UPDATE:  24/05/93 - PE BRIDEN - ADAS91: CHANGED I4UNIT(0)-> I4UNIT(-1)
```

```
C
C UNIX-IDL PORT:
C
C VERSION: 1.1                          DATE: 11-11-96
C MODIFIED: WILLIAM OSBORN (TESSELLA SUPPORT SERVICES PLC)
C               - FIRST CONVERTED
C
C VERSION: 1.2                          DATE: 20-11-96
C MODIFIED: WILLIAM OSBORN (TESSELLA SUPPORT SERVICES PLC)
C               - TIDIED OUTPUT
C
C VERSION: 1.3                          DATE: 28-11-96
C MODIFIED: WILLIAM OSBORN (TESSELLA SUPPORT SERVICES PLC)
C               - CORRECTED DEFINITION OF OPEN17 TO LOGICAL TYPE
C
C-----------------------------------------------------------------------
C-----------------------------------------------------------------------
      INTEGER    NKDIM       , IUNT17           , IUNT12
C-----------------------------------------------------------------------
      REAL*8     LOGMIN
C-----------------------------------------------------------------------
      PARAMETER( NKDIM = 10  , IUNT17 = 17      , IUNT12 = 12 )
C-----------------------------------------------------------------------
      PARAMETER( LOGMIN = -74.0                 )
C-----------------------------------------------------------------------
      CHARACTER  XFESYM*2
      CHARACTER  UIDIN*6     , USERID*6
      CHARACTER  YEAR*2      , DSNAME*80        , DSNOUT*80  , TITLE*32
      CHARACTER  SEQUA*2     , DATE*8           , CDTYP(7)*3
      CHARACTER  DSNO(10)*80 , DSNIN(50,10)*80
C-----------------------------------------------------------------------
      LOGICAL    SELTAB      , REPTAB           , LERROR     ,
     &           LEXIST      , LSWIT            , OPEN17
C-----------------------------------------------------------------------
      INTEGER    I4UNIT
      INTEGER    NDZ         , NDDEN            , NDTIN
      INTEGER    IZ0         , IZ1              , IZ2        ,
     &                         NEL1             , NEL2       ,
     &           ISWIT       , MAXT             , MAXD       ,
     &           NIND
      INTEGER    ID          , IS               , IT         ,
     &           IDE         , ITE              , IZE        ,
     &           IZSTRT      , IZSTOP           ,
     &           NZMAX       , NDMAX            , NTMAX
      INTEGER    IZF         , LS               , LD1
C-----------------------------------------------------------------------
      REAL*8     T(NDTIN)    , TL(NDTIN)         ,
     &           DENSA(NDDEN), DENSL(NDDEN)
      REAL*8     ZIPT(NKDIM) , TR(NKDIM)         , DENSR(NKDIM)
      REAL*8     EIA(50)     , ATTY(NDTIN,NDDEN)
      REAL*8     ARRAY(NDZ,NDTIN,NDDEN)
      REAL*8     AIPT(NKDIM,NKDIM,NKDIM)
C-----------------------------------------------------------------------
      LOGICAL    ZINTRP(NDZ) , DINTRP(NDDEN,NDZ) , TINTRP(NDTIN,NDZ)
C-----------------------------------------------------------------------
      DATA  CDTYP/'acd','scd','ccd','prb','prc','plt','pls'/
C-----------------------------------------------------------------------
```

D4IBAL

```
SUBROUTINE D4IBAL ( MAXT  , IZ1   , IZ2  ,
     &              NDZ   , NDTIN ,
     &              ACDL  , SCDL
     &            )
      IMPLICIT NONE
C-----------------------------------------------------------------------
C
C  ****************** FORTRAN77 SUBROUTINE: D4IBAL *********************
C
C  PURPOSE: TO CALCULATE IONISATION BALANCES AT FIXED DENSITY
C
C  CALLING PROGRAM: ADAS404
C
C  SUBROUTINE:
C
C  INPUT : (I*4)  MAXT    = NUMBER OF USER ENTERED TEMPERATURES <= NDTIN
C  INPUT : (I*4)  IZ1     = MINIMUM ALLOWED IONIC CHARGE + 1
C                           (ACCORDING TO AVAILABLE 'NSET')
C  INPUT : (I*4)  IZ2     = MAXIMUM ALLOWED IONIC CHARGE + 1
C
C  INPUT : (I*4)  NDZ     = NUMBER OF CHARGE STATES
C  INPUT : (I*4)  NDTIN   = MAXIMUM NUMBER OF INPUT TEMPERATURES
C
C  I/O   : (R*8)  ACDL(,) = INPUT : LOG10(RECOMB. COLL-DIEL COEFF)
C                           OUTPUT: LOG10(IONISATION-BALANCE)
C                           NOTE:   THESE VALUES ARE FOR A FIXED DENSITY
C                              1ST ARRAY DIMENSION = ION CHARGE/STAGE
C                              2ND ARRAY DIMENSION = TEMPERATURE
C  I/O   : (R*8)  SCDL(,) = INPUT : LOG10(IONIS. COLL-DIEL COEFF)
C                           OUTPUT: IONISATION-BALANCE
C                           NOTE:   THESE VALUES ARE FOR A FIXED DENSITY
C                              1ST ARRAY DIMENSION = ION CHARGE/STAGE
C                              2ND ARRAY DIMENSION = TEMPERATURE
C
```

```
C          (I*4)  MAX     = MAXIMUM NUMBER OF CHARGES FOR COLL-DIEL COEF
C          (I*4)  MAX1    = MAXIMUM NUMBER OF CHARGES FOR ION.-BALANCE
C                           ('MAX' + 1)
C          (I*4)  IZ      = ARRAY SUBSCRIPT USED FOR ION CHARGE VALUES
C          (I*4)  IT      = ARRAY SUBSCRIPT USED FOR TEMPERATURE VALUES
C          (I*4)  IREF    = REFERENCE POINT IN COLL-DIEL COEFF ARRAY,
C                           REPRESENTING THE CHARGE BELOW WHICH THE ION.
C                           COLL-DIEL COEFF IS GREATER THAN RECOMB COLL-
C                           DIEL. COEFF..
C
C          (R*8)  S       = USED FOR SUMMING COEFFICIENTS
C          (R*8)  SLOG    = LOG10( 'S' )
C
C
C ROUTINES: NONE
C
C AUTHOR:   PAUL E. BRIDEN (TESSELLA SUPPORT SERVICES PLC)
C           K1/0/81
C           JET EXT. 4569
C
C DATE:     08/10/90
C
C UNIX-IDL PORT:
C
C VERSION: 1.1                          DATE: 11-11-96
C MODIFIED: WILLIAM OSBORN (TESSELLA SUPPORT SERVICES PLC)
C               - FIRST CONVERTED
C
C-----------------------------------------------------------------------
C-----------------------------------------------------------------------
      INTEGER MAXT  , IZ1   , IZ2
      INTEGER NDZ   , NDTIN
      INTEGER MAX   , MAX1  , IZ  , IT  , IREF
C-----------------------------------------------------------------------
      REAL*8  S     , SLOG
      REAL*8  ACDL(NDZ,NDTIN)  , SCDL(NDZ,NDTIN)
C-----------------------------------------------------------------------
```

D4LBAL

```
SUBROUTINE D4LBAL( NDZ    ,          NDDEN , NDTIN ,
     &                   IZ1    , IZ2    , MAXD  , MAXT  ,
     &                   LDACDL , LDSCDL ,
     &                   LTACDL , LTSCDL ,
     &                   LDIBAL ,
     &                   LTIBAL
     &                 )
      IMPLICIT NONE
C-----------------------------------------------------------------------
C
C  ****************** FORTRAN77 SUBROUTINE: D4LBAL *********************
C
C  PURPOSE:  TO IDENTIFY THE TEMPERATURES AND DENSITY FOR WHICH THE
C            CALCULATION OF IONISATION BALANCES INVOLVED THE USE OF
C            EXTRAPOLATED DATA.
C
C  CALLING PROGRAM: ADAS404
C
C  SUBROUTINE:
C
C  INPUT : (I*4)  NDZ     = NUMBER OF CHARGE STATES
C  INPUT : (I*4)  NDDEN   = MAXIMUM NUMBER OF INPUT DENSITIES
C  INPUT : (I*4)  NDTIN   = MAXIMUM NUMBER OF INPUT TEMPERATURES
C
C  INPUT : (I*4)  IZ1     = MINIMUM ALLOWED IONIC CHARGE + 1
C  INPUT : (I*4)  IZ2     = MAXIMUM ALLOWED IONIC CHARGE + 1
C  INPUT : (I*4)  MAXD    = NUMBER OF USER ENTERED DENSITIES (<=NDDEN)
C  INPUT : (I*4)  MAXT    = NUMBER OF USER ENTERED TEMPERATURES(<=NDTIN)
C
C  INPUT : (L*4)  LDACDL(,)=.TRUE. => RECOMBINATION COLL.-DIEL COEFFT.
C                                     VALUE FOR DENSITY     INDEX AND
C                                     CHARGE INTERPOLATED.
C                           =.FALSE.=> RECOMBINATION COLL.-DIEL COEFFT.
C                                     VALUE FOR DENSITY     INDEX AND
C                                     CHARGE EXTRAPOLATED.
C                            1ST DIMENSION: DENSITY     INDEX
C                            2ND DIMENSION: CHARGE-STATE INDEX
C  INPUT : (L*4)  LDSCDL(,)=.TRUE. => IONIZATION    COLL.-DIEL COEFFT.
C                                     VALUE FOR DENSITY     INDEX AND
C                                     CHARGE INTERPOLATED.
C                           =.FALSE.=> IONIZATION    COLL.-DIEL COEFFT.
C                                     VALUE FOR DENSITY     INDEX AND
C                                     CHARGE EXTRAPOLATED.
C                            1ST DIMENSION: DENSITY     INDEX
C                            2ND DIMENSION: CHARGE-STATE INDEX
C
C  INPUT : (L*4)  LTACDL(,)=.TRUE. => RECOMBINATION COLL.-DIEL COEFFT.
C                                     VALUE FOR TEMPERATURE INDEX AND
C                                     CHARGE INTERPOLATED.
C                           =.FALSE.=> RECOMBINATION COLL.-DIEL COEFFT.
C                                     VALUE FOR TEMPERATURE INDEX AND
C                                     CHARGE EXTRAPOLATED.
C                            1ST DIMENSION: TEMPERATURE INDEX
C                            2ND DIMENSION: CHARGE-STATE INDEX
```

```
C  INPUT : (L*4)  LTSCDL(,)=.TRUE. => IONIZATION    COLL.-DIEL COEFFT.
C                                     VALUE FOR TEMPERATURE INDEX AND
C                                     CHARGE INTERPOLATED.
C                            =.FALSE.=> IONIZATION    COLL.-DIEL COEFFT.
C                                     VALUE FOR TEMPERATURE INDEX AND
C                                     CHARGE EXTRAPOLATED.
C                             1ST DIMENSION: TEMPERATURE INDEX
C                             2ND DIMENSION: CHARGE-STATE INDEX
C
C  OUTPUT: (L*4)  LDIBAL() =.TRUE. => IONIZATION BALANCES FOR DENSITY
C                                     INVOLVE NOT EXTRAPOLATION.
C                            =.FALSE.=> IONIZATION BALANCES FOR DENSITY
C                                     INVOLVE EXTRAPOLATION  IN  SOME
C                                     PART OF THEIR CALCULTION.
C                             1ST DIMENSION: DENSITY INDEX
C  OUTPUT: (L*4)  LTIBAL() =.TRUE. => IONIZATION BALANCES FOR TEMP'TURE
C                                     INVOLVE NOT EXTRAPOLATION.
C                            =.FALSE.=> IONIZATION BALANCES FOR TEMP'TURE
C                                     INVOLVE EXTRAPOLATION  IN  SOME
C                                     PART OF THEIR CALCULTION.
C                             1ST DIMENSION: TEMPERATURE INDEX
C
C          (I*4)  NZ      = NUMBER OF CHARGE STATES TO BE ASSESSED
C          (I*4)  ID      = ARRAY SUBSCRIPT USED FOR DENSITY INDEX
C          (I*4)  IT      = ARRAY SUBSCRIPT USED FOR TEMPERATURE INDEX
C          (I*4)  IZ      = ARRAY SUBSCRIPT USED FOR CHARGE-STATE INDEX
C
C          (L*4)  LS      = .TRUE.  => NO EXTRAPOLATION
C                           .FALSE. => EXTRAPOLATION
C
C NOTE:
C
C ROUTINES: NONE
C
C AUTHOR:   PAUL E. BRIDEN (TESSELLA SUPPORT SERVICES PLC)
C           K1/0/81
C           JET EXT. 4569
C
C DATE:     30/01/91 - ADAS91 ROUTINE
C
C UNIX-IDL PORT:
C
C VERSION: 1.1                          DATE: 11-11-96
C MODIFIED: WILLIAM OSBORN (TESSELLA SUPPORT SERVICES PLC)
C                - FIRST CONVERTED
C
C-----------------------------------------------------------------------
C
C-----------------------------------------------------------------------
      INTEGER    NDZ     , NDDEN    , NDTIN      ,
     &           IZ1     , IZ2      , MAXD       , MAXT
      INTEGER    NZ      , ID       , IT         , IZ
C-----------------------------------------------------------------------
      LOGICAL    LS
C-----------------------------------------------------------------------
      LOGICAL    LDIBAL(NDDEN)             , LTIBAL(NDTIN)          ,
     &           LDACDL(NDDEN,NDZ)         , LDSCDL(NDDEN,NDZ)      ,
     &           LTACDL(NDTIN,NDZ)         , LTSCDL(NDTIN,NDZ)
C-----------------------------------------------------------------------
```

D4OPEN

```
SUBROUTINE D4OPEN( IUNIT, DSFULL , LEXIST )
       IMPLICIT NONE
C-----------------------------------------------------------------------
C
C  ****************** FORTRAN77 SUBROUTINE: D4OPEN *********************
C
C  PURPOSE: TO INQUIRE & OPEN INPUT DATA FILE & ALLOCATE TO UNIT 'IUNIT'
C           (READ ONLY)  - IF IT DOES NOT EXISTS A MESSAGE IS  SENT  TO
C           THE SCREEN AND LEXIST IS RETURNED AS FALSE.  *** THIS
C           VERSION SUPPRESSES ERROR MESSAGE ON NON-EXISTING FILES. IT
C           IS OTHERWISE IDENTICAL TO XXOPEN. ***
C
C  CALLING PROGRAM:  ADAS404
C
C  SUBROUTINE:
C
C  INPUT :    (I*4)  IUNIT   = UNIT TO WHICH INPUT FILE IS ALLOCATED
C  INPUT :    (C*(*))DSFULL  = FULL INPUT DATA SET NAME (INCL. USERID)
C                              IN FORM FOR DYNAMIC ALLOCATION.
C  OUTPUT:    (L*4)  LEXIST  = .TRUE.  => DATA SETS EXISTS AND IS OPEN
C                              = .FALSE. => DATA SET DOES NOT EXIST
C
C             (I*4)  I4UNIT  = FUNCTION (SEE ROUTINE SECTION BELOW)
C             (C*1)  BSLASH  = '/' - MUST BE FIRST 'DSFULL'CHARACTER
C NOTE:
C
C ROUTINES:
C          ROUTINE    SOURCE    BRIEF DESCRIPTION
C          ------------------------------------------------------------
C          I4UNIT     ADAS      FETCH UNIT NUMBER FOR OUTPUT OF MESSAGES
C          XXTERM     ADAS      TERMINATES ADAS PROGRAM WITH MESSAGE
C
```

```
C AUTHOR:  LORNE HORTON (JET)
C            - BASED ON XXOPEN.
C
C DATE:    20-10-97
C-----------------------------------------------------------------------
C VERSION: 1.1                                          DATE:27-02-98
C MODIFIED: RICHARD MARTIN
C               - PUT UNDER SCCS CONTROL.
C
C-----------------------------------------------------------------------
       INTEGER   I4UNIT
       INTEGER   IUNIT
C-----------------------------------------------------------------------
       LOGICAL   LEXIST
C-----------------------------------------------------------------------
       CHARACTER DSFULL*(*)   , BSLASH*1
C-----------------------------------------------------------------------
       DATA      BSLASH /'/'/
C-----------------------------------------------------------------------



SUBROUTINE D4OUT0( IUNIT , IZ1    , IZ2    ,
     &                   DATE  , ENAME  , TITLE  ,
     &                   T     , TL     , MAXT   ,
     &                   DENSA , DENSL  , MAXD   ,
     &                   CADAS , IRESO
     &                 )
      IMPLICIT NONE
C-----------------------------------------------------------------------
C
C  ****************** FORTRAN77 SUBROUTINE: D4OUT0 *********************
C
C  PURPOSE:  TO GENERATE MAIN HEADING AND KEYS FOR TABULAR OUTPUT.
C
C  CALLING PROGRAM: ADAS404
C
C  SUBROUTINE:
C
C  INPUT : (I*4)  IUNIT   = OUTPUT STREAM FOR COLL.-DIEL. TABLE
C  INPUT : (I*4)  IZ1     = MINIMUM ALLOWED IONIC CHARGE + 1
C  INPUT : (I*4)  IZ2     = MAXIMUM ALLOWED IONIC CHARGE + 1
C
C  INPUT : (C*8)  DATE    = CURRENT DATE (AS 'DD/MM/YY')
C  INPUT : (C*12) ENAME   = NAME OF ELEMENT UNDER CONSIDERATION
C  INPUT : (C*32) TITLE   = USER ENTERED PROGRAM RUN TITLE.
C
C  INPUT : (R*8)  T()     = SET OF 'MAXT' ELECTRON TEMPERATURES (USER
C                           ENTERED VALUES) - UNITS KELVIN.
C  INPUT : (R*8)  TL()    = LOG10('T()')
C  INPUT : (I*4)  MAXT    = NUMBER OF TEMPERATURES (< 56)
C
C  INPUT : (R*8)  DENSA() = SET OF 'MAXD' ELECTRON DENSITIES (CM-3)
C                           (USER ENTERED VALUES)
C  INPUT : (R*8)  DENSL() = LOG10('DENSA()')
C  INPUT : (I*4)  MAXD    = NUMBER OF DENSITIES (< 31)
C
C  I/O   : (C*80) CADAS   = ADAS HEADER: INCLUDES RELEASE, PROGRAM, TIME
C                           (BACKGROUND - REQUIRED AS INPUT. THIS SUB-
C                                         ROUTINE WILL UPDATE THE TIME
C                                         AND DATE IN THIS ADAS HEADER.
C                            FOREGROUND - SET WITHIN SUBROUTINE.)
C
C          (I*4)  L1      = PARAMETER = 1
C          (I*4)  L2      = PARAMETER = 2
C          (I*4)  IPLEN   = OUTPUT PAGE LENGTH IN LINES
C          (I*4)  IPLEFT  = PAGE LENGTH IN LINES FOR DENS/TEMP VALUES ON
C                           HEADER PAGE. (IF 'MAXT > PLEFT' PUT DENSITY/
C                           TEMPERATURE VALUES ON NEW PAGE)
C                           ('IPLEFT=IPLEN-26')
C
C          (I*4)  I       = GENERAL ARRAY ELEMENT INDEX
C
C          (R*8)  R8TCON  = REAL*8 FUNCTION (SEE ROUTINE SECTION BELOW)
C          (R*8)  TEV     = ELECTRON TEMPERATURE IN eV
C
C ROUTINES:
C           ROUTINE    SOURCE    BRIEF DESCRIPTION
C           ------------------------------------------------------------
C           XXADAS     ADAS      GATHERS ADAS HEADER INFORMATION
C           R8TCON     ADAS      REAL*8 FUNCTION: CONVERTS TEMP. UNITS
C
C AUTHOR:   PAUL E. BRIDEN (TESSELLA SUPPORT SERVICES PLC)
C           K1/0/81
C           JET EXT. 4569
C
C DATE:     08/10/90
C
C UPDATE:   17/01/91 - PE BRIDEN: ADDED HEADER INFORMATION TO OUTPUT
C                                 - RENAMED SUBROUTINE (ORIGINALLY D4TAB0)
C
C UPDATE:   28/01/91 - PE BRIDEN: - ADDED 'CADAS' AS AN ARGUMENT
C
C UPDATE:   29/01/91 - PE BRIDEN: - REFORMATTED OUTPUT - ADDED DENSITY
C                                   AND TEMPERATURE SECTION.
C                                 - ADDED EXTRA ARGUMENTS FOR ABOVE.
C                                 - ADDED EXTRA VARIABLES FOR ABOVE.
C                                 - ADDED 'R8TCON' FUNCTION FOR ABOVE.
```

```
C
C UNIX-IDL PORT:
C
C VERSION: 1.1                          DATE: 11-11-96
C MODIFIED: WILLIAM OSBORN (TESSELLA SUPPORT SERVICES PLC)
C               - FIRST CONVERTED
C
C-----------------------------------------------------------------------
C-----------------------------------------------------------------------
      INTEGER    IPLEN       , L1       , L2          , IPLEFT
C-----------------------------------------------------------------------
      PARAMETER( IPLEN  = 66 , L1 = 1   , L2 = 2      )
      PARAMETER( IPLEFT = IPLEN - 26    )
C-----------------------------------------------------------------------
      INTEGER    IUNIT       , IZ1      , IZ2         , IRESO      ,
     &           MAXT        , MAXD     , I
C-----------------------------------------------------------------------
      REAL*8     R8TCON      , TEV
C-----------------------------------------------------------------------
      CHARACTER  ENAME*12    , TITLE*32 , DATE*8      , CADAS*80
C-----------------------------------------------------------------------
      REAL*8     T(MAXT)     , TL(MAXT) , DENSA(MAXD) , DENSL(MAXD)
C-----------------------------------------------------------------------
```

D4OUTF

```
SUBROUTINE D4OUTF ( DSNOUT, TITLE , DATE   , REPTAB ,
     &                    NDZ   , NDDEN , NDTIN  ,
     &                    IZ0   , IZ1   , IZ2    ,
     &                    MAXD  , MAXT  ,
     &                    DENSL , TL    ,
     &                    ARRAY
     &                  )
      IMPLICIT NONE
C-----------------------------------------------------------------------
C
C  ****************** FORTRAN77 SUBROUTINE: D4OUTF *********************
C
C  PURPOSE: TO DYNAMICALLY OPEN AND OUTPUT ELEMENT MASTER FILE
C
C  CALLING PROGRAM: D4DATA
C
C  DATA:
C           THE OUTPUT ELEMENT MASTER DATA IS A SEQUENTIAL FILE WHICH
C           IS NAMED AS FOLLOWS:
C
C             1. JETUID.ACD<YR>#<EL>.DATA
C             2. JETUID.SCD<YR>#<EL>.DATA
C             3. JETUID.CCD<YR>#<EL>.DATA
C             4. JETUID.PRB<YR>#<EL>.DATA
C             5. JETUID.PRC<YR>#<EL>.DATA
C             6. JETUID.PLT<YR>#<EL>.DATA
C             7. JETUID.PLS<YR>#<EL>.DATA
C
C           WHERE <YR> DENOTES TWO INTEGERS FOR THE YEAR SELECTED.
C           IF <YR> IS BLANK THEN THE CURRENT RECOMMENDED DATA SETS ARE
C           USED
C
C           <EL> IS THE ELEMENT SYMBOL
C
C           THE PARTICULAR TYPE OPENED (1-7) IS SELECTED BY 'ISWIT'
C           (SEE SUBROUTINE 'D4DATA')
C
C  SUBROUTINE:
C
C  INPUT : (C*80) DSNOUT  = OUTPUT ELEMENT MASTER FILE DATA SET NAME
C  INPUT : (C*32) TITLE   = USER ENTERED PROGRAM RUN TITLE.
C  INPUT : (C*8)  DATE    = CURRENT DATE (AS 'DD/MM/YY')
C  OUTPUT: (L*4)  REPTAB  = .TRUE.  => REPLACE EXISTING ELEMENT MASTER
C                                      FILES.
C                           = .FALSE. => DO NOT REPLACE EXISTING ELEMENT
C                                      MASTER FILES.
C
C  INPUT : (I*4)  NDZ      = NUMBER OF CHARGE STATES
C  INPUT : (I*4)  NDDEN    = MAXIMUM NUMBER OF INPUT DENSITIES
C  INPUT : (I*4)  NDTIN    = MAXIMUM NUMBER OF INPUT TEMPERATURES
C
C  INPUT : (I*4)  IZ0      = ELEMENT NUCLEAR CHARGE
C                                    (DETERMINES OUTPUT FILE NAME)
C  INPUT : (I*4)  IZ1      = MINIMUM ALLOWED IONIC CHARGE + 1
C                              (ACCORDING TO AVAILABLE NO. OF SEQUENCES
C                               STORED IN FILES FOR 'YEAR')
C  INPUT : (I*4)  IZ2      = MAXIMUM ALLOWED IONIC CHARGE + 1
C
C  INPUT : (I*4)  MAXD     = NUMBER OF USER SUPPLIED DENSITIES (<=NDDEN)
C  INPUT : (I*4)  MAXT     = NUMBER OF USER SUPPLIED TEMPS. (<=NDTIN)
C
C  INPUT : (R*8)  DENSL()  = LOG10 ( SET OF 'MAXD' ELECTRON DENSITIES
C                                                          (CM-3) )
C  INPUT : (R*8)  TL()     = LOG10 ( SET OF 'MAXT' ELECTRON TEMPERATURES
C                                                        (KELVIN) )
C
C  INPUT : (R*8)  ARRAY(,,)= LOG10(ELEMENT COLL.-DIEL COEFF INTERPOLATED
C                                  DATA)
```

```
C                             1ST ARRAY DIMENSION - ION CHARGE/STAGE
C                             2ND ARRAY DIMENSION - TEMPERATURE
C                             3RD ARRAY DIMENSION - DENSITY
C
C          (L)    LEXIST  = .TRUE.  => REQUESTED OUTPUT FILE EXISTS
C                         = .FALSE. => REQUESTED FILE DOES NOT EXIST
C
C          (C*12) XFELEM   = FUNCTION (SEE ROUTINES SECTION BELOW)
C          (C*12) ENAME    = ELEMENT NAME
C
C          (I*4)  I4UNIT   = FUNCTION (SEE ROUTINE SECTION BELOW)
C          (I*4)  IZF      = ELEMENT RECOMBINING ION CHARGE
C          (I*4)  ID       = ARRAY SUBSCRIPT USED FOR DENSITY VALUES
C          (I*4)  IT       = ARRAY SUBSCRIPT USED FOR TEMPERATURE VALUES
C          (I*4)  IZ       = ARRAY SUBSCRIPT USED FOR ION CHARGE VALUES
C          (I*4)  IRCODE   = RETURN CODE FROM IBM SUBROUTINE 'FILEINF'
C
C
C NOTE:
C          STREAM HANDLING:
C                  STREAM 13 IS USED FOR WRITING  ELEMENT  MASTER FILES
C
C ROUTINES:
C          ROUTINE    SOURCE    BRIEF DESCRIPTION
C          ------------------------------------------------------------
C          D4TLOG     ADAS      CONVERTS LOG10(TEMPERATURE) ARRAY FROM:
C                                     KELVIN <-> ELECTRON VOLTS
C          XFELEM     ADAS      CHATACTER*12 FUNCTION -
C                               ELEMENT NAME FOR GIVEN NUCLEAR CHARGE
C          I4UNIT     ADAS      FETCH UNIT NUMBER FOR OUTPUT OF MESSAGES
C          FILEINF    IBM       SETS UP CHARACTERISTICS BEFORE AN OPEN
C
C AUTHOR:  PAUL E. BRIDEN (TESSELLA SUPPORT SERVICES PLC)
C          K1/0/81
C          JET EXT. 4569
C
C DATE:    26/10/90
C
C DATE:    13/02/91 - PE BRIDEN - ADAS91 - REPLACED XXELEM WITH XFELEM
C
C UPDATE:  23/04/93 - PE BRIDEN - ADAS91: ADDED I4UNIT FUNCTION TO WRITE
C                                         STATEMENTS FOR SCREEN MESSAGES
C
C UPDATE:  24/05/93 - PE BRIDEN - ADAS91: CHANGED I4UNIT(0)-> I4UNIT(-1)
C
C UNIX-IDL PORT:
C
C VERSION: 1.1                           DATE: 11-11-96
C MODIFIED: WILLIAM OSBORN (TESSELLA SUPPORT SERVICES PLC)
C               - FIRST CONVERTED
C
C-----------------------------------------------------------------------
C-----------------------------------------------------------------------
      CHARACTER XFELEM*12
      CHARACTER DSNOUT*80 , TITLE*32   , DATE*8   , ENAME*12
C-----------------------------------------------------------------------
      LOGICAL   REPTAB    , LEXIST
C-----------------------------------------------------------------------
      INTEGER   I4UNIT
      INTEGER   NDZ       , NDDEN      , NDTIN
      INTEGER   IZ0       , IZ1        , IZ2      ,
     &          MAXD      , MAXT
      INTEGER   IZF       , ID         , IT       , IZ    , IRCODE
C-----------------------------------------------------------------------
      REAL*8    DENSL(NDDEN) , TL(NDTIN) , ARRAY(NDZ,NDTIN,NDDEN)
C-----------------------------------------------------------------------
```

D4SPLN

```
SUBROUTINE D4SPLN( ISWIT  , LSWIT  ,
     &                   NUDMAX , NUTMAX ,
     &                   NDDEN  , NDTIN  , NDZ1V  ,
     &                   MAXT   , MAXD   ,
     &                   IDE    , ITE    , IZE    ,
     &                   DUSR   , TUSR   , IZ1    ,
     &                   DENSR  , TR     , ZIPT   ,
     &                   EIA    , AIPT   ,
     &                   LZRNG  , LDRNG  , LTRNG  ,
     &                   ATTY   , AOUT
     &                 )
      IMPLICIT NONE
C-----------------------------------------------------------------------
C
C  ****************** FORTRAN77 SUBROUTINE: D4SPLN *********************
C
C  PURPOSE: TO INTERPOLATE/EXTRAPOLATED DATA FROM MASTER CONDENSED  FILE
C           TO THE USER ENTERED TEMPERATURE/DENSITY ARRAY FOR THE SELEC-
C           TED RECOMBINING ION CHARGE.
C           BASED ON ADAS9140.FORT(D1SPLN)
C
C  CALLING PROGRAM: LH404RU
C
C  DATA:
C
```

```
C           THE  SOURCE  DATA IS CONTAINED AS  MEMBERS  OF  PARTITIONED
C           DATA SETS AS FOLLOWS:
C
C             1. JETUID.ACD<YR>.DATA
C             2. JETUID.SCD<YR>.DATA
C             3. JETUID.CCD<YR>.DATA
C             4. JETUID.PRB<YR>.DATA
C             5. JETUID.PRC<YR>.DATA
C             6. JETUID.QCD<YR>.DATA
C             7. JETUID.XCD<YR>.DATA
C             8. JETUID.PLT<YR>.DATA
C             9. JETUID.PLS<YR>.DATA
C            10. JETUID.MET<YR>.DATA
C
C
C           WHERE <YR> DENOTES TWO INTEGERS FOR THE YEAR SELECTED.
C
C           THE PARTICULAR TYPE OPENED (1-10) IS SELECTED BY 'ISWIT'
C
C
C  SUBROUTINE:
C
C  INPUT : (I*4)  ISWIT   = DATA TYPE SELECTOR (SEE ABOVE) (1 -> 10)
C  INPUT : (L*4)  LSWIT   = .TRUE.  => SET OF 'EIA' VALUES PRESENT IN
C                                      MASTER CONDENSED FILE.
C                           .FALSE  => SET OF 'EIA' VALUES NOT PRESENT
C                                      IN MASTER CONDENSED FILE.
C
C  INPUT : (I*4)  NUDMAX  = USER ENTERED VALUES -
C                            MAXIMUM NUMBER OF DENSITY VALUES
C  INPUT : (I*4)  NUTMAX  = USER ENTERED VALUES -
C                            MAXIMUM NUMBER OF TEMPERATURE VALUES
C
C  INPUT : (I*4)  NDDEN   = INPUT MASTER CONDENSED FILE -
C                            MAXIMUM NUMBER OF REDUCED DENSITIES
C  INPUT : (I*4)  NDTIN   = INPUT MASTER CONDENSED FILE -
C                            MAXIMUM NUMBER OF REDUCED TEMPERATURES
C  INPUT : (I*4)  NDZ1V   = INPUT MASTER CONDENSED FILE -
C                            MAXIMUM NUMBER OF CHARGE STATES
C
C  INPUT : (I*4)  MAXT    = USER ENTERED VALUES -
C                            NUMBER OF TEMPERATURE VALUES ENTERED
C  INPUT : (I*4)  MAXD    = USER ENTERED VALUES -
C                            NUMBER OF DENSITY VALUES ENTERED
C
C  INPUT : (I*4)  IDE     = INPUT MASTER CONDENSED FILE -
C                            NUMBER OF REDUCED DENSITIES READ
C  INPUT : (I*4)  ITE     = INPUT MASTER CONDENSED FILE -
C                            NUMBER OF REDUCED TEMPERATURES READ
C  INPUT : (I*4)  IZE     = INPUT MASTER CONDENSED FILE -
C                            NUMBER OF CHARGE STATES READ
C
C  INPUT : (R*8)  DUSR()  = USER ENTERED VALUES -
C                           SET OF 'IUDVAL' ENTERED ELECTRON DENSITIES
C                           (UNITS: CM**-3)
C                           DIMENSION: TEMPERATURE/DENSITY PAIR INDEX
C  INPUT : (R*8)  TUSR()  = USER ENTERED VALUES -
C                           SET OF'IUTVAL' ENTERED ELECTRON TEMPERATURES
C                           (UNITS: KELVIN)
C                           DIMENSION: TEMPERATURE/DENSITY PAIR INDEX
C  INPUT : (I*4)  IZ1     = USER ENTERED VALUE -
C                           RECOMBINING ION CHARGE
C
C  INPUT : (R*8)  DENSR() = INPUT MASTER CONDENSED FILE -
C                           SET OF 'IDE' REDUCED DENSITIES (CM-3/Z1**7)
C  INPUT : (R*8)  TR()    = INPUT MASTER CONDENSED FILE -
C                           SET OF 'ITE' REDUCED TEMPERATURES (K/Z1**2)
C  INPUT : (R*8)  ZIPT()  = INPUT MASTER CONDENSED FILE -
C                           SET OF 'IZE' INPUT RECOMBINING ION CHARGES
C
C  INPUT : (R*8)  EIA()   = INPUT MASTER CONDENSED FILE -
C                           IONISATION RATE COEFFTS. - (UNITS: RYDBERGS)
C                           DIMENSION: ION CHARGE
C  INPUT : (R*8)  AIPT(,,)= INPUT MASTER CONDENSED FILE -
C                           RELEVANT COEFFICIENT/POWER DATA FOR 'ISWIT'.
C                           1ST DIMENSION: DENSITY INDEX     ('DENSR()')
C                           2ND DIMENSION: TEMPERATURE INDEX  ('TR()')
C                           3RD DIMENSION: CHARGE STATE INDEX ('ZIPT()')
C
C  OUTPUT: (L*4)  LZRNG(1) = .TRUE.  => 'AOUT()' VALUES FOR CHARGE-
C                                       STATE 'IZ1' INTERPOLATED.
C                          = .FALSE. => 'AOUT()' VALUE  FOR CHARGE-
C                                       STATE 'IZ1' EXTRAPOLATED.
C  OUTPUT: (L*4)  LDRNG()  = .TRUE.  => 'AOUT()' VALUE FOR DENSITY
C                                       INDEX INTERPOLATED.
C                          = .FALSE. => 'AOUT()' VALUE FOR DENSITY
C                                       INDEX EXTRAPOLATED.
C                           DIMENSION: DENSITY INDEX
C  OUTPUT: (L*4)  LTRNG()  = .TRUE.  => 'AOUT()' VALUE FOR TEMPERATURE
C                                       INDEX INTERPOLATED.
C                          = .FALSE. => 'AOUT()' VALUE FOR TEMPERATURE
C                                       INDEX EXTRAPOLATED.
C                           DIMENSION: TEMPERATURE INDEX
C
C  OUTPUT: (R*8)  AOUT(,)  = EXTRAPOLATED/INTERPOLATED  DATA  FOR
C                            USER ENTERED TEMPERATURE/DENSITY ARRAY.
C                           ( STORES LOG10(INTERPOLATED VALUES) )
C                              1ST DIMENSION: TEMPERATURE
```

```
C                              2ND DIMENSION: DENSITY
C
C          (I*4)  NUDIM   = PARAMETER = MUST BE GREATER THAN OR EQUAL TO
C                                       'NUDMAX' AND 'NUTMAX'
C
C          (I*4)  NDMAX1  = 'NDDEN'
C          (I*4)  NTMAX1  = 'NDTIN'
C          (I*4)  NZMAX1  = 'NDZ1V'
C          (I*4)  NDMAX2  = 'NUDMAX'
C          (I*4)  NTMAX2  = 'NUTMAX'
C          (I*4)  ITD     = GENERAL USE ARRAY SUBSCRIPT INDEX
C          (I*4)  IDD     = GENERAL USE ARRAY SUBSCRIPT INDEX
C
C          (R*8)  ATTY(,) = WORKING SPACE FOR 3-WAY SPLINE ITERPOLATION
C                           ( STORES LOG10(INTERPOLATED VALUES) )
C                            1ST DIMENSION: TEMPERATURE
C                            2ND DIMENSION: DENSITY
C
C  PARAMETER (I*4)  DLOGMIN = SETS MINIMUM VALUE OF LOG OF COEFFICIENT
C
C NOTE:
C
C ROUTINES:
C          ROUTINE    SOURCE    BRIEF DESCRIPTION
C          ------------------------------------------------------------
C          XUFLOW
C          DXSPL1     ADAS      1ST PART OF 3-WAY SPLINE OF INPUT DATA
C          DXSPL2     ADAS      2ND PART OF 3-WAY SPLINE OF INPUT DATA
C          DXSPL3     ADAS      3RD PART OF 3-WAY SPLINE OF INPUT DATA
C
C
C AUTHOR:  WILLIAM J. DICKSON       12/12/92
C          (REFER TO DOCUMENTATION FOR   D1SPLN)
C
C UPDATES FROM D1SPLN:
C
C   12/12/92   ARRAY BOUNDS FOR ATTY SET EQUAL TO THOSE IN DXSPL1 ETC
C              THERFORE INCLUDE ATTY IN CALL LIST
C   22/02/96   HOUSECLEANING AFTER COPY FOR USE WITH LH404RU
C-----------------------------------------------------------------------
C UNIX-IDL PORT:
C
C VERSION: 1.1                          DATE: 11-11-96
C MODIFIED: WILLIAM OSBORN (TESSELLA SUPPORT SERVICES PLC)
C               - FIRST CONVERTED
C
C
C-----------------------------------------------------------------------
      INTEGER    NUDIM
      REAL*8     DLOGMIN
C-----------------------------------------------------------------------
      PARAMETER( NUDIM = 40    ,  DLOGMIN = -74.0  )
C-----------------------------------------------------------------------
      INTEGER    ISWIT                   ,
     &           NUDMAX                  , NUTMAX        ,
     &           NDDEN                   , NDTIN         , NDZ1V       ,
     &           MAXT                    , MAXD          ,
     &           IDE                     , ITE           , IZE         ,
     &           IZ1
      INTEGER    NDMAX1                  , NTMAX1        , NZMAX1      ,
     &           NDMAX2                  , NTMAX2        , ITD ,
     &           IDD
C-----------------------------------------------------------------------
      LOGICAL    LSWIT                   , LZRNG(1)
C-----------------------------------------------------------------------
      REAL*8     DUSR(NUDMAX)            , TUSR(NUTMAX)  ,
     &           DENSR(NDDEN)            , TR(NDTIN)     , ZIPT(NDZ1V) ,
     &           EIA(50)                 , AOUT(NUTMAX,NUDMAX)
C     REAL*8     ATTY(NUDIM,NUDIM)
      REAL*8     ATTY(NUTMAX,NUDMAX)
      REAL*8     AIPT(NDDEN,NDTIN,NDZ1V)
C-----------------------------------------------------------------------
      LOGICAL    LDRNG(NUDMAX)           , LTRNG(NUTMAX)
C-----------------------------------------------------------------------
```

D4TLOG

```
SUBROUTINE D4TLOG( INTYP, ITVAL, TEMP )
      IMPLICIT NONE
C-----------------------------------------------------------------------
C
C  ****************** FORTRAN77 SUBROUTINE: D4TLOG *********************
C
C  PURPOSE:      TO CONVERT AN ARRAY OF LOG10(TEMPERATURES) FROM:
C           (KELVIN TO ELECTRON VOLTS) OR (ELECTRON VOLTS TO KELVIN)
C
C  CALLING PROGRAM:  D4OUTF
C
C  SUBROUTINE:
C
C  INPUT :    (I*4)  INTYP   = 1 => INPUT 'TEMP(array)' UNITS: KELVIN
C                              = 2 => INPUT 'TEMP(array)' UNITS: eV
C  INPUT :    (I*4)  ITVAL   = NUMBER OF TEMPERATURES IN 'TIN(array)'
C  I/O   :    (R*8)  TEMP()  = LOG10(INPUT TEMPERATURES (STATED UNITS))
```

```
C
C             (R*8)  EV2KEL  = LOG10( ELEC.VOLTS TO KELVIN CONVERSION)
C             (R*8)  TCONV   = TEMPERATURE CONVERSION PARAMETER
C
C ROUTINES:  NONE
C
C NOTE:
C            TEMPERATURE CONVERSION PARAMETERS:
C
C            INTYP = 1 ; TCONV =>             KELVIN  -> eV
C            INTYP = 2 ; TCONV =>                 eV  -> KELVIN
C
C AUTHOR:  PAUL E. BRIDEN (TESSELLA SUPPORT SERVICES PLC)
C          K1/0/81
C          JET EXT. 4569
C
C DATE:    08/10/90
C
C UNIX-IDL PORT:
C
C VERSION: 1.1                           DATE: 11-11-96
C MODIFIED: WILLIAM OSBORN (TESSELLA SUPPORT SERVICES PLC)
C                - FIRST CONVERTED
C
C-----------------------------------------------------------------------
C
C-----------------------------------------------------------------------
      INTEGER I          , INTYP      , ITVAL
C-----------------------------------------------------------------------
      REAL*8  EV2KEL     , TCONV
      REAL*8  TEMP(ITVAL)
C-----------------------------------------------------------------------
      PARAMETER ( EV2KEL=4.06466D+00 )
C-----------------------------------------------------------------------
```

D4ZNEL

```
SUBROUTINE D4ZNEL ( IZ1  , IZ2  ,
     &                    NEL1 , NEL2 ,
     &                    IZ0  , IZE1 , IZE2
     &                  )
      IMPLICIT NONE
C-----------------------------------------------------------------------
C
C  ****************** FORTRAN77 SUBROUTINE: D4ZNEL *********************
C
C  PURPOSE: TO RETURN THE MAXIMUM AND MINIMUM CHOSEN FOR THE IONIC
C           CHARGE (+1) AND THE NUMBER OF ELECTRONS IN EACH CASE.
C
C  CALLING PROGRAM: ADAS404
C
C  SUBROUTINE:
C
C  OUTPUT: (I*4)  IZ1     = MINIMUM ALLOWED IONIC CHARGE + 1
C  OUTPUT: (I*4)  IZ2     = MAXIMUM ALLOWED IONIC CHARGE + 1
C
C  OUTPUT: (I*4)  NEL1    = NUMBER OF ELECTRONS IN STATE 'IZ1'
C  OUTPUT: (I*4)  NEL2    = NUMBER OF ELECTRONS IN STATE 'IZ2'
C
C  INPUT : (I*4)  IZ0     = ELEMENT NUCLEAR CHARGE
C  INPUT : (I*4)  IZE1    = LOWEST ION CHARGE
C  INPUT : (I*4)  IZE2    = HIGHEST ION CHARGE  (NB. EXCLUDING THE  BARE
C                           NUCLEUS - ONE MORE STAGE IS BROUGHT IN AUTO-
C                           MATICALLY IN THE IONISATION BALANCE)
C
C  ROUTINES: NONE
C
C  AUTHOR:  PAUL E. BRIDEN (TESSELLA SUPPORT SERVICES PLC)
C           K1/0/81
C           JET EXT. 4569
C
C  DATE:    08/10/90
C
C UNIX-IDL PORT:
C
C VERSION: 1.1                           DATE: 11-20-96
C MODIFIED: WILLIAM OSBORN (TESSELLA SUPPORT SERVICES PLC)
C                - FIRST CONVERTED
C
C VERSION: 1.2                           DATE: 20-10-97
C MODIFIED: LORNE HORTON (JET)
C       - REMOVED NONSENSE WITH NIND, NSET AND YEAR
C
C-----------------------------------------------------------------------
C-----------------------------------------------------------------------
      INTEGER IZ1  , IZ2
      INTEGER NEL1 , NEL2
      INTEGER IZ0  , IZE1 , IZE2
C-----------------------------------------------------------------------
```

D5DATA

```
SUBROUTINE D5DATA( DSFLLA , LSELA  , LEXSA  , LDEFA , LPART  ,
     &                   IZ0    , IZ1MIN , IZ1MAX , NPART  ,
     &                   NTDIM  , ITMAX  ,
     &                   ISDIMD , IZDIMD , ITDIMD , IPDIMD , NPARTR,
     &                   DTEV   , DDENS  ,
     &                   DTEVD  , DDENSD , DRCOFD , ZDATA  ,
     &                   DRCOFI ,
     &                   ACDA   , LACDA  ,
     &                   SCDA   , LSCDA  ,
     &                   CCDA   , LCCDA  ,
     &                   PRBA   , LPRBA  ,
     &                   PRCA   , LPRCA  ,
     &                   QCDA   , LQCDA  ,
     &                   XCDA   , LXCDA  ,
     &                   PLTA   , LPLTA
     &                 )
       IMPLICIT NONE
C
C-----------------------------------------------------------------------
C
C  ***************** FORTRAN77 SUBROUTINE: D5DATA *********************
C
C PURPOSE : TO EXTRACT A COMPLETE SET OF COLLISIONAL DIELECTRONIC DATA
C           FOR A TEMP/DENSITY MODEL
C           FROM EITHER PARTIAL (METASTABLE/PARENT RESOLVED) OR STANDARD
C           (UNRESOLVED) ISONUCLEAR MASTER FILES
C
C NOTE    : THE SOURCE DATA IS CONTAINED AS SEQUENTIAL DATASETS
C           WITH THE FOLLOWING NAMING CONVENTIONS:
C
C                  (1) JETSHP.ACD<YR>#<EL).<CODE>DATA
C                  (2) JETSHP.SCD<YR>#<EL>.<CODE>DATA
C                  (3) JETSHP.CCD<YR>#<EL>.<CODE>DATA
C                  (4) JETSHP.PRB<YR>#<EL>.<FILT>.<CODE>DATA
C                  (5) JETSHP.PRC<YR>#<EL>.<FILT>.<CODE>DATA
C                  (6) JETSHP.QCD<YR>#<EL>.<CODE>DATA
C                  (7) JETSHP.XCD<YR>#<EL>.<CODE>DATA
C                  (8) JETSHP.PLT<YR>#<EL>.<CODE>DATA
C
C       WHERE, <YR>   = TWO DIGIT YEAR NUMBER
C              <EL>   = ONE OR TWO CHARACTER ELEMENT SYMBOL
C              <CODE> = R       => PARTIAL DATA
C                       U       => PARTIAL DATA
C                       OMITTED => STANDARD DATA
C              <FILT> = SIX CHARACTER POWER FILTER CODE
C
C       AND DATA OF CLASSES 6 AND 7 DO NOT EXIST FOR THE STANDARD CASE.
C
C
C INPUT  : (C*120)DSFLLA()  = MASTER FILE DATA SET NAMES (FULL MVS DSN)
C                             (IN FORM SUITABLE FOR DYNAMIC ALLOCATION)
C INPUT  : (L*4)  LSELA()   = .TRUE.  => INPUT DATA SET TYPE FOR THIS
C                                        INDEX SELECTED
C                           = .FALSE. => INPUT DATA SET FOR THIS INDEX
C                                        NOT SELECTED
C INPUT  : (L*4)  LEXSA()   = .TRUE.  => INPUT DATA SET TYPE FOR THIS
C                                        SELECTED INDEX EXISTS
C                           = .FALSE. => INPUT DATA SET DOES NOT EXIST
C                                        FOR THIS SELECTED INDEX
C INPUT  : (L*4)  LDEFA()   = .TRUE.  => INPUT DATA SET TYPE FOR THIS
C                                        DEFAULT YEAR INDEX EXISTS
C                           = .FALSE. => INPUT DATA SET DOES NOT EXIST
C                                        FOR THIS DEFAULT YEAR INDEX
C INPUT  : (L*4)  LPART     = .TRUE.  => PARTIAL DATA SELECTED
C                           = .FALSE. => STANDARD DATA SELECTED
C INPUT  : (I*4)  IZ0       = NUCLEAR CHARGE
C INPUT  : (I*4)  IZ1MIN    = MINIMUM ION CHARGE+1 IN MASTER DATA FILES
C INPUT  : (I*4)  IZ1MAX    = MAXIMUM ION CHARGE+1 IN MASTER DATA FILES
C INPUT  : (I*4)  NPART()   = METASTABLE PARTITION.  I.E. NUMBER OF
C                             METASTABLES FROM CHARGE STATE IZ1MIN-1 TO
C                             IZ1MAX ON INPUT
C INPUT  : (I*4)  NTDIM     = MAXIMUM NUMBER OF DTEV/DDENS PAIRS
C INPUT  : (I*4)  ITMAX     = NUMBER OF ( DTEV() , DDENS() ) PAIRS
C INPUT  : (I*4)  ISDIMD    = MAXIMUM NUMBER OF (CHARGE, PARENT, GROUND)
C                             BLOCKS IN ISONUCLEAR MASTER FILES
C INPUT  : (I*4)  IZDIMD    = MAXIMUM NUMBER OF CHARGE STATES
C                             IN ISONUCLEAR MASTER FILES
C INPUT  : (I*4)  ITDIMD    = MAXIMUM NUMBER OF TEMP OR DENS VALUES IN
C                             ISOELECTRONIC MASTER FILES
C INPUT  : (I*4)  IPDIMD    = MAXIMUM NUMBER OF METASTABLES FOR EACH
C                             IONISATION STAGE
C INPUT  : (R*8)  DTEV()    = DLOG10(ELECTRON TEMPERATURES (EV))
C INPUT  : (R*8)  DDENS()   = DLOG10(ELECTRON DENSITIES (CM-3))
C
C OUTPUT : (I*4)  NPARTR()  = METASTABLE PARTITION.  I.E. NUMBER OF
C                             METASTABLES FROM CHARGE STATE IZ1MIN-1 TO
C                             IZ1MAX FOUND IN MASTER FILE
C OUTPUT : (R*8)  DTEVD()   = DLOG10(DATA ELECTRON TEMPERATURES (EV))
C                             IN SELECTED MASTER FILE
C OUTPUT : (R*8)  DDENSD()  = DLOG10(DATA ELECTRON DENSITIES (CM-3))
C                             IN SELECTED MASTER FILE
C OUTPUT : (R*8)  DRCOFD(,,)= DLOG10(DATA RATE COEFFICIENTS (CM-3/S))
C                             IN SELECTED MASTER FILE
C                             1ST DIM: (CHARGE,META,GRD) BLOCK INDEX
```

```
C                               2ND DIM: TEMPERATURE INDEX
C                               3RD DIM: DENSITY INDEX
C OUTPUT : (R*8)  ZDATA()   = CHARGE + 1 FOR IONS IN SELECTED MASTER
C                               FILE
C                               1ST DIM: (CHARGE,META,GRD) BLOCK INDEX
C OUTPUT : (R*8)  DRCOFI()  = INTERPOLATION OF DRCOFD(,,) FOR
C                               DTEV() & DDENS()
C OUTPUT : (R*8)  ACDA(,,,) = INTERPOLATION OF ACD COEFFICIENT (CM3 S-1)
C                               1ST DIM: TEMPERATURE INDEX
C                               2ND DIM: CHARGE STATE INDEX
C                               3RD DIM: RECOMBINING METASTABLE INDEX
C                               4TH DIM: RECOMBINED METASTABLE INDEX
C OUTPUT : (L*4)  LACDA(,,) = .TRUE.  => ACD COEFFICIENT AVAILABLE
C                               .FALSE. => ACD COEFFICIENT NOT AVAILABLE
C                               1ST DIM: CHARGE STATE INDEX
C                               2ND DIM: RECOMBINING METASTABLE INDEX
C                               3RD DIM: RECOMBINED METASTABLE INDEX
C OUTPUT : (R*8)  SCDA(,,,) = INTERPOLATION OF SCD COEFFICIENT (CM3 S-1)
C                               1ST DIM: TEMPERATURE INDEX
C                               2ND DIM: CHARGE STATE INDEX
C                               3RD DIM: RECOMBINING METASTABLE INDEX
C                               4TH DIM: RECOMBINED METASTABLE INDEX
C OUTPUT : (L*4)  LSCDA(,,) = .TRUE.  => SCD COEFFICIENT AVAILABLE
C                               .FALSE. => SCD COEFFICIENT NOT AVAILABLE
C                               1ST DIM: CHARGE STATE INDEX
C                               2ND DIM: RECOMBINING METASTABLE INDEX
C                               3RD DIM: RECOMBINED METASTABLE INDEX
C OUTPUT : (R*8)  CCDA(,,,) = INTERPOLATION OF CCD COEFFICIENT (CM3 S-1)
C                               1ST DIM: TEMPERATURE INDEX
C                               2ND DIM: CHARGE STATE INDEX
C                               3RD DIM: RECOMBINING METASTABLE INDEX
C                               4TH DIM: RECOMBINED METASTABLE INDEX
C OUTPUT : (L*4)  LCCDA(,,) = .TRUE.  => CCD COEFFICIENT AVAILABLE
C                               .FALSE. => CCD COEFFICIENT NOT AVAILABLE
C                               1ST DIM: CHARGE STATE INDEX
C                               2ND DIM: RECOMBINING METASTABLE INDEX
C                               3RD DIM: RECOMBINED METASTABLE INDEX
C OUTPUT : (R*8)  PRBA(,,)  = INTERPOLATION OF PRB COEFFICIENT (W CM3 )
C                               1ST DIM: TEMPERATURE INDEX
C                               2ND DIM: CHARGE STATE INDEX
C                               3RD DIM: RECOMBINING METASTABLE INDEX
C OUTPUT : (L*4)  LCCDA(,)  = .TRUE.  => PRB COEFFICIENT AVAILABLE
C                               .FALSE. => PRB COEFFICIENT NOT AVAILABLE
C                               1ST DIM: CHARGE STATE INDEX
C                               2ND DIM: RECOMBINING METASTABLE INDEX
C OUTPUT : (R*8)  PRCA(,,)  = INTERPOLATION OF PRC COEFFICIENT (W CM3 )
C                               1ST DIM: TEMPERATURE INDEX
C                               2ND DIM: CHARGE STATE INDEX
C                               3RD DIM: RECOMBINING METASTABLE INDEX
C OUTPUT : (L*4)  LPRCA(,)  = .TRUE.  => PRC COEFFICIENT AVAILABLE
C                               .FALSE. => PRC COEFFICIENT NOT AVAILABLE
C                               1ST DIM: CHARGE STATE INDEX
C                               2ND DIM: RECOMBINING METASTABLE INDEX
C OUTPUT : (R*8)  QCDA(,,,) = INTERPOLATION OF QCD COEFFICIENT (CM3 S-1)
C                               1ST DIM: TEMPERATURE INDEX
C                               2ND DIM: CHARGE STATE INDEX
C                               3RD DIM: FIRST METASTABLE INDEX
C                               4TH DIM: SECOND METASTABLE INDEX
C OUTPUT : (L*4)  LQCDA(,,) = .TRUE.  => QCD COEFFICIENT AVAILABLE
C                               .FALSE. => QDC COEFFICIENT NOT AVAILABLE
C                               1ST DIM: CHARGE STATE INDEX
C                               2ND DIM: FIRST METASTABLE INDEX
C                               3RD DIM: SECOND METASTABLE INDEX
C OUTPUT : (R*8)  XCDA(,,,) = INTERPOLATION OF XCD COEFFICIENT (CM3 S-1)
C                               1ST DIM: TEMPERATURE INDEX
C                               2ND DIM: CHARGE STATE INDEX
C                               3RD DIM: FIRST PARENT METASTABLE INDEX
C                               4TH DIM: SECOND PARENT METASTABLE INDEX
C OUTPUT : (L*4)  LXCDA(,,) = .TRUE.  => XCD COEFFICIENT AVAILABLE
C                               .FALSE. => XDC COEFFICIENT NOT AVAILABLE
C                               1ST DIM: CHARGE STATE INDEX
C                               2ND DIM: FIRST PARENT METASTABLE INDEX
C                               3RD DIM: SECOND PARENT METASTABLE INDEX
C OUTPUT : (R*8)  PLTA(,,)  = INTERPOLATION OF PLT COEFFICIENT (W CM3 )
C                               1ST DIM: TEMPERATURE INDEX
C                               2ND DIM: CHARGE STATE INDEX
C                               3RD DIM: METASTABLE INDEX
C OUTPUT : (L*4)  LPLTA(,)  = .TRUE.  => PLT COEFFICIENT AVAILABLE
C                               .FALSE. => PLT COEFFICIENT NOT AVAILABLE
C                               1ST DIM: CHARGE STATE INDEX
C                               2ND DIM:  METASTABLE INDEX
C
C PROGRAM: (I*4)  IT        = GENERAL INDEX FOR TEMPERATURE
C          (I*4)  IZ        = GENERAL INDEX FOR CHARGE
C          (I*4)  IZ1       = GENERAL INDEX FOR CHARGE+1
C          (I*4)  IPRT      = GENERAL INDEX FOR PARENT METASTABLE
C          (I*4)  JPRT      = GENERAL INDEX FOR PARENT METASTABLE
C          (I*4)  IGRD      = GENERAL INDEX FOR METASTABLE
C          (I*4)  JGRD      = GENERAL INDEX FOR METASTABLE
C
C
C ROUTINES:
C          ROUTINE    SOURCE    BRIEF DESCRIPTION
C          ------------------------------------------------------------
C
C
C AUTHOR : H. P. SUMMERS, JET
C          K1/1/57
```

```
C          JET  EXT. 4941
C
C DATE   : 25/04/94
C
C IDL-UNIX PORT:
C VERSION:     1.1                DATE:    31/10/95
C MODIFIED:    TIM HAMMOND
C              - INITIAL VERSION TO BE USED FOR UNIX PLATFORMS
C
C VERSION:     1.2                DATE:    08/11/95
C MODIFIED:    TIM HAMMOND
C              - ALTERED ALL DECISIONS 'IF (LEXSA(I))' WHICH OPENED ANY
C                CLASS OF FILE WHICH EXISTED EVEN IF IT HAD NOT BEEN
C                SELECTED TO 'IF (LEXSA(I).AND.LSELA(I))' SO THAT EVEN
C                IF A PARTICULAR FILE EXISTS IT IS ONLY OPENED AND READ
C                IF IT HAS BEEN REQUESTED.
C               - TIDIED UP COMMENTS AND CODE.
C
C VERSION:     1.3                DATE:    08/11/95
C MODIFIED:    TIM HAMMOND
C              - REMOVED SUPERFLUOUS VARIABLES
C
C VERSION:     1.4                DATE:    09/11/95
C MODIFIED:    TIM HAMMOND
C              - CHANGED LOOP:  2 IT = 1,ITDIMD
C                           TO:  2 IT = 1,NTDIM
C                AS IT WAS SUBSCRIPTING ARRAYS ACDA ETC. OUT OF
C                RANGE
C
C VERSION:     1.5                DATE:    13/11/95
C MODIFIED:    TIM HAMMOND
C              - CHANGED DECISION STATEMENTS AGAIN (SEE 1.2) SO THEY
C                NOW READ: 'IF ((LEXSA(I).OR.LDEFA(I)).AND.LSELA(I))'
C                AS BEFORE THE CODE WAS IGNORING THE CASE WHERE THE
C                DEFAULT FILE EXISTED AND THE USER HAD ASKED FOR THIS
C                DATA TO BE INCLUDED. IT IS NOT NECESSARY TO SPECIFY
C                DIFFERENT FILENAMES FOR DEFAULT AND USER DATA AS THE
C                ARRAY USED CONTAINS THE DEFAULT FILENAME WHEREVER
C                THE USER FILE DOES NOT EXIST. SEE d5spf0.pro FOR
C                MORE DETAILS OF THIS.
C
C-----------------------------------------------------------------------
      INTEGER   IFAIL   , IZ0     , ICLASS
      INTEGER   IZ1     , IZ1MIN  , IZ1MAX  , NTDIM   , ITMAX
      INTEGER   ISDIMD  , IZDIMD  , ITDIMD  , IPDIMD
      INTEGER   ISMAXD  , IZMAXD  , ITMAXD  , IDMAXD
      INTEGER   IT      , IZ      , IPRT    , JPRT    , IGRD    , JGRD
C-----------------------------------------------------------------------
      INTEGER   NPART(IZDIMD)     , NPARTR(IZDIMD)
C-----------------------------------------------------------------------
      REAL*8    DTEV(ITMAX)   , DDENS(ITMAX)
      REAL*8    DTEVD(ITDIMD) , DDENSD(ITDIMD) , ZDATA(ISDIMD)
      REAL*8    DRCOFD(ISDIMD,ITDIMD,ITDIMD)
      REAL*8    DRCOFI(ITMAX)
      REAL*8    ACDA(NTDIM,IZDIMD,IPDIMD,IPDIMD)
      REAL*8    SCDA(NTDIM,IZDIMD,IPDIMD,IPDIMD)
      REAL*8    CCDA(NTDIM,IZDIMD,IPDIMD,IPDIMD)
      REAL*8    PRBA(NTDIM,IZDIMD,IPDIMD)
      REAL*8    PRCA(NTDIM,IZDIMD,IPDIMD)
      REAL*8    QCDA(NTDIM,IZDIMD,IPDIMD,IPDIMD)
      REAL*8    XCDA(NTDIM,IZDIMD,IPDIMD,IPDIMD)
      REAL*8    PLTA(NTDIM,IZDIMD,IPDIMD)
C-----------------------------------------------------------------------
      CHARACTER DSFLLA(8)*120 , DSNINC*120
C-----------------------------------------------------------------------
      LOGICAL   LPART
C-----------------------------------------------------------------------
      LOGICAL     LSELA(8)      , LEXSA(8)       , LDEFA(8)
      LOGICAL   LACDA(IZDIMD,IPDIMD,IPDIMD)
      LOGICAL   LSCDA(IZDIMD,IPDIMD,IPDIMD)
      LOGICAL   LCCDA(IZDIMD,IPDIMD,IPDIMD)
      LOGICAL   LPRBA(IZDIMD,IPDIMD)
      LOGICAL   LPRCA(IZDIMD,IPDIMD)
      LOGICAL   LQCDA(IZDIMD,IPDIMD,IPDIMD)
      LOGICAL   LXCDA(IZDIMD,IPDIMD,IPDIMD)
      LOGICAL   LPLTA(IZDIMD,IPDIMD)
C-----------------------------------------------------------------------
```

D5DIAG

```
SUBROUTINE D5DIAG( NDSTAT , NDMET ,
     &                   NSTATE , NMET  ,
     &                   CFREC  , CFION , CFMET
     &                 )
      IMPLICIT NONE
C
C-------------------------------------------------------------------------------
C  ***************** FORTRAN77 SUBROUTINE : D5DIAG ****************      ********
C
C PURPOSE: CALCULATION OF PRIME DIAGONAL OF METASTABLE RATE COEFFICIENT
C   MATRIX
C
C CALLING PROGRAM: D5MPOP
C
```

```
C INPUT: (R*8) CFREC( , , )  = RECOMBINATION RATE COEFFICIENTS TO ALL
C                              METASTABLE NDMET;STARTING FROM FIRST TO
C                              GROUND LEVEL WITH CFREC(1,NDMET,NDMET)
C                              SET TO ZERO
C                              DIMENSIONS = (NSTATE,NDMET,NDMET)
C
C INPUT: (R*8) CFION( , , )  = IONISATION RATE COEFFICIENTS TO ALL
C                              METASTABLE NDMET;STARTING FROM GROUND
C                              TO FIRST LEVEL,WITH
C                              CFION(NSTATE,NDMET,NDMET) SET TO ZERO
C                              DIMENSIONS = (NSTATE,NDMET,NDMET)
C INPUT: (I*4) NDSTAT        = MAXIMUM NUMBER OF NDMET
C INPUT: (I*4) NSTATE        = PARAMETER = NO OF NDMET
C INPUT: (I*4) NDMET         = PARAMETER = MAXIMUM SIZE OF MATRICES
C                              HOLDING METASTABLE TRANSITIONS
C INPUT  (I*4) NMET( )       = NO  OF METASTABLES IN EACH ENERGY LEVEL
C                              DETERMINES ACTUAL SIZE OF MINI MATRICES
C                              DIMENSION = NSTATE
C
C OUTPUT:(R*8) CFMET( , , )  = CROSS COUPLING COEFFICIENTS BETWEEN
C                              METASTABLE NDMET WITH LEADING DIAGONAL
C                              CALCULATED
C                              DIMENSIONS = (NSTATE,NDMET,NDMET)
C
C ROUTINES : NONE
C
C AUTHOR : D. BROOKS,  H. P. SUMMERS, JET
C          K1/1/57
C          JET EXT. 4941
C
C
C DATE : 07/12/93
C
C UNIX-IDL PORT:
C
C VERSION: 1.1                          DATE: 08-11-95
C MODIFIED: TIM HAMMOND (TESSELLA SUPPORT SERVICES PLC)
C               - FIRST RELEASE
C
C-----------------------------------------------------------------------------
       INTEGER NDMET
       INTEGER NSTATE,NDSTAT
       INTEGER I,J,K
C-----------------------------------------------------------------------------
       INTEGER NMET(NDSTAT)
C-----------------------------------------------------------------------------
       REAL*8  SUM
C-----------------------------------------------------------------------------
       REAL*8  CFREC(NDMET,NDMET,NDSTAT),
     &         CFION(NDMET,NDMET,NDSTAT),
     &         CFMET(NDMET,NDMET,NDSTAT)
C-----------------------------------------------------------------------------
```

D5MFSP

```
SUBROUTINE D5MFSP( NDSTAT , NDMET  , NDONE  ,
     &                     NSTATE , NMET   , ID     , NMSUM  ,
     &                     CFREC  , CFION  , CFMET  , CPOPN  ,
     &                     POPN   , POPNMO , POPNPO ,
     &                     CPOPND , CPOPNZ ,
     &                     POPF   ,
     &                     XTEMP  , YTEMP  ,
     &                     RHS    , RDUM   , SOLVE  , LSOLVE , LAGAIN
     &                    )
        IMPLICIT NONE
C-----------------------------------------------------------------------------
C****************** FORTRAN77 SUBROUTINE: D5MFSP ******************** ********
C
C PURPOSE: TO PERFORM THE MAIN MATRIX ALGEBRA WHICH CALCULATES THE
C          LEVEL POPULATIONS-INCLUDING METASTABLE STATES
C
C CALLING PROGRAM: D5MPOP
C
C INPUT: (R*8) CFREC( , , )  = RECOMBINATION RATE COEFFICIENTS TO ALL
C         METASTABLE NDMET;STARTING FROM FIRST TO
C         GROUND LEVEL,WITH CFREC(NDMET,NDMET,1)
C         SET TO ZERO
C         DIMENSIONS = (NDMET,NDMET,NDSTAT)
C
C        (R*8) CFION( , , )  = IONISATION RATE COEFFICIENTS TO ALL
C         METASTABLE NDMET;STARTING FROM GROUND TO
C         FIRST LEVEL,WITH
C                CFION(NDMET,NDMET,NSTATE) SET TO ZERO
C         DIMENSIONS = (NDMET,NDMET,NDSTAT)
C
C        (I*4) NSTATE        = PARAMETER = NO OF NDMET
C
C        (I*4) NDMET         = PARAMETER = MAXIMUM SIZE OF MATRICES
C         HOLDING METASTABLE TRANSITIONS
C
C        (R*8) NMET( )       = NO  OF METASTABLES IN EACH ENERGY LEVEL
C         DETERMINES ACTUAL SIZE OF MINI MATRICES
C         DIMENSION = NDSTAT
C
```

```
C         (I*4) NDONE         = 1 0;MODIFYING MATRICES IN ORDER TO USE
C          SUBROUTINES
C
C         (I*4) ID            = POSITION OF DOMINANT TERM
C
C         (R*8) CFMET( , , )  = CROSS COUPLING COEFFICIENTS BETWEEN
C          METASTABLE NDMET WITH LEADING DIAGONAL
C          CALCULATED
C          DIMENSIONS = (NDMET,NDMET,NDSTAT)
C
C         (L*4) LSOLVE        =  TRUE  => XXMINV SOLVES SET OF 'N' LINEAR
C           EQUATIONS A X = B WHERE A,X,B ARE
C           MATRICES/VECTORS AND:
C           A = 'A(,)' ON INPUT
C           X = 'B()' ON OUTPUT
C           B = 'B()' ON INPUT
C           FALSE  => ONLY MATRIX INVERSION,
C           A INVERSE REPLACES A
C
C         (R*8) DINT          = + OR - 1 DEPENDING ON THE NUMBER OF ROW
C          INTERCHANGES IN THE MATRIX INVERSION
C
C
C         (R*8) NMETZ    = ACTUAL DIMENSION OF NORMALIZATION MATRIX
C          ONCE FIRST ROW & COLUMN IS ELIMINATED
C        = NMET(ID)+NMET(ID+1)-1
C
C         (I*4) NDSTAT    = PARAMETER = MAXIMUM NUMBER OF NDMET
C
C         (I*4) NPOSX    = NMET(ID)
C
C         (I*4) NPOSY    = NMET(ID+1)
C
C
C OUTPUT:(R*8) CPOPN( , , )  = ARRAY HOLDING COEFFICIENTS OF POPULATION
C          STATE EQUATIONS
C          DIMENSIONS = (NDMET,NDMET,NDSTAT+1)
C
C         (R*8) POPN( , , )   = ARRAY HOLDING POPULATION STATE VALUES WITH
C          THIRD DIMENSION SET TO 1
C          DIMENSIONS = (NDMET,NDONE,NDSTAT+1)
C
C         (R*8) CPOPND( , , ) = TEMPORARY NAME OF MATRIX TO BE SUBSTITUTED
C          INTO NEXT EQUATION IN UPWARD LOOP
C          DIMENSIONS = (NDMET,NDMET,NDSTAT+1)
C
C         (R*8) CPOPNZ( , , ) = TEMPORARY NAME OF MATRIX TO BE SUBSTITUTED
C          INTO NEXT EQUATION  IN DOWNWARD LOOP
C          DIMENSIONS = (NDMET,NDMET,NDSTAT+1)
C
C         (R*8) POPNPO( , , ) = TEMPORARY NAME OF MATRIX HOLDING POPULATION
C          STATE VALUES AFTER NORMALIZATION,TO BE
C          SUBSTITUTED INTO NEXT EQUATION IN UPWARD
C          LOOP
C          DIMENSIONS = (NDMET,NDONE,NDSTAT+1)
C
C         (R*8) POPNMO( , , ) = TEMPORARY NAME OF MATRIX HOLDING POPULATION
C          STATE VALUES AFTER NORMALIZATION,TO BE
C          SUBSTITUTED INTO NEXT EQUATION IN DOWNWARD
C          LOOP
C          DIMENSIONS = (NDMET,NDONE,NDSTAT+1)
C
C         (R*8) SUM           = SUM OF ALL LEVEL POPULATION VALUES
C          INCLUDING METASTABLES
C
C         (R*8) XTEMP( , )    = TEMPORARY MATRIX FOR DURING SUBROUTINE
C          CALCULATIONS
C          DIMENSIONS = (NDMET,NDMET)
C
C         (R*8) YTEMP( , )    = TEMPORARY MATRIX FOR DURING SUBROUTINE
C          CALCULATIONS
C          DIMENSIONS = (NDMET,NDMET)
C
C         (R*8) PTEMP( , , )  = TEMPORARY MATRIX FOR DURING ERROR CHECK
C          CALCULATIONS
C          DIMENSIONS = (NDMET,NDONE,NDSTAT)
C
C         (R*8) QTEMP( , , )  = TEMPORARY MATRIX FOR DURING ERROR CHECK
C          CALCULATIONS
C          DIMENSIONS = (NDMET,NDONE,NDSTAT)
C
C         (R*8) RTEMP( , , )  = TEMPORARY MATRIX FOR DURING ERROR CHECK
C          CALCULATIONS
C          DIMENSIONS = (NDMET,NDONE,NDSTAT)
C
C         (R*8) STEMP( , , )  = TEMPORARY MATRIX FOR DURING ERROR CHECK
C          CALCULATIONS
C          DIMENSIONS = (NDMET,NDONE,NDSTAT)
C
C         (R*8) TEMP( , , )   = MATRIX HOLDING RESULTS OF ERROR CHECK
C          ALL OF WHICH SHOULD BE ZERO
C          DIMENSIONS = (NDMET,NDONE,NDSTAT)
C
C         (R*8) SOLVE( , )    = NORMALIZATION MATRIX AT CRITICAL STAGE
C          DIMENSIONS = (2*NDMET-1,2*NDMET-1)
C
C         (R*8) CTEMP( , , )  = HOLDS VALUES OF CFMET FOR ERROR CHECK,IS
C          NECCESSARY SINCE CFMET IS ALTERED DURING
```

```
C         CALCULATIONS
C         DIMENSIONS = (NDMET,NDMET,NDSTAT)
C
C        (R*8) RHS( )    = SIPHONED OFF COLUMN OF NORMALIZATION
C         MATRIX,USED TO CALCULATE METASTABLE
C         NDMET OF DOMINANT STAGE THROUGH XXMINV
C         DIMENSIONS = (2*NDMET-1)
C
C        (R*8) RDUM( )    = DUMMY ARRAY USED IN XXMINV AS RHS WHEN
C         LSOLVE =  FALSE
C
C
C ROUTINES :
C           ROUTINE   SOURCE    BRIEF DESCRIPTION
C           ------------------------------------------------------------
C           DXMADD    ADAS      MATRIX ADDITION/SUBTRACTION
C           DXMMUL    ADAS      MATRIX MULTIPLICATION
C           XXMINV    ADAS      MATRIX INVERSION
C
C
C AUTHOR:  D. BROOKS, H. P. SUMMERS, JET
C          K1/1/57
C          JET EXT. 4941
C
C DATE:    02/06/94
C
C UPDATE:  14/02/95  HPS - INTRODUCED IAGAIN TO IMPROVE DOMINANT STAGE
C                          IDENTIFICATION.
C UPDATE:  06/07/95  HPS - MODIFIED LOOP TO PREVENT IAGAIN AND HENCE ID
C                          BEING SET GREATER THAN NSTATE-1.
C
C UNIX-IDL PORT:
C
C VERSION: 1.1                          DATE: 08-11-95
C MODIFIED: TIM HAMMOND (TESSELLA SUPPORT SERVICES PLC)
C               - FIRST RELEASE
C
C VERSION: 1.2                          DATE: 01-12-95
C MODIFIED: TIM HAMMOND (TESSELLA SUPPORT SERVICES PLC)
C               - COPIED FOLLOWING UPDATES MADE BY DAVID BROOKS:
C
C UPDATE:  29/11/95  DHB - INTRODUCED A CHECK TO MAKE SURE THAT THE
C                          POPULATION EQUATIONS ARE SOLVED FOR THE BEST
C                          POSSIBLE CHOICE OF DOMINANT STAGE. NB: THIS
C                          IS NOT THE DOMINANT STAGE ITSELF BUT THE
C                          NEAREST STAGE TO IT THAT CAN SUPPORT THE
C                          CALCULATION I.E. THERE IS A CHECK TO MAKE
C                          SURE THE DOMINANT STAGE IDENTIFICATION DOES
C                          NOT PUSH THE SOLUTION LOOP TOO CLOSE TO ANY
C                          REGION OF RAPID POPULATION DROP OFF. THE
C                          PARAMETER ACC HAS BEEN INTRODUCED TO MEASURE
C                          THIS DROP OFF AND CAN BE ADJUSTED IF IT IS TOO
C                          STRINGENT.
C UPDATE:  29/11/95  DHB - ADDED CHECK TO AVOID UNNECCESARY LOOPING IN
C                          UNRESOLVED CASE.
C
C VERSION: 1.3                          DATE: 01-12-95
C MODIFIED: TIM HAMMOND (TESSELLA SUPPORT SERVICES PLC)
C               - SWAPPED ORDER OF DECLARATION OF PARAMETER ACC.
C
C-----------------------------------------------------------------------
       INTEGER NDSTAT,NDMET,NDONE,ID,IAGAIN
       INTEGER NMETZ,NPOSX,NPOSY
       INTEGER NSTATE,NMSUM
       INTEGER I,J,K,IM
C-----------------------------------------------------------------------
       INTEGER NMET(NDSTAT)
C-----------------------------------------------------------------------
       LOGICAL LSOLVE , LAGAIN
C-----------------------------------------------------------------------
       REAL*8  SUM,DINT,ACC,RATIO
       PARAMETER ( ACC = 1.0D-06 )
C-----------------------------------------------------------------------
       REAL*8  CFREC(NDMET,NDMET,NDSTAT)
       REAL*8  CFION(NDMET,NDMET,NDSTAT),CFMET(NDMET,NDMET,NDSTAT)
       REAL*8  CPOPN(NDMET,NDMET,NDSTAT+1),POPN(NDMET,NDONE,NDSTAT+1)
       REAL*8  CPOPND(NDMET,NDMET,NDSTAT+1),
     &         CPOPNZ(NDMET,NDMET,NDSTAT+1)
       REAL*8  POPNMO(NDMET,NDONE,NDSTAT+1),
     &         POPNPO(NDMET,NDONE,NDSTAT+1)
       REAL*8  SOLVE(2*NDMET-1,2*NDMET-1)
       REAL*8  XTEMP(NDMET,NDMET),YTEMP(NDMET,NDMET),RDUM(NDMET)
       REAL*8  RHS(2*NDMET-1)
       REAL*8  POPF(NMSUM)
C-----------------------------------------------------------------------
```

D5MPOP

```
SUBROUTINE D5MPOP( NTDIM , IZDIMD, IPDIMD,
     &                   NSTAGE, ITMAX , NPRT  , NMSUM ,
     &                   ACDA  , SCDA  , CCDA  , QCDA  , XCDA  ,
     &                   DENS  , DENSH ,
     &                   ITEM  ,
     &                   CFREC , CFION , CFMET ,
```

```
     &                    POPN  , POPNMO, POPNPO,
     &                    CPOPN , CPOPND, CPOPNZ,
     &                    POPF  ,
     &                    XTEMP , YTEMP , YTEM  ,
     &                    RHS   , RDUM  , SOLVE , LSOLVE
     &                   )
       IMPLICIT REAL*8(A-H,O-Z)
C
C-----------------------------------------------------------------------------
C                                                                        ********
C  ****************** FORTRAN 77 SUBROUTINE: D5MPOP ***************************
C
C  PURPOSE: CALCULATION OF METASTABLE RESOLVED IONISATION STAGE
C           POPULATIONS OF A PARTICULAR ELEMENT FOR A GIVEN TEMPERATURE
C           AND DENSITY
C
C  CALLING PROGRAM: ADAS405
C
C  SUBROUTINE:
C
C
C INPUT :(I*4) NTDIM         = MAXIMUM NUMBER OF MODEL TEMPS/DENSITIES
C INPUT :(I*4) IZDIMD        = MAXIMUM NUMBER OF STAGES-1
C INPUT :(I*4) IPDIMD        = MAXIMUM SIZE OF METASTABLES FRO A STAGE
C INPUT :(I*4) NSTAGE        = NUMBER OF STAGES-1
C INPUT :(I*4) ITMAX         = NUMBER OF MODEL TEMPS/DENSITIES
C INPUT :(R*8) NPRT( )       = PARTITION OF TOTAL METASTABLES ACCORDING
C                              TO IONISATION STAGES
C                              1ST DIM: STAGE INDEX
C INPUT :(I*4) NMSUM         = TOTAL NUMBER OF POPULATIONS
C INPUT :(R*8) ACDA(,,,)     = GENERALISED CR RECOMBINATION COEFFICIENT
C                              1ST DIM: TEMPERATURE INDEX
C                              2ND DIM: STAGE INDEX (LESS 1)
C                              3RD DIM: METASTABLE INDEX
C                              4TH DIM: METASTABLE INDEX
C INPUT :(R*8) SCDA(,,,)     = GENERALISED CR IONISATION COEFFICIENT
C                              1ST DIM: TEMPERATURE INDEX
C                              2ND DIM: STAGE INDEX (LESS 1)
C                              3RD DIM: METASTABLE INDEX
C                              4TH DIM: METASTABLE INDEX
C INPUT :(R*8) CCDA(,,,)     = GENERALISED CR CHARGE EXCH. COEFFICIENT
C                              1ST DIM: TEMPERATURE INDEX
C                              2ND DIM: STAGE INDEX (LESS 1)
C                              3RD DIM: METASTABLE INDEX
C                              4TH DIM: METASTABLE INDEX
C INPUT :(R*8) QCDA(,,,)     = GENERALISED CR CROSS-COUPL. COEFFICIENT
C                              1ST DIM: TEMPERATURE INDEX
C                              2ND DIM: STAGE INDEX (LESS 1)
C                              3RD DIM: METASTABLE INDEX
C                              4TH DIM: METASTABLE INDEX
C INPUT :(R*8) XCDA(,,,)     = GENERALISED CR PARENT X-CP. COEFFICIENT
C                              1ST DIM: TEMPERATURE INDEX
C                              2ND DIM: STAGE INDEX (LESS 1)
C                              3RD DIM: METASTABLE INDEX
C                              4TH DIM: METASTABLE INDEX
C INPUT :(R*8) DENS()        = ELECTRON DENSITIES FOR MODEL
C INPUT :(R*8) DENSH()       = NEUTRAL HYDROGEN DENSITIES FOR MODEL
C
C INPUT :(I*4) ITEM          = CURRENT TEMP/DENSITY INDEX
C
C OUTPUT:(R*8) CFREC( , , )  = RECOMBINATION RATE COEFFICIENTS TO ALL
C                              METASTABLE IPDIMD;STARTING FROM FIRST TO
C                              GROUND LEVEL,WITH CFREC(1,IPDIMD,IPDIMD)
C                              SET TO ZERO
C                              DIMENSIONS = (IPDIMD,IPDIMD,IZDIMD)
C OUTPUT:(R*8) CFION( , , )  = IONISATION RATE COEFFICIENTS TO ALL
C                              METASTABLE IPDIMD;STARTING FROM GROUND
C                              TO FIRST LEVEL,WITH
C                              CFION(NSTAGE,IPDIMD,IPDIMD)
C                              SET TO ZERO
C                              DIMENSIONS = (IPDIMD,IPDIMD,IZDIMD)
C OUTPUT:(R*8) CFMET( , , )  = CROSS COUPLING COEFFICIENTS BETWEEN
C                              METASTABLE IPDIMD WITH LEADING DIAGONAL
C                              CALCULATED
C                              DIMENSIONS = (IPDIMD,IPDIMD,IZDIMD)
C
C OUTPUT:(R*8) POPN( , , )   = ARRAY HOLDING POPULATION STATE VALUES
C                              WITH SECOND DIMENSION SET TO 1
C                              DIMENSIONS = (IPDIMD,NDONE,IZDIMD+1)
C OUTPUT:(R*8) POPNMO( , , ) =TEMPORARY NAME OF MATRIX HOLDING POPULATI ON
C                              STATE VALUES AFTER NORMALIZATION,TO BE
C                              SUBSTITUTED INTO NEXT EQUATION IN
C                              DOWNWARD LOOP
C                              DIMENSIONS = (IPDIMD,NDONE,IZDIMD+1)
C OUTPUT:(R*8) POPNPO( , , ) =TEMPORARY NAME OF MATRIX HOLDING POPULATI ON
C                              STATE VALUES AFTER NORMALIZATION,TO BE
C                              SUBSTITUTED INTO NEXT EQUATION IN UPWARD
C                              LOOP
C                              DIMENSIONS = (IPDIMD,NDONE,IZDIMD+1)
C
C OUTPUT:(R*8) CPOPN( , , )  = ARRAY HOLDING COEFFICIENTS OF POPULATION
C                              STATE EQUATIONS
C                              DIMENSIONS = (IPDIMD,IPDIMD,IZDIMD+1)
C OUTPUT:(R*8) CPOPND( , , ) = TEMPORARY NAME OF MATRIX TO BE SUBSTITUTED
C                              INTO NEXT EQUATION IN UPWARD LOOP
C                              DIMENSIONS = (IPDIMD,IPDIMD,IZDIMD+1)
C OUTPUT:(R*8) CPOPNZ( , , ) = TEMPORARY NAME OF MATRIX TO BE SUBSTITUTED
C                              INTO NEXT EQUATION  IN DOWNWARD LOOP
```

```
C                               DIMENSIONS = (IPDIMD,IPDIMD,IZDIMD+1)
C
C OUTPUT:(R*8) POPF()         = POPULATIONS FOR A SPECIFIED TEMPERATURE  D
C                               1ST DIM: INDEX OVER STAGES/METASTABLES
C
C OUTPUT:(R*8) XTEMP( , )     =TEMPORARY MATRIX USED DURING SUBROUTINE
C                               CALCULATIONS
C                               DIMENSIONS = (IPDIMD,IPDIMD)
C OUTPUT:(R*8) YTEMP( , )     =TEMPORARY MATRIX FOR DURING SUBROUTINE
C                               CALCULATIONS
C                               DIMENSIONS = (IPDIMD,IPDIMD)
C OUTPUT:(R*8) YTEM( )        = TEMPORARY ARRAY FOR HOLDING VALUES OF
C                               DIFFERENCE BETWEEN RECOMBINATION AND
C                               IONISATION GROUND LEVEL COEFFICIENTS
C                               DIMENSIONS = (NSTAGE)
C
C OUTPUT:(R*8) RHS( )         = SIPHONED OFF COLUMN OF NORMALIZATION
C                               MATRIX,USED TO CALCULATE METASTABLE
C                               IPDIMD OF DOMINANT STAGE THROUGH MATINV
C                               DIMENSIONS = (2*IPDIMD-1)
C OUTPUT:(R*8) RDUM( )        = DUMMY ARRAY USED IN MATINV AS RHS WHEN
C                               LSOLVE =  FALSE
C OUTPUT:(R*8) SOLVE( , )     = NORMALIZATION MATRIX AT CRITICAL STAGE
C                               DIMENSIONS = (2*IPDIMD-1,2*IPDIMD-1)
C OUTPUT:(L*4) LSOLVE         = .TRUE.  => SOLVE SET OF EQUATIONS
C                               = .FALSE. => INVERT MATRIX ONLY
C
C        (I*4) NDONE          = PARAMETER = 1 TO ALLOW 3D MATRIX USE
C        (I*4) ID             = POSITION OF DOMINANT TERM
C        (I*4) ISTATE         = STAGE INDEX
C        (I*4) ITEM           = GENERAL INDEX
C        (I*4) I              = GENERAL INDEX
C        (I*4) J              = GENERAL INDEX
C        (I*4) K              = GENERAL INDEX
C        (R*8) YMIN           = VALUE OF DIFFERENCE BETWEEN
C                                RECOMBINATION AND IONISATION COEFFICIENTS
C                               OF GROUND IPDIMD
C
C  ROUTINES:
C           ROUTINE    SOURCE    BRIEF DESCRIPTION
C           ------------------------------------------------------------
C           D5DIAG     ADAS      SETS UP ON-DIAGONAL ELEMENT OF MATRIX
C           D5MFSP     ADAS      EXECUTES PARTITION MATRIX INVERSION
C           DXMADD     ADAS      MATRIX ADDITION/SUBTRACTION
C           DXMMUL     ADAS      MATRIX MULTIPLICATION
C           XXMINV     ADAS      MATRIX INVERSION
C
C
C  AUTHOR:  D. BROOKS, H. P. SUMMERS, JET
C           K1/1/57
C           JET EXT. 4941
C
C  DATE:    02/06/94
C
C  UPDATE:  14/02/95  HPS - INTRODUCED IAGAIN TO IMPROVE DOMINANT STAGE
C                           IDENTIFICATION.  CHANGED A LOOP LIMIT.
C UNIX-IDL PORT:
C
C VERSION: 1.1                          DATE: 08-11-95
C MODIFIED: TIM HAMMOND (TESSELLA SUPPORT SERVICES PLC)
C               - FIRST RELEASE
C
C VERSION: 1.2                          DATE: 01-12-95
C MODIFIED: TIM HAMMOND (TESSELLA SUPPORT SERVICES PLC)
C               - COPIED FOLLOWING CHANGES MADE BY DAVID BROOKS
C
C  UPDATE:  29/11/95  DHB - CHANGED THE METHOD FOR THE FIRST GUESS AT THE
C                           DOMINANT STAGE TO AVOID DIVISION BY ZERO
C                           ERRORS IN D5MFSP. NOW PICK A STAGE THAT HAS AN
C                           INVERTIBLE SOLUTION AND ADJUST AFTER THE
C                           POPULATION FRACTIONS HAVE BEEN CALCULATED.
C
C-----------------------------------------------------------------------------
       INTEGER NTDIM,IZDIMD,IPDIMD, NDONE
C-----------------------------------------------------------------------------
       PARAMETER ( NDONE = 1 )
C-----------------------------------------------------------------------------
       INTEGER ID     , ITEM , NMSUM
       INTEGER NSTAGE , ITMAX
C-----------------------------------------------------------------------------
       LOGICAL LSOLVE , LAGAIN
C-----------------------------------------------------------------------------
       REAL*8 YMIN
C-----------------------------------------------------------------------------
       INTEGER NPRT(IZDIMD)
C-----------------------------------------------------------------------------
       REAL*8 ACDA(NTDIM,IZDIMD,IPDIMD,IPDIMD)
       REAL*8 SCDA(NTDIM,IZDIMD,IPDIMD,IPDIMD)
       REAL*8 QCDA(NTDIM,IZDIMD,IPDIMD,IPDIMD)
       REAL*8 XCDA(NTDIM,IZDIMD,IPDIMD,IPDIMD)
       REAL*8 CCDA(NTDIM,IZDIMD,IPDIMD,IPDIMD)
       REAL*8 CFREC(IPDIMD,IPDIMD,IZDIMD),
     &        CFION(IPDIMD,IPDIMD,IZDIMD),
     &        CFMET(IPDIMD,IPDIMD,IZDIMD)
       REAL*8 CPOPN(IPDIMD,IPDIMD,IZDIMD+1) ,
     &        CPOPND(IPDIMD,IPDIMD,IZDIMD+1),
     &        CPOPNZ(IPDIMD,IPDIMD,IZDIMD+1)
       REAL*8 POPNMO(IPDIMD,NDONE,IZDIMD+1),
```

```
     &        POPNPO(IPDIMD,NDONE,IZDIMD+1),
     &        POPN(IPDIMD,NDONE,IZDIMD+1)
       REAL*8 RDUM(IPDIMD),RHS(2*IPDIMD-1),SOLVE(2*IPDIMD-1,2*IPDIMD-1)
       REAL*8 DENS(NTDIM) , DENSH(NTDIM)
       REAL*8 XTEMP(IPDIMD,IPDIMD),YTEMP(IPDIMD,IPDIMD)
       REAL*8 YTEM(IZDIMD)
       REAL*8 POPF(NMSUM)
C-----------------------------------------------------------------------------
```

D5OTG1

```
SUBROUTINE D5OTG1( LGHOST , DATE  ,
     &                   IMDIMD , NTDIM ,
     &                   ELEMT  , TITLE , GTIT1  , DSNINC ,
     &                   IZ0    , YEAR  , YEARDF ,
     &                   LGRD1  , LDEF1 ,
     &                   XMIN   , XMAX  , YMIN  , YMAX   ,
     &                   NMSUM  , ITMAX  ,
     &                   TEV    ,
     &                   POPTIT , FPABUN
     &                 )
      IMPLICIT NONE
C-----------------------------------------------------------------------
C
C  ****************** FORTRAN77 SUBROUTINE: D5OTG1 *********************
C
C  PURPOSE:  COMMUNICATES GRAPHICS DATA TO IDL
C
C            PROVIDES  GRAPH OF METASTABLE FRACTIONAL ABUNDANCES. A
C            SINGLE GRAPH WILL CONTAIN UP TO SEVEN METASTABLES. (IF MORE
C            THAN SEVEN METASTABLES ARE PRESENT EXTRA GRAPHS WILL  BE
C            OUTPUT AS REQUIRED).
C
C            PLOT IS LOG10(N(META.)/N(TOTAL FOR ELEMENT)) VERSUS
C                    LOG10(ELECTRON TEMPERATURE (EV) )
C
C  CALLING PROGRAM: ADAS405
C
C  SUBROUTINE:
C
C  INPUT : (L*4)  LGHOST  = .TRUE.  => GHOST80 INITIALISED
C                           .FALSE. => GHOST80 NOT INITIALISED
C  INPUT : (C*8)  DATE    = CURRENT DATE AS 'DD/MM/YY'
C
C  INPUT : (I*4)  IMDIMD  = MAXIMUM NUMBER OF METASTABLES ALLOWED
C  INPUT : (I*4)  NTDIM   = MAXIMUM NUMBER OF DENSITIES ALLOWED
C
C  INPUT : (C*2)  ELEMT   = ELEMENT SYMBOL.
C  INPUT : (C*40) TITLE   = ISPF ENTERED GENERAL TITLE FOR PROGRAM RUN
C  INPUT : (C*40) GTIT1   = ISPF ENTERED TITLE FOR GRAPH
C  INPUT : (C*44) DSNINC  = INPUT COPASE DATA SET NAME (MVS DSN)
C
C  INPUT : (I*4)  IZ0     = NUCLEAR CHARGE
C  INPUT : (C*2)  YEAR    = TWO DIGIT YEAR NUMBER
C  INPUT : (C*2)  YEARDF  = TWO DIGIT DEFAULT YEAR NUMBER
C
C  INPUT : (L*4)  LGRD1   = .TRUE.  => PUT GRAPH IN GRID FILE
C                           = .FALSE. => DO NOT PUT GRAPH IN GRID FILE
C  INPUT : (L*4)  LDEF1   = .TRUE.  => USE GRAPH DEFAULT SCALING
C                           = .FALSE. => DO NOT USE DEFAULT SCALING
C
C  INPUT : (R*8)  XMIN    = LOWER LIMIT FOR X-AXIS OF GRAPH
C  INPUT : (R*8)  XMAX    = UPPER LIMIT FOR X-AXIS OF GRAPH
C  INPUT : (R*8)  YMIN    = LOWER LIMIT FOR Y-AXIS OF GRAPH
C  INPUT : (R*8)  YMAX    = UPPER LIMIT FOR Y-AXIS OF GRAPH
C
C  INPUT : (I*4)  NMSUM   = NUMBER OF METASTABLES
C  INPUT : (I*4)  ITMAX   = NUMBER OF INPUT ELECTRON DENSITIES
C
C  INPUT : (R*8)  TEV()   = ELECTRON DENSITIES (UNITS: CM-3)
C
C  INPUT : (C*10)POPTIT() = METASTABLE DESIGNATIONS
C  INPUT : (R*8) FPABUN(,)= METASTABLE DEPENDENCE
C                             1ST DIMENSION: TEMPERATURE INDEX
C                             2ND DIMENSION: METASTABLE INDEX
C
C          (I*4)  NDIM1   = PARAMETER = MAXIMUM NUMBER OF TEMP.   VALUES
C                           (MUST NOT BE LESS THAN 'NTDIM')
C          (I*4)  NDIM2   = PARAMETER = MAXIMUM NUMBER OF METASTABLES
C                           (MUST NOT BE LESS THAN 'IMDIMD')
C          (I*4)  NGPIC   = PARAMETER = MAXIMUM NUMBER OF LEVEL POPULAT-
C                           IONS TO BE DISPLAYED ON A SINGLE GRAPH.
C          (I*4)  NGLEV   = PARAMETER = MAXIMUM NUMBER OF METASTABLES
C                           WHICH CAN BE LISTED ON THE GRAPH.
C
C          (R*4)  CUTMIN  = PARAMETER = IN DEFAULT GRAPH SCALING IS THE
C                           MINIMUM Y-VALUE THAT IS ALLOWED.
C                           (NOTE: 'CUTMIN' MUST BE > THAN 'GHZERO')
C          (R*4)  GHZERO  = PARAMETER = VALUE BELOW WHICH GHOST80 TAKES
C                           NUMBERS AS BEING ZERO = 1.0E-36
C
C          (I*4)  IT      = TEMP. INDEX NUMBER FOR ARRAY USE
C          (I*4)  IM      = METASTABLE INDEX NUMBER FOR ARRAY USE
C          (I*4)  IMMAX   = MINIMUM OF: NO. OF METASTABLES OR NGLEV'
```

```
C
C          (R*4)  X()     = X-AXIS CO-ORDINATES FOR USE WITH GHOST80
C                             ELECTRON DENSITIES
C          (R*4)  Y(,)    = Y-AXIS CO-ORDINATES FOR USE WITH GHOST80
C                             LEVEL POPULATIONS.
C                             1ST DIMENSION = ELECTRON TEMP.   INDEX
C                             2nd DIMENSION = ORDINARY  LEVEL  INDEX
C
C          (C*80) ISPEC   = GRAPH TITLE (INCORPORATES 'ELEMT,IZ0').
C          (C*23) XTIT    = X-AXIS UNITS/TITLE
C          (C*23) YTIT    = Y-AXIS UNITS/TITLE
C          (C*9)  KEY0    = '    KEY: '
C          (C*9)  MNMX0   = 'MINIMAX: '
C          (C*9)  FILE0   = 'FILE   : '
C          (C*8)  ADAS0   = 'ADAS   :'
C          (C*28) KEY()   = DESCRIPTIVE KEY FOR GRAPH (2 TYPES)
c
C
C          (L*4)  LGTXT   = .TRUE.  => LAST SCREEN DUMP WAS TEXT.
C                         = .FALSE. => LAST SCREEN DUMP WAS GHOST80.
C
C ROUTINES:
C          ROUTINE     SOURCE    BRIEF DESCRIPTION
C          ------------------------------------------------------------
C
C AUTHOR:  H. P. SUMMERS, JET
C          K1/1/57
C          JET EXT. 4941
C
C DATE:    28/04/94
C
C UNIX-IDL PORT:
C
C VERSION: 1.1                          DATE: 08-11-95
C MODIFIED: TIM HAMMOND (TESSELLA SUPPORT SERVICES PLC)
C               - FIRST RELEASE
C
C VERSION: 1.2                          DATE: 08-11-95
C MODIFIED: TIM HAMMOND (TESSELLA SUPPORT SERVICES PLC)
C               - REMOVED SUPERFLUOUS VARIABLES AND CORRECTED ERROR
C                 IN DEFN OF XXFLSH
C
C VERSION: 1.3                          DATE: 08-11-95
C MODIFIED: TIM HAMMOND (TESSELLA SUPPORT SERVICES PLC)
C               - REMOVED SUPERFLUOUS VARIABLES AND CORRECTED ERROR
C                 IN DEFN OF XXFLSH
C
C VERSION: 1.4                          DATE: 08-06-98
C MODIFIED: RICHARD MARTIN
C                   - INCREASED NDIM1 TO 30:
C
C-----------------------------------------------------------------------
      INTEGER   NDIM1    , NDIM2    , NGPIC    , NGLEV
C-----------------------------------------------------------------------
      REAL*4    CUTMIN   , GHZERO
C-----------------------------------------------------------------------
      PARAMETER ( NDIM1= 30  , NDIM2=200        , NGPIC=7 , NGLEV = 55 )
      PARAMETER ( CUTMIN = 1.0E-30 , GHZERO = 1.0E-36 )
C-----------------------------------------------------------------------
      INTEGER   PIPEIN   , PIPEOU
      INTEGER   IMDIMD   , NTDIM
      INTEGER   NMSUM    , ITMAX    ,
     &          IZ0
      INTEGER   IT       , IM       ,
     &          IMMAX
      PARAMETER( PIPEIN=5      , PIPEOU=6  )
C-----------------------------------------------------------------------
      REAL*8    XMIN     , XMAX     ,
     &          YMIN     , YMAX
C-----------------------------------------------------------------------
      LOGICAL   LGHOST   , LGRD1    , LDEF1    , LGTXT
C-----------------------------------------------------------------------
      CHARACTER ELEMT*2  , TITLE*40 , GTIT1*40 , DSNINC*44
      CHARACTER YEAR*2   , YEARDF*2
      CHARACTER DATE*8   ,
     &          FILE0*9  , MNMX0*9  , KEY0*9   , ADAS0*8  ,
     &          XTIT*25  , YTIT*25  ,
     &          ISPEC*80
C-----------------------------------------------------------------------
      REAL*4    X(NDIM1)            , Y(NDIM1,NDIM2)
C-----------------------------------------------------------------------
      CHARACTER POPTIT(IMDIMD)*10
      CHARACTER KEY(3)*22
C-----------------------------------------------------------------------
      REAL*8    TEV(NTDIM)
      REAL*8    FPABUN(NTDIM,IMDIMD)
C-----------------------------------------------------------------------
      DATA ISPEC(1:40)
     &          /'ION FRACTION  VS  ELECTRON TEMPERATURE: '/
      DATA XTIT  /'ELECTRON TEMPERATURE (eV)'/
      DATA YTIT  /'N(INDX)/N(TOTAL)         '/
      DATA ADAS0 /'ADAS   :'/               ,
     &     FILE0 /'FILE   : '/              ,
     &     MNMX0 /'MINIMAX: '/              ,
     &     KEY0  /'KEY    : '/              ,
     &     KEY(1)/'(FULL LINE - TOTAL   )'/  ,
     &     KEY(2)/' (DASH LINE - PARTIAL)'/  ,
     &     KEY(3)/'                     ) '/
```

```
C
C-----------------------------------------------------------------------
```

D5OTG2

```
      SUBROUTINE D5OTG2( LGHOST , LEXSS , DATE  ,
     &                   IMDIMD , NTDIM ,
     &                   ELEMT  , TITLE , GTIT1  , DSNINC ,
     &                   IZ0    , YEAR  , YEARDF ,
     &                   LGRD1  , LDEF1 ,
     &                   XMIN   , XMAX  , YMIN  , YMAX   ,
     &                   NMSUM  , ITMAX  ,
     &                   TEV    ,
     &                   POPTIT , PLTPEQ ,
     &                   PRBEQ  , PRCEQ  , PLTEQ, PRADA
     &                 )
      IMPLICIT NONE
C-----------------------------------------------------------------------
C
C  ****************** FORTRAN77 SUBROUTINE: D5OTG2 *********************
C
C  PURPOSE:  GRAPHIC ROUTINE FOR TEMP/DENSITY MODEL GHOST80.
C
C            PROVIDES  GRAPH OF METASTABLE FRACTIONAL LINE POWER
C            FUNCTIONS AND THE PRB, PRC AND PLT POWER FUNCTIONS. A
C            SINGLE GRAPH WILL CONTAIN UP TO SEVEN METASTABLES. (IF MORE
C            THAN SEVEN METASTABLES ARE PRESENT EXTRA GRAPHS WILL  BE
C            OUTPUT AS REQUIRED).
C
C            PLOT IS LOG10(POWER FUNCTION (W CM3 ) ) VERSUS
C                    LOG10(ELECTRON TEMPERATURE (EV) )
C
C  CALLING PROGRAM: ADAS405
C
C  SUBROUTINE:
C
C  INPUT : (L*4)  LGHOST  = .TRUE.  => GHOST80 INITIALISED
C                           .FALSE. => GHOST80 NOT INITIALISED
C  INPUT : (L*4)  LEXSS()   = .TRUE.  => OUTPUT STANDARD MASTER DATA FOR
C                                        THIS INDEX GENERATED
C                           = .FALSE. => OUTPUT STANDARD MASTER DATA FOR
C                                        THIS INDEX NOT GENERATED
C  INPUT : (C*8)  DATE    = CURRENT DATE AS 'DD/MM/YY'
C
C  INPUT : (I*4)  IMDIMD  = MAXIMUM NUMBER OF METASTABLES ALLOWED
C  INPUT : (I*4)  NTDIM   = MAXIMUM NUMBER OF DENSITIES ALLOWED
C
C  INPUT : (C*2)  ELEMT   = ELEMENT SYMBOL.
C  INPUT : (C*40) TITLE   = ISPF ENTERED GENERAL TITLE FOR PROGRAM RUN
C  INPUT : (C*40) GTIT1   = ISPF ENTERED TITLE FOR GRAPH
C  INPUT : (C*44) DSNINC  = INPUT COPASE DATA SET NAME (MVS DSN)
C
C  INPUT : (I*4)  IZ0     = NUCLEAR CHARGE
C  INPUT : (C*2)  YEAR    = TWO DIGIT YEAR NUMBER
C  INPUT : (C*2)  YEARDF  = TWO DIGIT DEFAULT YEAR NUMBER
C
C  INPUT : (L*4)  LGRD1   = .TRUE.  => PUT GRAPH IN GRID FILE
C                           = .FALSE. => DO NOT PUT GRAPH IN GRID FILE
C  INPUT : (L*4)  LDEF1   = .TRUE.  => USE GRAPH DEFAULT SCALING
C                           = .FALSE. => DO NOT USE DEFAULT SCALING
C
C  INPUT : (R*8)  XMIN    = LOWER LIMIT FOR X-AXIS OF GRAPH
C  INPUT : (R*8)  XMAX    = UPPER LIMIT FOR X-AXIS OF GRAPH
C  INPUT : (R*8)  YMIN    = LOWER LIMIT FOR Y-AXIS OF GRAPH
C  INPUT : (R*8)  YMAX    = UPPER LIMIT FOR Y-AXIS OF GRAPH
C
C  INPUT : (I*4)  NMSUM   = NUMBER OF METASTABLES
C  INPUT : (I*4)  ITMAX   = NUMBER OF INPUT ELECTRON DENSITIES
C
C  INPUT : (R*8)  TEV()   = ELECTRON DENSITIES (UNITS: CM-3)
C
C  INPUT : (C*10)POPTIT() = METASTABLE DESIGNATIONS
C  INPUT : (R*8) PLTPEQ(,)= METASTABLE FRCATIONAL LINE POWER FUNCTION
C                             1ST DIMENSION: TEMPERATURE INDEX
C                             2ND DIMENSION: METASTABLE INDEX
C  INPUT : (R*8)  PRBEQ() = TOTAL EQUILIBRIUM RADIATED RECOM-BREMS
C                           POWER FUNCTION
C  INPUT : (R*8)  PRCEQ() = TOTAL EQUILIBRIUM CX RADIATED RECOM POWER
C                           FUNCTION NORMALISED TO ELECTRON
C                           DENSITY
C  INPUT : (R*8)  PLTEQ() = TOTAL EQUILIBRIUM RADIATED LINE POWER
C                           FUNCTION
C  INPUT : (R*8)  PRADA() = TOTAL EQUILIBRIUM RADIATED POWER FUNCTION
C
C          (I*4)  NDIM1   = PARAMETER = MAXIMUM NUMBER OF TEMP. VALUES
C                           (MUST NOT BE LESS THAN 'NTDIM')
C          (I*4)  NDIM2   = PARAMETER = MAXIMUM NUMBER OF METASTABLES
C                           (MUST NOT BE LESS THAN 'IMDIMD')
C          (I*4)  NGPIC   = PARAMETER = MAXIMUM NUMBER OF LEVEL POPULAT-
C                           IONS TO BE DISPLAYED ON A SINGLE GRAPH.
C          (I*4)  NGLEV   = PARAMETER = MAXIMUM NUMBER OF METASTABLES
C                           WHICH CAN BE LISTED ON THE GRAPH.
C
C          (R*4)  CUTMIN  = PARAMETER = IN DEFAULT GRAPH SCALING IS THE
```

```
C                           MINIMUM Y-VALUE THAT IS ALLOWED.
C                           (NOTE: 'CUTMIN' MUST BE > THAN 'GHZERO')
C          (R*4)  GHZERO  = PARAMETER = VALUE BELOW WHICH GHOST80 TAKES
C                           NUMBERS AS BEING ZERO = 1.0E-36
C
C          (I*4)  IT      = TEMP. INDEX NUMBER FOR ARRAY USE
C          (I*4)  IM      = METASTABLE INDEX NUMBER FOR ARRAY USE
C          (I*4)  IMMAX   = MINIMUM OF: NO. OF METASTABLES OR NGLEV'
C
C          (R*4)  X()     = X-AXIS CO-ORDINATES FOR USE WITH GHOST80
C                           ELECTRON DENSITIES
C          (R*4)  Y(,)    = Y-AXIS CO-ORDINATES FOR USE WITH GHOST80
C                           LEVEL POPULATIONS.
C                           1ST DIMENSION = ELECTRON TEMP. INDEX
C                           2ND DIMENSION = METASTABLE  INDEX
C
C          (C*80) ISPEC   = GRAPH TITLE (INCORPORATES 'ELEMT,IZ0').
C          (C*3)  CNAM()  = 3 BYTE STRING FOR POWER FUNCTION TOTAL NAMES
C          (C*80) CADAS   = ADAS HEADER: INCLUDES RELEASE, PROGRAM, TIME
C          (C*13) DNAME   = '       DATE: '
C          (C*23) XTIT    = X-AXIS UNITS/TITLE
C          (C*23) YTIT    = Y-AXIS UNITS/TITLE
C          (C*9)  KEY0    = '    KEY: '
C          (C*9)  MNMX0   = 'MINIMAX: '
C          (C*9)  FILE0   = 'FILE   : '
C          (C*8)  ADAS0   = 'ADAS   :'
C          (C*28) KEY()   = DESCRIPTIVE KEY FOR GRAPH (2 TYPES)
C
C          (C*1)  GRID    = DUMMY NAME VARIABLE FOR USE WITH GHOST80
C          (C*1)  PIC     = DUMMY NAME VARIABLE FOR USE WITH GHOST80
C          (C*3)  C3BLNK  = BLANK 3 BYTE STRING
C          (C*30) HEAD1   = HEADING FOR LEVEL ASSIGNMENTS
C          (C*30) STRG1   = HEADING FOR LEVEL ASSIGNMENTS
C
C          (L*4)  LGTXT   = .TRUE.  => LAST SCREEN DUMP WAS TEXT.
C                         = .FALSE. => LAST SCREEN DUMP WAS GHOST80.
C
C ROUTINES:
C          ROUTINE     SOURCE    BRIEF DESCRIPTION
C          ------------------------------------------------------------
C
C AUTHOR:  H. P. SUMMERS, JET
C          K1/1/57
C          JET EXT. 4941
C
C DATE:    28/04/94
C
C UNIX-IDL PORT:
C
C VERSION: 1.1                          DATE: 08-11-95
C MODIFIED: TIM HAMMOND (TESSELLA SUPPORT SERVICES PLC)
C               - FIRST RELEASE
C
C VERSION: 1.2                          DATE: 08-11-95
C MODIFIED: TIM HAMMOND (TESSELLA SUPPORT SERVICES PLC)
C               - TIDIED UP MINOR SYNTAX ERRORS
C
C VERSION: 1.3                          DATE: 08-11-95
C MODIFIED: TIM HAMMOND (TESSELLA SUPPORT SERVICES PLC)
C               - TIDIED UP MINOR SYNTAX ERRORS
C
C VERSION: 1.4                          DATE: 08-06-98
C MODIFIED: RICHARD MARTIN
C                   - INCREASED NDIM1 TO 30.
C
C-----------------------------------------------------------------------
      INTEGER   NDIM1    , NDIM2    , NGPIC    , NGLEV
C-----------------------------------------------------------------------
      REAL*4    CUTMIN   , GHZERO
C-----------------------------------------------------------------------
      PARAMETER ( NDIM1= 30  , NDIM2=200        , NGPIC=7 , NGLEV = 55 )
      PARAMETER ( CUTMIN = 1.0E-35 , GHZERO = 1.0E-36 )
C-----------------------------------------------------------------------
      INTEGER   PIPEIN   , PIPEOU
      INTEGER   IMDIMD   , NTDIM
      INTEGER   NMSUM    , ITMAX    ,
     &          IZ0
      INTEGER   IT       , IM       ,
     &          IMMAX
      PARAMETER( PIPEIN=5      , PIPEOU=6  )
C-----------------------------------------------------------------------
      REAL*8    XMIN     , XMAX     ,
     &          YMIN     , YMAX
C-----------------------------------------------------------------------
      LOGICAL   LGHOST   , LGRD1    , LDEF1    , LGTXT
C-----------------------------------------------------------------------
      LOGICAL   LEXSS(8)
C-----------------------------------------------------------------------
      CHARACTER ELEMT*2  , TITLE*40 , GTIT1*40 , DSNINC*44
      CHARACTER YEAR*2   , YEARDF*2
      CHARACTER GRID*1   , PIC*1    , C3BLNK*3 , DATE*8   ,
     &          FILE0*9  , MNMX0*9  , KEY0*9   , ADAS0*8  ,
     &          DNAME*13 , GNAME*10 ,
     &          XTIT*25  , YTIT*23  ,
     &          HEAD1*30 ,
     &          STRG1*30 ,
     &          ISPEC*80 , CADAS*80
C-----------------------------------------------------------------------
```

```
      REAL*4    X(NDIM1)           , Y(NDIM1,NDIM2)      , Z(NDIM1,4)
C-----------------------------------------------------------------------
      CHARACTER POPTIT(IMDIMD)*10   , CNAM(4)*3
      CHARACTER KEY(3)*22
C-----------------------------------------------------------------------
      REAL*8    TEV(NTDIM)
      REAL*8    PLTPEQ(NTDIM,IMDIMD) ,
     &          PRBEQ(NTDIM)  , PRCEQ(NTDIM)   ,  PLTEQ(NTDIM) ,
     &          PRADA(NTDIM)
C-----------------------------------------------------------------------
      SAVE      CADAS
C-----------------------------------------------------------------------
      DATA ISPEC(1:40)
     &          /'POWER FUNCTION VS ELECTRON TEMPERATURE: '/
      DATA (CNAM(IM), IM=1,4)
     &          / 'PRB' , 'PRC' , 'PLT' , 'TOT' /
      DATA XTIT  /'ELECTRON TEMPERATURE (eV)'/
      DATA YTIT  /'POWER FUNCTION (W cm3) '/
      DATA ADAS0 /'ADAS   :'/               ,
     &     FILE0 /'FILE   : '/              ,
     &     MNMX0 /'MINIMAX: '/              ,
     &     KEY0  /'KEY    : '/              ,
     &     KEY(1)/'(FULL LINE - TOTAL   )'/  ,
     &     KEY(2)/' (DASH LINE - PARTIAL)'/  ,
     &     KEY(3)/'                     ) '/
      DATA GRID  /' '/   ,
     &     PIC   /' '/   ,
     &     C3BLNK/'   '/ ,
     &     CADAS /' '/
      DATA DNAME /'       DATE: '/,
     &     GNAME /'SPECIES : '/
      DATA HEAD1 /'---- METASTABLE ASSIGMENTS ---'/
      DATA STRG1 /'INDX        DESIGNATION       '/
C-----------------------------------------------------------------------
```

D5OTG3

```
SUBROUTINE D5OTG3( LGHOST , DATE  ,
     &                   IMDIMD , NTDIM , NDLINE , NDCOMP ,
     &                   ELEMT  , TITLE , GTIT1  , DSNINC ,
     &                   IZ0    , YEAR  , YEARDF ,
     &                   LGRD1  , LDEF1 ,
     &                   XMIN   , XMAX  , YMIN   , YMAX   ,
     &                   NMSUM  , ITMAX ,
     &                   TEV    , POPTIT,
     &                   IBSEL  ,
     &                   NLINE  , NCOMP ,
     &                   TITL   , SPECL , IPLINE ,
     &                   GCFPEQ , GCFEQ
     &                 )
      IMPLICIT NONE
C-----------------------------------------------------------------------
C
C  ***************** FORTRAN77 SUBROUTINE: D5OTG3 *********************
C
C  PURPOSE:  PIPE COMMS WITH IDL
C
C            PROVIDES DATA FOR  GRAPH OF SELECTED GCF FUNCTION AND
C            ITS COMPONENTS
C
C            PLOT IS LOG10(GCF FUNCTION ( CM3 S-1) ) VERSUS
C                    LOG10(ELECTRON TEMPERATURE (EV) )
C
C  CALLING PROGRAM: ADAS405
C
C  SUBROUTINE:
C
C  INPUT : (L*4)  LGHOST   = .TRUE.  => GHOST80 INITIALISED
C                            .FALSE. => GHOST80 NOT INITIALISED
C  INPUT : (C*8)  DATE     = CURRENT DATE AS 'DD/MM/YY'
C
C  INPUT : (I*4)  IMDIMD   = MAXIMUM NUMBER OF METASTABLES ALLOWED
C  INPUT : (I*4)  NTDIM    = MAXIMUM NUMBER OF DENSITIES ALLOWED
C  INPUT : (I*4)  NDLINE   = MAXIMUM NUMBER OF LINES ALLOWED
C  INPUT : (I*4)  NDCOMP   = MAXIMUM NUMBER OF COMPONENT FOR EACH LINE
C
C  INPUT : (C*2)  ELEMT    = ELEMENT SYMBOL.
C  INPUT : (C*40) TITLE    = ISPF ENTERED GENERAL TITLE FOR PROGRAM RUN
C  INPUT : (C*40) GTIT1    = ISPF ENTERED TITLE FOR GRAPH
C  INPUT : (C*44) DSNINC   = INPUT COPASE DATA SET NAME (MVS DSN)
C
C  INPUT : (I*4)  IZ0      = NUCLEAR CHARGE
C  INPUT : (C*2)  YEAR     = TWO DIGIT YEAR NUMBER
C  INPUT : (C*2)  YEARDF   = TWO DIGIT DEFAULT YEAR NUMBER
C
C  INPUT : (L*4)  LGRD1    = .TRUE.  => PUT GRAPH IN GRID FILE
C                            = .FALSE. => DO NOT PUT GRAPH IN GRID FILE
C  INPUT : (L*4)  LDEF1    = .TRUE.  => USE GRAPH DEFAULT SCALING
C                            = .FALSE. => DO NOT USE DEFAULT SCALING
C
C  INPUT : (R*8)  XMIN     = LOWER LIMIT FOR X-AXIS OF GRAPH
C  INPUT : (R*8)  XMAX     = UPPER LIMIT FOR X-AXIS OF GRAPH
C  INPUT : (R*8)  YMIN     = LOWER LIMIT FOR Y-AXIS OF GRAPH
C  INPUT : (R*8)  YMAX     = UPPER LIMIT FOR Y-AXIS OF GRAPH
```

```
C
C  INPUT : (I*4)  NMSUM    = NUMBER OF METASTABLES
C  INPUT : (I*4)  ITMAX    = NUMBER OF INPUT ELECTRON DENSITIES
C
C  INPUT : (R*8)  TEV()    = ELECTRON DENSITIES (UNITS: CM-3)
C
C  INPUT : (C*10) POPTIT() = METASTABLE DESIGNATIONS
C  INPUT : (I*4)  NLINE    = NUMBER OF LINES IDENTIFIED IN SCRIPT
C  INPUT : (I*4)  NCOMP()  = NUMBER OF COMPONENTS OF SCRIPT LINE
C  INPUT : (C*12) TITL(,)  = TITLE FOR LINE COMPONENT
C                            1ST DIM: LINE INDEX
C                            2ND DIM: COMPONENT INDEX
C  INPUT : (C*16) SPECL(,) = SPECIFICATION OF POINTERS OF LINE CPTS.
C                            1ST DIM: LINE INDEX
C                            2ND DIM: COMPONENT INDEX
C  INPUT : (I*4)  IPLINE(,)= METASTABLE POINTER OF LINE COMPONENT
C                            1ST DIM: LINE INDEX
C                            2ND DIM: COMPONENT INDEX
C  INPUT : (R*8)  GCFPEQ(,,)=GCF FUNC. COMPONENT (CM3 S-1)
C                           1ST DIM: TEMPERATURE INDEX
C                           2ND DIM: LINE INDEX
C                           3ND DIM: LINE COMPONENT INDEX
C  INPUT : (R*8)  GCFEQ()  = GCF FUNCTION  (CM3 S-1)
C
C          (I*4)  NDIM1    = PARAMETER = MAXIMUM NUMBER OF TEMP. VALUES
C                            (MUST NOT BE LESS THAN 'NTDIM')
C          (I*4)  NDIM2    = PARAMETER = MAXIMUM NUMBER OF METASTABLES
C                            (MUST NOT BE LESS THAN 'IMDIMD')
C          (I*4)  NGPIC    = PARAMETER = MAXIMUM NUMBER OF LEVEL POPUL-
C                            ATIONS TO BE DISPLAYED ON A SINGLE GRAPH.
C          (I*4)  NGLEV    = PARAMETER = MAXIMUM NUMBER OF METASTABLES
C                            WHICH CAN BE LISTED ON THE GRAPH.
C
C          (R*4)  CUTMIN   = PARAMETER = IN DEFAULT GRAPH SCALING IS
C                            THE  MINIMUM Y-VALUE THAT IS ALLOWED.
C                            (NOTE: 'CUTMIN' MUST BE > THAN 'GHZERO')
C          (R*4)  GHZERO   = PARAMETER = VALUE BELOW WHICH GHOST80 TAKES
C                            NUMBERS AS BEING ZERO = 1.0E-36
C
C          (I*4)  IT       = TEMP. INDEX NUMBER FOR ARRAY USE
C          (I*4)  IC       = LINE COMPONENT INDEX
C          (I*4)  IM       = METASTABLE INDEX NUMBER FOR ARRAY USE
C          (I*4)  IMMAX    = MINIMUM OF: NO. OF METASTABLES OR NGLEV'
C
C          (R*4)  X()      = X-AXIS CO-ORDINATES FOR USE WITH GHOST80
C                             ELECTRON DENSITIES
C          (R*4)  Y(,)     = Y-AXIS CO-ORDINATES FOR USE WITH GHOST80
C                             LEVEL POPULATIONS.
C                             1ST DIMENSION = ELECTRON TEMP. INDEX
C                             2ND DIMENSION = METASTABLE  INDEX
C
C          (L*4)  LPLINE() = .TRUE.  => META. REFERENCED BY A LINE CPT
C                          = .FALSE. => META. NOT REFERENCED BY LINE CPT
C
C          (C*80) ISPEC    = GRAPH TITLE (INCORPORATES 'ELEMT,IZ0').
C          (C*80) CADAS    = ADAS HEADER: INCLUDES RELEASE,PROGRAM,TIME
C          (C*13) DNAME    = '       DATE: '
C          (C*13) FNAME    = 'INPUT FILE : '
C          (C*13) GNAME    = 'GRAPH TITLE: '
C          (C*23) XTIT     = X-AXIS UNITS/TITLE
C          (C*23) YTIT     = Y-AXIS UNITS/TITLE
C          (C*9)  KEY0    = '    KEY: '
C          (C*9)  MNMX0   = 'MINIMAX: '
C          (C*9)  FILE0   = 'FILE   : '
C          (C*8)  ADAS0   = 'ADAS   :'
C          (C*28) KEY()   = DESCRIPTIVE KEY FOR GRAPH (2 TYPES)
C
C          (C*1)  GRID     = DUMMY NAME VARIABLE FOR USE WITH GHOST80
C          (C*1)  PIC      = DUMMY NAME VARIABLE FOR USE WITH GHOST80
C          (C*3)  C3BLNK   = BLANK 3 BYTE STRING
C          (C*3)  CNAM()   = 3 BYTE STRING FOR POWER FUNCT. TOTAL NAMES
c
C          (C*30) HEAD1    = HEADING FOR METASTABLE ASSIGMENTS
C          (C*30) HEAD2    = HEADING FOR SPECTRUM LINE SPECIFICATIONS
C          (C*30) STRG1    = INDX/DESIGNATION TITLE
C          (C*30) STRG3    = COMPONENT TITLE
C          (C*30) STRG4    = COMPONENT PARAMETER TITLE
C          (C*13) STRG5    = TITLE
C          (C*13) STRG6    = SELECT NO.
C          (C*13) STRG7    = COMPONENTS
C
C          (L*4)  LGTXT    = .TRUE.  => LAST SCREEN DUMP WAS TEXT.
C                          = .FALSE. => LAST SCREEN DUMP WAS GHOST80.
C
C ROUTINES:
C          ROUTINE     SOURCE    BRIEF DESCRIPTION
C          ------------------------------------------------------------
C           XXFLSH      IDL_ADAS  FLUSHES OUT UNIX PIPE
C
C
C AUTHOR:  H. P. SUMMERS, JET
C          K1/1/57
C          JET EXT. 4941
C
C DATE:    28/04/94
C
C UNIX-IDL PORT:
C
```

```
C VERSION: 1.1                          DATE: 08-11-95
C MODIFIED: TIM HAMMOND (TESSELLA SUPPORT SERVICES PLC)
C               - FIRST RELEASE
C
C VERSION: 1.2                          DATE: 08-11-95
C MODIFIED: TIM HAMMOND (TESSELLA SUPPORT SERVICES PLC)
C               - CORRECTED MINOR SYNTAX ERRORS
C
C VERSION: 1.3                          DATE: 14-10-95
C MODIFIED: WILLIAM OSBORN (TESSELLA SUPPORT SERVICES PLC)
C               - ADDED I4UNIT WRITES FOR HP MACHINES
C
C VERSION: 1.4                          DATE: 08-06-98
C MODIFIED: RICHARD MARTIN
C                   - INCREASED NDIM1 to 30.
C
C-----------------------------------------------------------------------
      INTEGER   NDIM1    , NDIM2    , NGPIC    , NGLEV
C-----------------------------------------------------------------------
      REAL*4    CUTMIN   , GHZERO
C-----------------------------------------------------------------------
      PARAMETER ( NDIM1= 30  , NDIM2=200        , NGPIC=7 , NGLEV = 55 )
      PARAMETER ( CUTMIN = 1.0E-30 , GHZERO = 1.0E-36 )
C-----------------------------------------------------------------------
      INTEGER   PIPEIN   , PIPEOU
      INTEGER   IMDIMD   , NTDIM    , NDLINE   , NDCOMP
      INTEGER   NMSUM    , ITMAX    , NLINE    , IBSEL    ,
     &          IZ0
      INTEGER   IT       , IM       , I4UNIT   ,
     &          IMMAX    , IC
      PARAMETER( PIPEIN=5      , PIPEOU=6  )
C-----------------------------------------------------------------------
      INTEGER   NCOMP(NDLINE)       , IPLINE(NDLINE,NDCOMP)
C-----------------------------------------------------------------------
      REAL*8    XMIN     , XMAX     ,
     &          YMIN     , YMAX
C-----------------------------------------------------------------------
      LOGICAL   LGHOST   , LGRD1    , LDEF1    , LGTXT
C-----------------------------------------------------------------------
      LOGICAL   LPLINE(NDIM2)
C-----------------------------------------------------------------------
      CHARACTER ELEMT*2  , TITLE*40 , GTIT1*40 , DSNINC*44
      CHARACTER YEAR*2   , YEARDF*2
      CHARACTER GRID*1   , PIC*1    , C3BLNK*3 , DATE*8   ,
     &          FILE0*9  , MNMX0*9  , KEY0*9   , ADAS0*8  ,
     &          DNAME*13 , GNAME*10 ,
     &          XTIT*25  , YTIT*24  ,
     &          HEAD1*30 , HEAD2*30 ,
     &          STRG1*30 , STRG3*30 , STRG4*30 ,
     &          STRG5*13 , STRG6*13 , STRG7*13 ,
     &          ISPEC*80 , CADAS*80
C-----------------------------------------------------------------------
      CHARACTER TITL(NDLINE,NDCOMP)*12 , SPECL(NDLINE,NDCOMP)*16     ,
     &          CNAM(1)*3
C-----------------------------------------------------------------------
      REAL*4    X(NDIM1)            , Y(NDIM1,NDIM2)      , Z(NDIM1,1)
C-----------------------------------------------------------------------
      CHARACTER POPTIT(IMDIMD)*10
      CHARACTER KEY(3)*22
C-----------------------------------------------------------------------
      REAL*8    TEV(NTDIM)
      REAL*8    GCFPEQ(NTDIM,NDLINE,NDCOMP) ,
     &          GCFEQ(NTDIM,NDLINE)
C-----------------------------------------------------------------------
      SAVE      CADAS
C-----------------------------------------------------------------------
      DATA ISPEC(1:40)
     &           /'CONTRIB. FUNCT. VS ELECTRON TEMPERATURE:'/
      DATA XTIT  /'ELECTRON TEMPERATURE (eV)'/
      DATA YTIT  /'CONTRIB. FUNC. (cm3 s-1)'/
      DATA ADAS0 /'ADAS   :'/               ,
     &     FILE0 /'FILE   : '/              ,
     &     MNMX0 /'MINIMAX: '/              ,
     &     KEY0  /'KEY    : '/              ,
     &     KEY(1)/'(FULL LINE - TOTAL   )'/  ,
     &     KEY(2)/' (DASH LINE - PARTIAL)'/  ,
     &     KEY(3)/'                     ) '/
      DATA GRID  /' '/   ,
     &     PIC   /' '/    ,
     &     C3BLNK/'   '/ ,
     &     CADAS /' '/
      DATA DNAME /'       DATE: '/,
     &     GNAME /'SPECIES : '/
      DATA HEAD1 /'---- METASTABLE ASSIGMENTS ---'/,
     &     HEAD2 /'--SPECTRUM LINE SPECIFICATION-'/
      DATA STRG1 /'INDX        DESIGNATION       '/,
     &     STRG3 /'COMPONENT PARAMETERS          '/,
     &     STRG4 /'IC IZ IM  IP  IF  INDX        '/,
     &     STRG5 /'TITLE      = '/,
     &     STRG6 /'SELECT NO. = '/,
     &     STRG7 /'COMPONENTS = '/
C-----------------------------------------------------------------------
      DATA CNAM(1) / 'TOT' /
C-----------------------------------------------------------------------
```

D5OUT0

```
SUBROUTINE D5OUT0( IWRITE   , IMDIMD , NDLINE , NDCOMP , NDRAT  ,
     &                    NDFILE   , DSFULL,
     &                    TITLE    , DATE   ,
     &                    IZ0      , LPART  , YEAR   , YEARDF ,
     &                    LSELA    , LEXSA  , LDEFA  , FILTR  ,
     &                    NFILE    ,
     &                    DSNINC   , DSPECA ,
     &                    NTDIM    , ITMAX  ,
     &                    TEV      , TEVH   , DENS   , DENSH  ,
     &                    IZL      , IZH    , NSTAGE , NMSUM  ,
     &                    POPTIT   , FPABUN ,
     &                    PRBEQ    , PRCEQ  , PLTEQ  , PRAD   ,
     &                    NLINE    , NCOMP  ,
     &                    IZION    , IMET   , CIMET  , INDPH  , CINDPH ,
     &                    IFILE    , TITL   ,
     &                    GCFPEQ   , LPEC   , GCF    ,
     &                    NRAT     ,
     &                    ILINE    , JLINE  , TITR   ,
     &                    RATA     , CADAS
     &                  )
       IMPLICIT NONE
C-----------------------------------------------------------------------
C
C  ****************** FORTRAN77 SUBROUTINE: D5OUT0 *********************
C
C  PURPOSE:  TO  PRINT PRIMARY OUTPUT FROM IONISATION BALANCE PROGRAM
C            ADAS405
C
C  CALLING PROGRAM: ADAS405
C
C  SUBROUTINE:
C
C  INPUT : (I*4)  IWRITE   = OUTPUT UNIT FOR RESULTS
C  INPUT : (I*4)  IMDIMD   = MAXIMUM NUMBER OF CHARGE/MET STATES
C  INPUT : (I*4)  NDLINE   = MAXIMUM NUMBER OF LINES ALLOWED
C  INPUT : (I*4)  NDCOMP   = MAXIMUM NUMBER OF COMPONENT FOR EACH LINE
C  INPUT : (I*4)  NDRAT    = MAXIMUM NUMBER OF LINE RATIOS ALLOWED
C  INPUT : (I*4)  NDFILE   = MAXIMUM NUMBER OF EMISSIVITY FILES
C
C  INPUT : (C*40) TITLE    = TITLE OF RUN (READ FROM ISPF PANEL)
C  INPUT : (C*8)  DATE     = CURRENT DATE (AS 'DD/MM/YY')
C
C  INPUT : (I*4)  IZ0      = INPUT FILE: EMITTING ION NUCLEAR CHARGE
C  INPUT : (L*4)  LPART    = .TRUE.  => PARTIAL DATA SELECTED
C                            = .FALSE. => STANDARD DATA SELECTED
C  INPUT : (C*2)  YEAR     = SELECTED YEAR -  TWO DIGIT YEAR NUMBER
C  INPUT : (C*2)  YEARDF   = DEFAULT YEAR - TWO DIGIT YEAR NUMBER
C  INPUT : (L*4)  LSELA()  = .TRUE.  => INPUT DATA SET TYPE FOR THIS
C                                       INDEX SELECTED
C                            = .FALSE. => INPUT DATA SET FOR THIS INDEX
C                                       NOT SELECTED
C  INPUT : (L*4)  LEXSA()  = .TRUE.  => INPUT DATA SET TYPE FOR THIS
C                                       SELECTED INDEX EXISTS
C                            = .FALSE. => INPUT DATA SET DOES NOT EXIST
C                                       FOR THIS SELECTED INDEX
C  INPUT : (L*4)  LDEFA()  = .TRUE.  => INPUT DATA SET TYPE FOR THIS
C                                       DEFAULT YEAR INDEX EXISTS
C                            = .FALSE. => INPUT DATA SET DOES NOT EXIST
C                                        FOR THIS DEFAULT YEAR INDEX
C  INPUT : (C*7)  FILTR    = STRING GIVING FILTER NAME PART OF FILES
C  INPUT : (I*4)  NFILE    = NUMBER OF PEC FILES ACCESSED
C  INPUT : (C*80) DSNINC   = NAME OF SCRIPT FILE
C  INPUT : (C*80) DSFULL   = NAME OF OUTPUT TEXT FILE
C  INPUT : (C*80) DSGCFPEQ() = NAMES OF PHOTON EMIISVITY COEFFICIENT FILES
C  INPUT : (I*4)  NTDIM    = MAXIMUM NUMBER OF TE/NE PAIRS
C  INPUT : (I*4)  ITMAX    = NUMBER OF OUTPUT TEMPERATURES
C
C  INPUT : (R*8)  TEV()    = SELECTED ELECTRON TEMPERATURES (EV)
C  INPUT : (R*8)  TEVH()   = SELECTED HYDROGEN TEMPERATURES (EV)
C  INPUT : (R*8)  DENS()   = SELECTED ELECTRON DENSITIES (CM-3)
C  INPUT : (R*8)  DENSH()  = SELECTED HYDROGEN DENSITIES (CM-3)
C  INPUT : (I*4)  IZL      = LOWEST ION CHARGE+1
C  INPUT : (I*4)  IZH      = HIGHEST ION CHARGE +1 (EXCL BARE NUCL.)
C  INPUT : (I*4)  NSTAGE   = NUMBER OF IONISATION STAGES
C  INPUT : (I*4)  NMSUM    = TOTAL METASTABLE STATE SUM
C  INPUT : (R*8)  POPTIT() = (ION/MET) POPULATION TITLE
C  INPUT : (R*8)  FPABUN(,)= (ION/MET) POPULATION FRACTION
C                            1ST.DIM: TEMPERATURE INDEX
C                            2ND.DIM: (ION/MET) STATE INDEX
C  INPUT : (R*8)  PRBEQ()  = EQUIL. RECOM/BREMS. POWER FUNCT.(W CM3)
C  INPUT : (R*8)  PRCEQ()  = EQUIL. CX/RECOM.    POWER FUNCT.(W CM3)
C  INPUT : (R*8)  PLTEQ()  = EQUIL. LOW LINE     POWER FUNCT.(W CM3)
C  INPUT : (R*8)  PRAD()   = EQUIL. TOTAL RAD.   POWER FUNCT.(W CM3)
C  INPUT : (I*4)  NCOMP()  = NUMBER OF COMPONENTS OF SCRIPT LINE
C                            1ST DIM: LINE INDEX
C  INPUT : (I*4)  IZION(,) = CHARGE STATE OF COMPONENT
C                            1ST DIM: LINE INDEX
C                            2ND DIM: COMPONENT INDEX
C  INPUT : (I*4)  IMET(,)  = NUMBER OF COMPONENTS OF SCRIPT LINE
C                            1ST DIM: LINE INDEX
C                            2ND DIM: COMPONENT INDEX
C  INPUT : (C*1)  CIMET(,) = SIGN (+, BLANK OR -) OF METASTABLE
C                            1ST DIM: LINE INDEX
C                            2ND DIM: COMPONENT INDEX
```

```
C  INPUT : (I*4)  INDPH(,) = PEC FILE INDEX OF LINE COMPONENT
C                            1ST DIM: LINE INDEX
C                            2ND DIM: COMPONENT INDEX
C  INPUT : (C*1   CINDPH(,)= DRIVER (E OR BLANK => ELECTRONS)
C                                    (H          => HYDROGEN )
C                             1ST DIM: LINE INDEX
C                             2ND DIM: COMPONENT INDEX
C  INPUT : (I*4)  IFILE(,) = INDEX OF PEC FILE IN FILE LIST
C                            1ST DIM: LINE INDEX
C                            2ND DIM: COMPONENT INDEX
C  INPUT : (R*8)  GCFPEQ(,,)= GCF FUNC. COMPONENT (CM3 S-1)
C                            1ST DIM: TEMPERATURE INDEX
C                            2ND DIM: LINE INDEX
C                            3RD DIM: LINE COMPONENT INDEX
C  INPUT : (L*4)  LPEC(,)  = .TRUE.  => PHOTON EMISSIVITY OBTAINED
C                            .FALSE. => PHOTON EMISSIVITY NOT OBTAINED
C                            1ST DIM: LINE INDEX
C                            2ND DIM: COMPONENT INDEX
C  INPUT : (R*8)  GCF(,)   = LINE GTE FUNCTIONS (CM3 S-1)
C                            1ST IND: TEMPERATURE INDEX
C                            2ND IND: LINE INDEX
C  INPUT : (C*12) TITL(,)  = TITLE FOR LINE COMPONENT
C                            1ST DIM: LINE INDEX
C                            2ND DIM: COMPONENT INDEX
C  INPUT : (I*4)  NRAT     = NUMBER OF RATIOS IDENTIFIED IN SCRIPT
C  INPUT : (I*4)  ILINE()  = INDEX OF NUMERATOR LINE FOR LINE RATIO
C  INPUT : (I*4)  JLINE()  = INDEX OF DENOMINATOR LINE FOR LINE RATIO
C  INPUT : (C*25) TITR()   = TILE FOR LINE RATIO
C  INPUT : (R*8)  RATA(,)  = LINE GCF RATIOS
C                            1ST IND: TEMPERATURE INDEX
C                            2ND IND: RATIO INDEX
C
C
C          (I*4)  I        = GENERAL USE - ARRAY ELEMENT INDEX
C          (I*4)  J        = GENERAL USE - ARRAY ELEMENT INDEX
C          (I*4)  IP       = GENERAL USE - ARRAY ELEMENT INDEX
C          (I*4)  IF       = GENERAL USE
C          (I*4)  IL       = GENERAL USE
C          (I*4)  IC       = GENERAL USE
C          (I*4)  IR       = GENERAL USE
C          (I*4)  ITL      = GENERAL USE
C          (I*4)  ITU      = GENERAL USE
C          (R*8)  EV       = PARAMETER = EV/KELVIN CONVERSION CONSTANT
C
C          (C*12) XFELEM   = FUNCTION - (SEE ROUTINES SECTION BELOW)
C          (C*12) CELEM    = EMITTING ION  ELEMENT NAME
C          (C*80) CADAS    = ADAS HEADER: INCLUDES RELEASE,PROGRAM,TIME
C
C ROUTINES:
C          ROUTINE    SOURCE    BRIEF DESCRIPTION
C          ------------------------------------------------------------
C          XXADAS     ADAS      GATHERS ADAS HEADER INFORMATION
C          XFELEM     ADAS      CHARACTER*12 FUNCTION -
C                               RETURNS ELEMENT NAME   FOR GIVEN Z0
C
C AUTHOR  : H. P. Summers, JET
C           K1/1/57
C           JET EXT. 4941
C
C DATE:    27/04/44
C
C UNIX-IDL PORT:
C
C VERSION: 1.1                          DATE: 08-11-95
C MODIFIED: TIM HAMMOND (TESSELLA SUPPORT SERVICES PLC)
C               - FIRST RELEASE
C
C VERSION: 1.2                          DATE: 13-11-95
C MODIFIED: TIM HAMMOND (TESSELLA SUPPORT SERVICES PLC)
C               - REMOVED READING OF CADAS TO D5SPF1 TO
C                 SIMPLIFY WORKINGS OF PROGRAM
C
C VERSION: 1.3                          DATE: 05-12-95
C MODIFIED: TIM HAMMOND (TESSELLA SUPPORT SERVICES PLC)
C               - CONCATENATED SEVERAL LINES IN FORMAT STATEMENT 1023
C                 AS THERE WERE TOO MANY LINE CONTINUATION
C                 CHARACTERS FOR SOME PLATFORMS.
C
C Version: 1.4                          Date: 25/3/97
C Modified: Richard Martin
C               FILTR changed from CHAR*6 to CHAR*7 to accomodate longer
C               filter names in accordance with ADAS408.
C
C-----------------------------------------------------------------------
      REAL*8     EV
C-----------------------------------------------------------------------
      PARAMETER ( EV = 11605.4 )
C-----------------------------------------------------------------------
      INTEGER    IWRITE        , IMDIMD       , NDLINE      , NDCOMP
      INTEGER    NDRAT         , NDFILE       , NTDIM
      INTEGER    IZ0           , I            , J           , ITMAX
      INTEGER    IZL           , IZH          , NSTAGE      , NMSUM
      INTEGER    ITL           , ITU          , IP          , IF
      INTEGER    IL            , IC           , IR
      INTEGER    NFILE         , NLINE        , NRAT
C-----------------------------------------------------------------------
      INTEGER    NCOMP(NDLINE)        ,
     &           IZION(NDLINE,NDCOMP) , IMET(NDLINE,NDCOMP)  ,
```

```
     &           INDPH(NDLINE,NDCOMP) , IFILE(NDLINE,NDCOMP)
      INTEGER    ILINE(NDRAT)         , JLINE(NDRAT)
C-----------------------------------------------------------------------
      LOGICAL    LPART
C-----------------------------------------------------------------------
      CHARACTER  TITLE*(*)     , DATE*8    , CRESOL*12
      CHARACTER  XFELEM*12     ,
     &           CELEM*12      , CADAS*80  ,
     &           YEAR*2        , YEARDF*2  , FILTR*7   ,
     &           CT*1          , CS*1
      CHARACTER  CCLASS(8)*3
      CHARACTER  DASHES*10     , BLANKS*10 , CLINE*100
      CHARACTER  DSNINC*80
C-----------------------------------------------------------------------
      CHARACTER  POPTIT(IMDIMD)*10
      CHARACTER  TITL(NDLINE,NDCOMP)*12 , TITR(NDRAT)*25
      CHARACTER  CIMET(NDLINE,NDCOMP)*1 , CINDPH(NDLINE,NDCOMP)*1
      CHARACTER  DSPECA(NDFILE)*120, DSFULL*80
C-----------------------------------------------------------------------
      REAL*8     TEV(NTDIM)  , TEVH(NTDIM) , DENS(NTDIM) , DENSH(NTDIM)
      REAL*8     PRBEQ(NTDIM), PRCEQ(NTDIM), PLTEQ(NTDIM), PRAD(NTDIM)
      REAL*8     FPABUN(NTDIM,IMDIMD)
      REAL*8     GCFPEQ(NTDIM,NDLINE,NDCOMP)
      REAL*8     GCF(NTDIM,NDLINE)
      REAL*8     RATA(NTDIM,NDRAT)
C-----------------------------------------------------------------------
      LOGICAL    LSELA(8)    , LEXSA(8)    , LDEFA(8)
      LOGICAL    LPEC(NDLINE,NDCOMP)
C-----------------------------------------------------------------------
      DATA       (CCLASS(I),I=1,8)/'ACD','SCD','CCD','PRB',
     &                            'PRC','QCD','XCD','PLT'/
      DATA       DASHES/'----------'/ , BLANKS/'          '/
C-----------------------------------------------------------------------
```

D5SCRP

```
SUBROUTINE D5SCRP( LRSCRP , LSNULL  ,
     &                    DSNINC , DSPECA  ,
     &                    NDLINE , NDCOMP  , NDRAT  , NDFILE ,
     &                    NFILE  , LFILE   ,
     &                    UID    , GROUP   , TYPE   , EXT    , ION    ,
     &                    MEMB   , IZ0     ,
     &                    NLINE  , NCOMP   ,
     &                    IZION  , IMET    , CIMET  , INDPH  , CINDPH ,
     &                    IFILE  , TITL    ,
     &                    NRAT   ,
     &                    ILINE  , JLINE   , TITR   , IRCODE
     &                  )
       IMPLICIT NONE
C-----------------------------------------------------------------------
C
C  ****************** FORTRAN77 SUBROUTINE: D5SCRP  *********************
C
C  PURPOSE: TO READ SCRIPT FILE AND ACCESS EMISSIVITY DATA
C           ON SPECTRAL LINES REQUESTED FOR FURTHER PROCESSING IN
C           EQUILIBRIUM IONISATION CODES.
C
C  CALLING PROGRAM: ADAS405
C
C  SUBROUTINE:
C
C  INPUT : (C*120) DSNINC   = SCRIPT DATA SET NAME (FULL MVS DSN)
C                             (IN FORM SUITABLE FOR DYNAMIC ALLOCATION)
C  INPUT : (I*4)   NDLINE   = MAXIMUM NUMBER OF LINES ALLOWED
C  INPUT : (I*4)   NDCOMP   = MAXIMUM NUMBER OF COMPONENT FOR EACH LINE
C  INPUT : (I*4)   NDRAT    = MAXIMUM NUMBER OF LINE RATIOS ALLOWED
C  INPUT : (I*4)   NDFILE   = MAXIMUM NUMBER OF EMISSIVITY FILES WHICH
C                             CAN BE SEARCHED
C
C  OUTPUT: (L*4)   LRSCRP   = .TRUE.  => SCRIPT FILE READ
C                             .FALSE. => SCRIPT FILE NOT READ
C  OUTPUT: (L*4)   LSNULL   = .TRUE.  => SCRIPT FILE SET TO NULL
C                             .FALSE. => SCRIPT FILE VALID
C  OUTPUT: (C*120) DSPECA() = PHOTON EMISSIVITY SOURCE FILES
C  OUTPUT: (I*4)   NFILE    = NUMBER OF PEC FILES TO BE SCANNED
C  OUTPUT: (L*4)   LFILE()  = .TRUE.  => PEC FILE EXISTS AND MATCHES
C                             .FALSE. => PEC FILE DOES NOT EXIST/MATCH
C  OUTPUT: (C*6)   UID()    = USER IDENTIFIER OF PEC FILE
C  OUTPUT: (C*8)   GROUP()  = GROUP IDENTIFIER OF PEC FILE
C  OUTPUT: (C*5)   TYPE()   = TYPE IDENTIFIER OF PEC FILE
C  OUTPUT: (C*3)   EXT()    = EXTENSION OF PEC FILE MEMBER NAME
C  OUTPUT: (C*4)   ION()    = ION NAME OF PEC FILE MEMBER NAME
C  OUTPUT: (C*8)   MEMB()   = MEMBER NAME OF PEC FILE
C  OUTPUT: (I*4)   NLINE    = NUMBER OF LINES IDENTIFIED IN SCRIPT
C  OUTPUT: (I*4)   NCOMP()  = NUMBER OF COMPONENTS OF SCRIPT LINE
C                             1ST DIM: LINE INDEX
C  OUTPUT: (I*4)   IZION(,) = CHARGE STATE OF COMPONENT
C                             1ST DIM: LINE INDEX
C                             2ND DIM: COMPONENT INDEX
C  OUTPUT: (I*4)   IMET(,)  = NUMBER OF COMPONENTS OF SCRIPT LINE
C                             1ST DIM: LINE INDEX
C                             2ND DIM: COMPONENT INDEX
C  OUTPUT: (C*1)   CIMET(,) = SIGN (+, BLANK OR -) OF METASTABLE
C                             1ST DIM: LINE INDEX
```

```
C                               2ND DIM: COMPONENT INDEX
C  OUTPUT: (I*4)   INDPH(,) = PEC FILE INDEX OF LINE COMPONENT
C                               1ST DIM: LINE INDEX
C                               2ND DIM: COMPONENT INDEX
C  OUTPUT: (C*1)   CINDPH(,)= DRIVER (E OR BLANK => ELECTRONS)
C                                 (H         => HYDROGEN )
C                               1ST DIM: LINE INDEX
C                               2ND DIM: COMPONENT INDEX
C  OUTPUT: (I*4)   IFILE(,) = INDEX OF PEC FILE IN FILE LIST
C                               1ST DIM: LINE INDEX
C                               2ND DIM: COMPONENT INDEX
C  OUTPUT: (C*12)  TITL(,)  = TITLE FOR LINE COMPONENT
C                               1ST DIM: LINE INDEX
C                               2ND DIM: COMPONENT INDEX
C  OUTPUT: (I*4)   NRAT     = NUMBER OF RATIOS IDENTIFIED IN SCRIPT
C  OUTPUT: (I*4)   ILINE()  = INDEX OF NUMERATOR LINE FOR LINE RATIO
C  OUTPUT: (I*4)   JLINE()  = INDEX OF DENOMINATOR LINE FOR LINE RATIO
C  OUTPUT: (C*25)  TITR()   = TILE FOR LINE RATIO
C  OUTPUT: (I*4)   IRCODE   = ERROR FLAG:
C                               0 => SCRIPT FILE WAS READ OKAY
C                               1 => SCRIPT FILE DOES NOT EXIST
C                               2 => I/O ERROR READING THE SCRIPT FILE
C                               3 => 1 OR MORE FILE NAMES IN SCRIPT FILE
C                                    IS/ARE INVALID.
C
C          (I*4)   IUNT10  = PARAMETER = INPUT UNIT FOR DATA
C          (L*4)   OPEN10  = .TRUE.  => FILE ALLOCATED TO UNIT 10.
C                            .FALSE. => NO FILE ALLOCATED TO UNIT 10.
C
C ROUTINES:
C          ROUTINE    SOURCE   BRIEF DESCRIPTION
C          ------------------------------------------------------------
C          XXSLEN     ADAS     FIND NON-BLANK CHARACTERS IN STRING
C
C
C AUTHOR:  H. P. SUMMERS, JET
C          K1/1/57
C          JET EXT. 4941
C
C DATE:    20/04/94
C
C IDL-UNIX PORT:
C VERSION: 1.1                  DATE:    08/11/95
C MODIFIED: TIM HAMMOND
C               - ADDED SCCS HEADER - FIRST VERSION
C
C VERSION: 1.2                  DATE:    08/11/95
C MODIFIED: TIM HAMMOND
C               - REMOVED SUPERFLUOUS VARIABLES
C
C VERSION: 1.3                  DATE:    10/11/95
C MODIFIED: TIM HAMMOND
C               - ADDED NEW ERROR CHECK VARIABLE IRCODE TO SEE
C                 WHETHER THE SCRIPT FILE WAS READ OKAY OR NOT.
C
C-----------------------------------------------------------------------
C
C-----------------------------------------------------------------------
      INTEGER    IUNT10  , IRCODE
C-----------------------------------------------------------------------
      PARAMETER( IUNT10 = 10 )
C-----------------------------------------------------------------------
      INTEGER    NDLINE  , NDCOMP  , NDRAT   , NDFILE ,
     &           NLINE   , NRAT    , NFILE   , IFIRST , ILAST ,
     &           INDL    , INDC    , INDR    , I       , J      ,
     &           IZ      , IZ0
C-----------------------------------------------------------------------
      INTEGER    NCOMP(NDLINE)        ,
     &           IZION(NDLINE,NDCOMP) , IMET(NDLINE,NDCOMP)  ,
     &           INDPH(NDLINE,NDCOMP) , IFILE(NDLINE,NDCOMP) ,
     &           ILINE(NDRAT)         , JLINE(NDRAT)
C-----------------------------------------------------------------------
      CHARACTER  DSNINC*120  , CLINE*120 , ELEM*2    , CSTRNG*5  ,
     &           DSNPEC*80   , IONT*4    ,  CIZ*2
C-----------------------------------------------------------------------
      CHARACTER  CIMET(NDLINE,NDCOMP)*1 , CINDPH(NDLINE,NDCOMP)*1 ,
     &           TITL(NDLINE,NDCOMP)*12 , TITR(NDRAT)*25          ,
     &           UID(NDFILE)*6  , GROUP(NDFILE)*8, TYPE(NDFILE)*5 ,
     &           MEMB(NDFILE)*8 , EXT(NDFILE)*3  , ION(NDFILE)*4
      CHARACTER  DSPECA(NDFILE)*120
C-----------------------------------------------------------------------
      LOGICAL    OPEN10      , LRSCRP    , LSNULL   , LEXIST
C-----------------------------------------------------------------------
      LOGICAL    LFILE(NDFILE)
C-----------------------------------------------------------------------
      DATA OPEN10 /.FALSE./
C-----------------------------------------------------------------------
```

D5SGCF

```
SUBROUTINE D5SGCF( IZ0    , IZL    , IZH    ,
     &                   ISDIMD , IZDIMD , ITDIMD , IPDIMD , IMDIMD ,
     &                   NMSUM  , IZIP   , IMIP   , IPIZM  ,
     &                   NDLINE , NDCOMP ,
```

```
     &                    NLINE  , NCOMP  , SPECL  , IPLINE ,
     &                    IZION  , IMET   , CIMET  , INDPH  , CINDPH ,
     &                    IFILE  ,
     &                    NTDIM  , ITMAX  ,
     &                    DENS   , DENSH  ,
     &                    PECA   , LPEC   ,
     &                    FPABUN ,
     &                    GCFPEQ , GCFEQ  ,
     &                    NDRAT  , NRAT   ,
     &                    ILINE  , JLINE  ,
     &                    RATA
     &                  )
       IMPLICIT NONE
C
C-----------------------------------------------------------------------
C
C  ****************** FORTRAN77 SUBROUTINE: D5SGCF *********************
C
C PURPOSE : TO ASSEMBLE GCF FUNCTIONS AND THEIR COMPONENTS USING
C           FRACTIONAL METASTABLE ABUNDANCES.
C
C
C
C INPUT  : (I*4)  IZ0       = NUCLEAR CHARGE
C INPUT  : (I*4)  IZL       = MINIMUM ION CHARGE+1 IN MASTER DATA FILES
C INPUT  : (I*4)  IZH       = MAXIMUM ION CHARGE+1 IN MASTER DATA FILES
C INPUT  : (I*4)  ISDIMD    = MAXIMUM NUMBER OF (CHARGE, PARENT, GROUND)
C                             BLOCKS IN ISONUCLEAR MASTER FILES
C INPUT  : (I*4)  IZDIMD    = MAXIMUM NUMBER OF CHARGE STATES
C                             IN ISONUCLEAR MASTER FILES
C INPUT  : (I*4)  ITDIMD    = MAXIMUM NUMBER OF TEMP OR DENS VALUES IN
C                             ISOELECTRONIC MASTER FILES
C INPUT  : (I*4)  IPDIMD    = MAXIMUM NUMBER OF METASTABLES FOR EACH
C                             IONISATION STAGE
C INPUT  : (I*4)  IMDIMD    = MAXIMUM NUMBER OF METASTABLES
C
C INPUT  : (I*4)  NMSUM     = TOTAL NUMBER OF POPULATIONS
C
C INPUT  :        IZIP()    = ION CHARGE +1 (IZ1) OF METASTABLE IN LIST
C INPUT  :        IMIP()    = METASTABLE INDEX WITHIN CHARGE STATE IZ1
C                             OF METASTABLE INDEX FROM COMPLETE LIST
C INPUT  :        IPIZM(,)  = METASTABLE INDEX IN COMPLETE LIST
C                             1ST DIM: INDEX IZ1-IZL+1
C                             2ND DIM: METASTABLE COUNT FOR STAGE (IGRD)
C INPUT  : (I*4)  NDLINE    = MAXIMUM NUMBER OF LINES ALLOWED
C INPUT  : (I*4)  NDCOMP    = MAXIMUM NUMBER OF COMPONENT FOR EACH LINE
C INPUT  : (I*4)  NLINE     = NUMBER OF LINES IDENTIFIED IN SCRIPT
C INPUT  : (I*4)  NCOMP()   = NUMBER OF COMPONENTS OF SCRIPT LINE
C INPUT  : (I*4)  IZION(,)  = CHARGE STATE OF COMPONENT
C                             1ST DIM: LINE INDEX
C                             2ND DIM: COMPONENT INDEX
C INPUT  : (I*4)  IMET(,)   = METASTABLE INDEX OF COMPONENT OF
C                             SCRIPT LINE WITHIN CHARGE STATE
C                             1ST DIM: LINE INDEX
C                             2ND DIM: COMPONENT INDEX
C INPUT  : (C*1)  CIMET(,)  = SIGN (+, BLANK OR -) OF METASTABLE
C                             1ST DIM: LINE INDEX
C                             2ND DIM: COMPONENT INDEX
C INPUT  : (I*4)  INDPH(,)  = PEC FILE INDEX OF LINE COMPONENT
C                             1ST DIM: LINE INDEX
C                             2ND DIM: COMPONENT INDEX
C INPUT  : (C*1   CINDPH(,) = DRIVER (E OR BLANK => ELECTRONS)
C                                    (H          => HYDROGEN )
C                              1ST DIM: LINE INDEX
C                              2ND DIM: COMPONENT INDEX
C INPUT  : (I*4)  IFILE(,)  = INDEX OF PEC FILE IN FILE LIST
C                             1ST DIM: LINE INDEX
C                             2ND DIM: COMPONENT INDEX
C INPUT  : (I*4)  NTDIM     = MAXIMUM NUMBER OF DTEV/DDENS PAIRS
C INPUT  : (I*4)  ITMAX     = NUMBER OF ( DTEV() , DDENS() ) PAIRS
C INPUT  : (R*8)  DENS()    = ELECTRON DENSITIES (CM-3))
C INPUT  : (R*8)  DENSH()   = HYDROGEN DENSITIES (CM-3))
C INPUT  : (R*8)  PECA(,,)  = PHOTON EMISSIVITY COEFFICIENTS (CM3 S-1)
C                             1ST DIM: TEMPERATURE INDEX
C                             2ND DIM: LINE INDEX
C                             3RD DIM: COMPONENT INDEX
C INPUT  : (L*4)  LPEC(,)   = .TRUE.  => PHOTON EMISSIVITY OBTAINED
C                             .FALSE. => PHOTON EMISSIVITY NOT OBTAINED
C                             2ND DIM: LINE INDEX
C                             3RD DIM: COMPONENT INDEX
C INPUT  : (R*8)  FPABUN(,) = RESOLVED METASTABLE EQUILIBRIUM
C                             FRACTIONAL ABUNDANCES
C                             1ST DIM: - TEMPERATURE/DENSITY PAIR
C                             2ND DIM: - METASTABLE INDEX
C INPUT  : (I*4)  NDRAT     = MAXIMUM NUMBER OF LINE RATIOS ALLOWED
C INPUT  : (I*4)  NRAT      = NUMBER OF RATIOS IDENTIFIED IN SCRIPT
C INPUT  : (I*4)  ILINE()   = INDEX OF NUMERATOR LINE FOR LINE RATIO
C INPUT  : (I*4)  JLINE()   = INDEX OF DENOMINATOR LINE FOR LINE RATIO
C
C OUTPUT : (C*16) SPECL(,)  = SPEC. OF POINTERS OF LINE COMPONENT
C                             1ST DIM: LINE INDEX
C                             2ND DIM: COMPONENT INDEX
C OUTPUT : (I*4)  IPLINE(,) = METASTABLE POINTER OF LINE COMPONENT
C                             1ST DIM: LINE INDEX
C                             2ND DIM: COMPONENT INDEX
C OUTPUT : (R*8)  GCFPEQ(,,)= GCF FUNC. COMPONENT (CM3 S-1)
C                             1ST DIM: TEMPERATURE INDEX
C                             2ND DIM: LINE INDEX
```

```
C                               3ND DIM: LINE COMPONENT INDEX
C OUTPUT : (R*8)  GCFEQ(,)  = GCF FUNCTION  (CM3 S-1)
C                               1ST DIM: TEMPERATURE INDEX
C                               2ND DIM: LINE INDEX
C OUTPUT : (R*8)  RATA(,)   = LINE GCF RATIOS
C                               1ST IND: TEMPERATURE INDEX
C                               2ND IND: RATIO INDEX
C
C
C PROGRAM: (I*4)  IT        = GENERAL INDEX FOR TEMPERATURE
C          (I*4)  IZ        = GENERAL INDEX FOR CHARGE
C          (I*4)  IP        = GENERAL INDEX FOR CHARGE
C          (I*4)  IZ1       = GENERAL INDEX FOR CHARGE+1
C          (I*4)  IL        = GENERAL INDEX FOR LINE
C          (I*4)  IR        = GENERAL INDEX FOR RATIO
C          (I*4)  ICPT      = GENERAL INDEX FOR LINE COMPONENT
C
C
C ROUTINES:
C          ROUTINE    SOURCE    BRIEF DESCRIPTION
C          ------------------------------------------------------------
C
C
C AUTHOR : H. P. SUMMERS, JET
C          K1/1/57
C          JET  EXT. 4941
C
C DATE   : 03/05/94
C
C UNIX-IDL PORT:
C
C VERSION: 1.1                          DATE: 08-11-95
C MODIFIED: TIM HAMMOND (TESSELLA SUPPORT SERVICES PLC)
C               - FIRST RELEASE
C
C VERSION: 1.2                          DATE: 08-11-95
C MODIFIED: TIM HAMMOND (TESSELLA SUPPORT SERVICES PLC)
C               - REMOVED SUPERFLUOUS VARIABLES
C
C-----------------------------------------------------------------------
       INTEGER   IZ0
       INTEGER   IZ1     , IZL     , IZH     , NTDIM   , ITMAX   , NMSUM
       INTEGER   ISDIMD  , IZDIMD  , ITDIMD  , IPDIMD  , IMDIMD
       INTEGER   NDLINE  , NDCOMP  , NLINE   , NDRAT   , NRAT
       INTEGER   IT
       INTEGER   IL      , IR      , ICPT
C-----------------------------------------------------------------------
       INTEGER   IZIP(IMDIMD)   , IMIP(IMDIMD) ,
     &           IPIZM(IZDIMD,IPDIMD)
       INTEGER   NCOMP(NDLINE)         ,
     &           IZION(NDLINE,NDCOMP) , IMET(NDLINE,NDCOMP)  ,
     &           INDPH(NDLINE,NDCOMP) , IFILE(NDLINE,NDCOMP) ,
     &           IPLINE(NDLINE,NDCOMP)
       INTEGER   ILINE(NDRAT)          , JLINE(NDRAT)
C-----------------------------------------------------------------------
       REAL*8    DNS           , DNSH
C-----------------------------------------------------------------------
       REAL*8    DENS(NTDIM)   , DENSH(NTDIM)   ,
     &           GCFEQ(NTDIM,NDLINE)
C
       REAL*8    FPABUN(NTDIM,IMDIMD)
C
       REAL*8    PECA(NTDIM,NDLINE,NDCOMP) , GCFPEQ(NTDIM,NDLINE,NDCOMP)
C
       REAL*8    RATA(NTDIM,NDRAT)
C
C-----------------------------------------------------------------------
       CHARACTER SPECL(NDLINE,NDCOMP)*16
       CHARACTER CIMET(NDLINE,NDCOMP)*1 , CINDPH(NDLINE,NDCOMP)*1
C-----------------------------------------------------------------------
       LOGICAL   LPEC(NDLINE,NDCOMP)
C-----------------------------------------------------------------------
```

D5SPC2

```
SUBROUTINE D5SPC2( DSNAME, IBSEL  , IZIN   , IZ0IN  ,
     &                   ITVAL  , TVAL   , DVAL   ,
     &                   WLNGTH ,
     &                   PECA   , LTRNG  , LDRNG  ,
     &                   TITLX  , IRCODE
     &                 )
      IMPLICIT NONE
C-----------------------------------------------------------------------
C
C  ****************** FORTRAN77 SUBROUTINE: D5PSC2 *******************
C
C  PURPOSE: TO EXTRACT AND INTERPOLATE  PHOTON EMISSIVITIES FOR
C           EMITTING IONS.
C
C            THIS IS A NEW ROUTINE, WRITTEN BECAUSE OF THE VERY
C           NAMING CONVENTIONS ON THE IBM AND UNIX MACHINES.
C           IT REPLACES THE OLD SPEC FORTRAN ROUTINE AND A LOT
C           OF THE OBSOLETE FUNCTIONALITY THEREIN. THIS ROUTINE
C           TAKES AS INPUT THE NAMES OF THE PHOTON EMISSIVITY FILES
```

```
C           AND CHECKS THEY ARE THERE BEFORE OPENING THEM AND
C           EXTRACTING ALL REQUIRED INFORMATION.
C
C  CALLING PROGRAM: D5SPEC
C
C  SUBROUTINE:
C
C  INPUT : (I*4)   IBSEL   = INDEX OF DATA-BLOCK SELECTED FOR ANALYSIS
C  INPUT : (I*4)   IZIN    = ION CHARGE OF EMITTING ION
C  INPUT : (I*4)   IZ0IN   = NUCLEAR CHARGE OF EMITTING ION
C
C  INPUT : (I*4)   ITVAL   = NO. OF ELECTRON TEMPERATURE/DENSITY PAIRS
C  INPUT : (R*8)   TVAL()  = ELECTRON TEMPERATURES (UNITS: EV)
C                            DIMENSION: TEMPERATURE/DENSITY PAIR INDEX
C  INPUT : (R*8)   DVAL()  = ELECTRON DENSITIES (UNITS: CM-3)
C                            DIMENSION: TEMPERATURE/DENSITY PAIR INDEX
C
C  OUTPUT: (R*8)   WLNGTH  = SELECTED BLOCK WAVELENGTH (ANGSTROMS)
C
C  OUTPUT: (R*8)   PECA()  = PHOTON EMISSIVITIES.
C                            DIMENSION: TEMPERATURE/DENSITY PAIR INDEX
C  OUTPUT: (L*4)   LTRNG() =.TRUE.  => OUTPUT 'PECA()'  VALUE WAS INTER-
C                                      POLATED  FOR  THE  USER  ENTERED
C                                      ELECTRON TEMPERATURE 'TVAL()'.
C                           .FALSE. => OUTPUT 'PECA()'  VALUE WAS EXTRA-
C                                      POLATED  FOR  THE  USER  ENTERED
C                                      ELECTRON TEMPERATURE 'TVAL()'.
C                            DIMENSION: TEMPERATURE/DENSITY PAIR INDEX
C  OUTPUT: (L*4)   LDRNG() =.TRUE.  => OUTPUT 'PECA()'  VALUE WAS INTER-
C                                      POLATED  FOR  THE  USER  ENTERED
C                                      ELECTRON DENSITY 'DVAL()'.
C                           .FALSE. => OUTPUT 'PECA()'  VALUE WAS EXTRA-
C                                      POLATED  FOR  THE  USER  ENTERED
C                                      ELECTRON DENSITY 'DVAL()'.
C                            DIMENSION: TEMPERATURE/DENSITY PAIR INDEX
C
C  OUTPUT: (C*120) TITLX   = INFORMATION STRING (DSN ETC.)
C  OUTPUT: (I*4)   IRCODE  = RETURN CODE FROM SUBROUTINE:
C                            0 => NORMAL COMPLETION - NO ERROR DETECTED
C                            1 => DATA SET MEMBER FOR EMITTING ION WITH
C                                 CHARGE 'IZIN' & ION CHARGE 'IZ0IN' CAN
C                                 NOT BE FOUND/DOES NOT EXIST.
C                            2 => DISCREPANCY BETWEEN REQUESTED CHARGES
C                                 AND THOSE IN INPUT FILE.
C                            3 => THE SELECTED DATA-BLOCK 'IBSEL' IS OUT
C                                 OF RANGE OR DOES NOT EXIST.
C                            4 => INVALID VALUE FOR 'IZ0IN' ENTERED.
C                                 ('IZ0MIN' <= 'IZ0IN' <= 'IZ0MAX')
C                            5 => INVALID VALUE FOR 'IZIN' ENTERED.
C                                 ( 0  <= 'IZIN' <= 99 )
C                            9 => ERROR ENCOUNTERED WHEN TRYING TO OPEN
C                                 INPUT DATA-SET.
C
C           (I*4)   NSTORE  = PARAMETER= MAXIMUM NUMBER  OF  DATA-BLOCKS
C                                        WHICH CAN BE READ FROM THE INPUT
C                                        DATA-SET.
C           (I*4)   NTDIM   = PARAMETER= MAXIMUM NUMBER OF ELECTRON TEMP-
C                                        ERATURES THAT CAN BE READ  FROM
C                                        AN INPUT DATA-SET DATA-BLOCK.
C           (I*4)   NDDIM   = PARAMETER= MAXIMUM NUMBER OF ELECTRON DENS-
C                                        ITIES  THAT  CAN  BE  READ  FROM
C                                        AN INPUT DATA-SET DATA-BLOCK.
C           (I*4)   IZ0MIN  = PARAMETER: MIN. ALLOWED VALUE FOR 'IZ0IN'
C           (I*4)   IZ0MAX  = PARAMETER: MAX. ALLOWED VALUE FOR 'IZ0IN'
C
C           (I*4)   IUNIT   = UNIT TO WHICH INPUT DATA SET IS ALLOCATED
C           (I*4)   NBSEL   = TOTAL NUMBER OF DATA-BLOCKS READ FROM INPUT
C                             DATA SET.
C           (I*4)   IZ0     = INPUT FILE - EMITTING ION - NUCLEAR CHARGE
C           (I*4)   IZ      = INPUT FILE - EMITTING ION - CHARGE
C           (I*4)   IZ1     = INPUT FILE - EMITTING ION - CHARGE + 1
C
C           (L*4)   LOPEN   = .TRUE.  => INPUT DATA SET OPEN.
C                             .FALSE. => INPUT DATA SET CLOSED.
C
C           (C*2)   ESYM    = INPUT FILE - EMITTING ION - ELEMENT SYMBOL
CA          (C*120)  DSNAME  = NAME OF DATA SET INTERROGATED
C
C           (I*4)   ISELA() = INPUT DATA FILE: DATA-BLOCK ENTRY INDICES.
C                             DIMENSION: DATA-BLOCK INDEX
C           (I*4)   ITA()   = INPUT DATA SET-NUMBER OF ELECTRON TEMPERA-
C                             TURES.
C                             DIMENSION: DATA-BLOCK INDEX
C           (I*4)   IDA()   = INPUT DATA SET-NUMBER OF ELECTRON DENSITIES
C                             DIMENSION: DATA-BLOCK INDEX
C
C           (R*8)   TETA(,) = INPUT DATA SET -
C                             ELECTRON TEMPERATURES (UNITS: eV)
C                             1st DIMENSION: ELECTRON TEMPERATURE INDEX
C                             2nd DIMENSION: DATA-BLOCK INDEX
C           (R*8)   TEDA(,) = INPUT DATA SET -
C                             ELECTRON DENSITIES    (UNITS: cm-3)
C                             1st DIMENSION: ELECTRON DENSITY     INDEX
C                             2nd DIMENSION: DATA-BLOCK INDEX
C           (R*8)   PEC(,,)   =INPUT DATA SET -
C                              FULL SET OF IONIZATIONS PER PHOTON
C                              1st DIMENSION: ELECTRON TEMPERATURE INDEX
C                              2nd DIMENSION: ELECTRON DENSITY     INDEX
```

```
C                             3rd DIMENSION: DATA-BLOCK INDEX
C
C          (C*10)  CWAVEL() = INPUT FILE - WAVELENGTH (ANGSTROMS)
C                             DIMENSION: DATA-BLOCK INDEX
C          (C*8)   CFILE()  = INPUT FILE - SPECIFIC ION FILE SOURCE
C                             DIMENSION: DATA-BLOCK INDEX
C          (C*8)   CTYPE()  = INPUT FILE - TYPE OF DATA (IE EXCIT., ETC)
C                             DIMENSION: DATA-BLOCK INDEX
C          (C*2)   CINDM()  = INPUT FILE - METASTABLE INDEX
C                             DIMENSION: DATA-BLOCK INDEX
C
C ROUTINES:
C          ROUTINE    SOURCE    BRIEF DESCRIPTION
C          ------------------------------------------------------------
C          E3DATA     ADAS      FETCH INPUT DATA FROM SELECTED DATA SET
C          E3CHKB     ADAS      CHECK VALIDITY OF ION AND 'IBSEL'
C          E3SPLN     ADAS      INTERPOLATE DATA WITH TWO WAY SPLINES
C          E3TITL     ADAS      CREATE DESCRIPTIVE TITLE FOR OUTPUT
C
C AUTHOR:  TIM HAMMOND (TESSELLA SUPPORT SERVICES PLC)
C DATE:    08/11/95
C
C VERSION: 1.1                          DATE: 08-11-95
C MODIFIED: TIM HAMMOND (TESSELLA SUPPORT SERVICES PLC)
C               - FIRST RELEASE
C
C VERSION: 1.2                          DATE: 10-11-95
C MODIFIED: TIM HAMMOND (TESSELLA SUPPORT SERVICES PLC)
C               - INCREASED LENGTH OF TITLX FROM 80 TO 120
C
C VERSION: 1.3                          DATE: 08-06-98
C MODIFIED: RICHARD MARTIN
C                   - INCREASED NTDIM AND NDDIM TO 30.
C
C-----------------------------------------------------------------------
C-----------------------------------------------------------------------
C
C-----------------------------------------------------------------------
      INTEGER     NSTORE         , NTDIM             , NDDIM
      INTEGER     IZ0MIN         , IZ0MAX
C-----------------------------------------------------------------------
      PARAMETER(  NSTORE = 350   , NTDIM  = 30       , NDDIM =  30  )
      PARAMETER(  IZ0MIN =   1   , IZ0MAX = 50       )
C-----------------------------------------------------------------------
      INTEGER     IBSEL          ,
     &            IZ0IN          , IZIN              ,
     &            ITVAL          , IRCODE
      INTEGER     IUNIT          , NBSEL             ,
     &            IZ0            , IZ                , IZ1
C-----------------------------------------------------------------------
      REAL*8      WLNGTH
C-----------------------------------------------------------------------
      LOGICAL     LOPEN,     LEXIST
C-----------------------------------------------------------------------
      CHARACTER   ESYM*2         ,
     &            DSNAME*120         , TITLX*120
C-----------------------------------------------------------------------
      INTEGER     ISELA(NSTORE)              ,
     &            ITA(NSTORE)                , IDA(NSTORE)
C-----------------------------------------------------------------------
      REAL*8      TVAL(ITVAL)                , DVAL(ITVAL)          ,
     &            PECA(ITVAL)
C-----------------------------------------------------------------------
      LOGICAL     LTRNG(ITVAL)               , LDRNG(ITVAL)
C-----------------------------------------------------------------------
      CHARACTER   CINDM(NSTORE)*2            , CFILE(NSTORE)*8      ,
     &            CTYPE(NSTORE)*8            , CWAVEL(NSTORE)*10
C-----------------------------------------------------------------------
      REAL*8      TETA(NTDIM,NSTORE)         , TEDA(NDDIM,NSTORE)
      REAL*8      PEC(NTDIM,NDDIM,NSTORE)
c-----------------------------------------------------------------------
      DATA        IUNIT  /15/
C-----------------------------------------------------------------------
```

D5SPEC

```
SUBROUTINE D5SPEC( LRSPEC ,
     &                   NDLINE , NDCOMP  , NDRAT  , NDFILE ,
     &                   NFILE  , LFILE   ,
     &                   UID    , GROUP   , TYPE   , EXT    ,
     &                   IZ0    , DSPECA  ,
     &                   NLINE  , NCOMP   ,
     &                   IZION  , IMET    , CIMET  , INDPH  ,
     &                   IFILE  ,
     &                   NTDIM  , ITMAX  ,
     &                   TEIN   , DEIN    , THIN   , DHIN   ,
     &                   PECA   ,
     &                   LPEC   , LTRNG   , LDRNG
     &                 )
       IMPLICIT NONE
C-----------------------------------------------------------------------
C
C  ****************** FORTRAN77 SUBROUTINE: D5SPEC  *******************
C
```

```
C  PURPOSE: TO CALCULATE PHOTON EMISSIVITY COEFFICIENTS FOR
C           SPECTRAL LINES IDENTIFIED IN SCRIPT FILE
C
C  CALLING PROGRAM: ADAS405
C
C  SUBROUTINE:
C
C  INPUT : (I*4)   NDLINE   = MAXIMUM NUMBER OF LINES ALLOWED
C  INPUT : (I*4)   NDCOMP   = MAXIMUM NUMBER OF COMPONENT FOR EACH LINE
C  INPUT : (I*4)   NDRAT    = MAXIMUM NUMBER OF LINE RATIOS ALLOWED
C  INPUT : (I*4)   NDFILE   = MAXIMUM NUMBER OF EMISSIVITY FILES WHICH
C                             CAN BE SEARCHED
C  INPUT : (I*4)   NFILE    = NUMBER OF PEC FILES TO BE SCANNED
C  INPUT : (L*4)   LFILE()  = .TRUE.  => PEC FILE EXISTS AND MATCHES
C                             .FALSE. => PEC FILE DOES NOT EXIST/MATCH
C  INPUT : (C*6)   UID()    = USER IDENTIFIER OF PEC FILE
C  INPUT : (C*8)   GROUP()  = GROUP IDENTIFIER OF PEC FILE
C  INPUT : (C*5)   TYPE()   = TYPE IDENTIFIER OF PEC FILE
C  INPUT : (C*3)   EXT()    = EXTENSION OF PEC FILE MEMBER NAME
C  INPUT : (I*4)   IZ0      = NUCLEAR CHARGE OF IMPURITY
C  INPUT : (C*120)DSPECA()  = PHOTON EMISSIVITY SOURCE FILES
C  INPUT : (I*4)   NLINE    = NUMBER OF LINES IDENTIFIED IN SCRIPT
C  INPUT : (I*4)   NCOMP()  = NUMBER OF COMPONENTS OF SCRIPT LINE
C                             1ST DIM: LINE INDEX
C  INPUT : (I*4)   IZION(,) = CHARGE STATE OF COMPONENT
C                             1ST DIM: LINE INDEX
C                             2ND DIM: COMPONENT INDEX
C  INPUT : (I*4)   IMET(,)  = NUMBER OF COMPONENTS OF SCRIPT LINE
C                             1ST DIM: LINE INDEX
C                             2ND DIM: COMPONENT INDEX
C  INPUT : (C*1)   CIMET(,) = SIGN (+, BLANK OR -) OF METASTABLE
C                             1ST DIM: LINE INDEX
C                             2ND DIM: COMPONENT INDEX
C  INPUT : (I*4)   INDPH(,) = PEC FILE INDEX OF LINE COMPONENT
C                             1ST DIM: LINE INDEX
C                             2ND DIM: COMPONENT INDEX
C  INPUT : (I*4)   IFILE(,) = INDEX OF PEC FILE IN FILE LIST
C                             1ST DIM: LINE INDEX
C                             2ND DIM: COMPONENT INDEX
C  INPUT : (I*4)   NTDIM    = MAXIMUM NUMBER OF TEMP/DENSITY SETS
C  INPUT : (I*4)   ITMAX    = NUMBER OF TEMP/DENSITY SETS
C  INPUT : (R*8)   TEIN()   = ELECTRON TEMPERATURES (EV)
C  INPUT : (R*8)   DEIN()   = ELECTRON DENSITIES (CM-3)
C  INPUT : (R*8)   THIN()   = HYDROGEN TEMPERATURES (EV)
C  INPUT : (R*8)   DHIN()   = HYDROGEN DENSITIES (CM-3)
C
C  OUTPUT: (L*4)   LRSPEC   = .TRUE.  => PEC PROCESSING DONE
C                             .FALSE. => PEC PROCESSING NOT DONE
C  OUTPUT: (R*8)   PECA(,,) = PHOTON EMISSIVITY COEFFICIENTS (CM3 S-1)
C                             1ST DIM: TEMPERATURE INDEX
C                             2ND DIM: LINE INDEX
C                             3RD DIM: COMPONENT INDEX
C  OUTPUT: (L*4)   LPEC(,)  = .TRUE.  => PHOTON EMISSIVITY OBTAINED
C                             .FALSE. => PHOTON EMISSIVITY NOT OBTAINED
C                             2ND DIM: LINE INDEX
C                             3RD DIM: COMPONENT INDEX
C
C          (I*4)   IUNT10  = PARAMETER = INPUT UNIT FOR DATA
C          (L*4)   OPEN10  = .TRUE.  => FILE ALLOCATED TO UNIT 10.
C                            .FALSE. => NO FILE ALLOCATED TO UNIT 10.
C
C ROUTINES:
C          ROUTINE   SOURCE   BRIEF DESCRIPTION
C          ------------------------------------------------------------
C           D5SPC2   IDL-ADAS  OBTAIN PHOTON EMISSIVITY COEFFICIENT
C
C AUTHOR:  H. P. SUMMERS, JET
C          K1/1/57
C          JET EXT. 4941
C
C DATE:    20/04/94
C
C UNIX-IDL PORT:
C
C VERSION: 1.1                          DATE: 08-11-95
C MODIFIED: TIM HAMMOND (TESSELLA SUPPORT SERVICES PLC)
C               - FIRST RELEASE
C
C VERSION: 1.2                          DATE: 08-11-95
C MODIFIED: TIM HAMMOND (TESSELLA SUPPORT SERVICES PLC)
C               - REMOVED SUPERFLUOUS VARIABLES
C
C VERSION: 1.3                          DATE: 10-11-95
C MODIFIED: TIM HAMMOND (TESSELLA SUPPORT SERVICES PLC)
C               - INCREASED LENGTH OF TITLX FROM 80 TO 120
C
C-----------------------------------------------------------------------
C
C-----------------------------------------------------------------------
      INTEGER    IRCODE
      INTEGER    NDLINE  , NDCOMP  , NDRAT   , NDFILE ,
     &           NLINE   , NFILE   , NTDIM   ,
     &           INDL    , INDC    ,
     &           IZ      , IZ0     , ITMAX
C-----------------------------------------------------------------------
      INTEGER    NCOMP(NDLINE)        ,
     &           IZION(NDLINE,NDCOMP) , IMET(NDLINE,NDCOMP)  ,
     &           INDPH(NDLINE,NDCOMP) , IFILE(NDLINE,NDCOMP)
```

```
C-----------------------------------------------------------------------
      REAL*8     WLNGTH
C-----------------------------------------------------------------------
      REAL*8     TEIN(NTDIM) , DEIN(NTDIM) , THIN(NTDIM) , DHIN(NTDIM) ,
     &           PECA(NTDIM,NDLINE,NDCOMP)
C-----------------------------------------------------------------------
      CHARACTER  TITLX*120
      CHARACTER  DSPECA(NDFILE)*120
C-----------------------------------------------------------------------
      CHARACTER  CIMET(NDLINE,NDCOMP)*1 ,
     &           UID(NDFILE)*6  , GROUP(NDFILE)*8, TYPE(NDFILE)*5 ,
     &           EXT(NDFILE)*3
C-----------------------------------------------------------------------
      LOGICAL    OPEN10      , LRSPEC
C-----------------------------------------------------------------------
      LOGICAL    LFILE(NDFILE) , LPEC(NDLINE,NDCOMP)
      LOGICAL    LTRNG(NTDIM)  , LDRNG(NTDIM)
C-----------------------------------------------------------------------
      DATA OPEN10 /.FALSE./
C-----------------------------------------------------------------------
```

D5SPOW

```
SUBROUTINE D5SPOW( LSELA  , LEXSA  , LDEFA  , LPART  , LEXSS  ,
     &                   IZ0    , IZL    , IZH    , NPART  ,
     &                   ISDIMD , IZDIMD , ITDIMD , IPDIMD , IMDIMD ,
     &                   ACDA   , SCDA   , CCDA   , PRBA   ,
     &                   PRCA   , QCDA   , XCDA   , PLTA   ,
     &                   NMSUM  , IZIP   , IMIP   , IPIZM  ,
     &                   NTDIM  , ITMAX  ,
     &                   DENS   , DENSH  ,
     &                   FPABUN , FSABUN ,
     &                   PLTPEQ ,
     &                   ACDSEQ , SCDSEQ , CCDSEQ , PRBSEQ ,
     &                   PRCSEQ , PLTSEQ ,
     &                   PRBEQ  , PRCEQ  , PLTEQ  , PRADA
     &                 )
       IMPLICIT NONE
C
C-----------------------------------------------------------------------
C
C  ****************** FORTRAN77 SUBROUTINE: D5SPOW *********************
C
C PURPOSE : TO ASSEMBLE RADIATED POWER FUNCTIONS USING FRACTIONAL
C           METASTABLE ABUNDANCES.
C           GENERATE STANDARD ISONUCLEAR MASTER DATA FROM PARTIAL DATA.
C
C NOTE    : THE SOURCE ISONUCLEAR MASTER FILE DATA ARE OBTAINED BY A
C           PRIOR CALL TO SUBROUTINE D5DATA FROM SEQUENTIAL FILES
C           WITH THE FOLLOWING NAMING CONVENTIONS:
C
C                   (1) JETSHP.ACD<YR>#<EL).<CODE>DATA
C                   (2) JETSHP.SCD<YR>#<EL>.<CODE>DATA
C                   (3) JETSHP.CCD<YR>#<EL>.<CODE>DATA
C                   (4) JETSHP.PRB<YR>#<EL>.<FILT>.<CODE>DATA
C                   (5) JETSHP.PRC<YR>#<EL>.<FILT>.<CODE>DATA
C                   (6) JETSHP.QCD<YR>#<EL>.<CODE>DATA
C                   (7) JETSHP.XCD<YR>#<EL>.<CODE>DATA
C                   (8) JETSHP.PLT<YR>#<EL>.<CODE>DATA
C
C       WHERE, <YR>   = TWO DIGIT YEAR NUMBER
C              <EL>   = ONE OR TWO CHARACTER ELEMENT SYMBOL
C              <CODE> = R       => PARTIAL DATA
C                       U       => PARTIAL DATA
C                       OMITTED => STANDARD DATA
C              <FILT> = SIX CHARACTER POWER FILTER CODE
C
C       AND DATA OF CLASSES 6 AND 7 DO NOT EXIST FOR THE PARTIAL CASE.
C
C
C INPUT  : (L*4)  LSELA()   = .TRUE.  => INPUT DATA SET TYPE FOR THIS
C                                        INDEX SELECTED
C                           = .FALSE. => INPUT DATA SET FOR THIS INDEX
C                                        NOT SELECTED
C INPUT  : (L*4)  LEXSA()   = .TRUE.  => INPUT DATA SET TYPE FOR THIS
C                                        SELECTED INDEX EXISTS
C                           = .FALSE. => INPUT DATA SET DOES NOT EXIST
C                                        FOR THIS SELECTED INDEX
C INPUT  : (L*4)  LDEFA()   = .TRUE.  => INPUT DATA SET TYPE FOR THIS
C                                        DEFAULT YEAR INDEX EXISTS
C                           = .FALSE. => INPUT DATA SET DOES NOT EXIST
C                                        FOR THIS DEFAULT YEAR INDEX
C INPUT  : (L*4)  LPART     = .TRUE.  => PARTIAL DATA SELECTED
C                           = .FALSE. => STANDARD DATA SELECTED
C INPUT  : (I*4)  IZ0       = NUCLEAR CHARGE
C INPUT  : (I*4)  IZL       = MINIMUM ION CHARGE+1 IN MASTER DATA FILES
C INPUT  : (I*4)  IZH       = MAXIMUM ION CHARGE+1 IN MASTER DATA FILES
C INPUT  : (I*4)  NPART()   = METASTABLE PARTITION.  I.E. NUMBER OF
C                             METASTABLES FROM CHARGE STATE IZL-1 TO
C                             IZH ON INPUT
C INPUT  : (I*4)  ISDIMD    = MAXIMUM NUMBER OF (CHARGE, PARENT, GROUND)
C                             BLOCKS IN ISONUCLEAR MASTER FILES
C INPUT  : (I*4)  IZDIMD    = MAXIMUM NUMBER OF CHARGE STATES
C                             IN ISONUCLEAR MASTER FILES
```

```
C INPUT  : (I*4)  ITDIMD    = MAXIMUM NUMBER OF TEMP OR DENS VALUES IN
C                             ISOELECTRONIC MASTER FILES
C INPUT  : (I*4)  IPDIMD    = MAXIMUM NUMBER OF METASTABLES FOR EACH
C                             IONISATION STAGE
C INPUT  : (I*4)  IMDIMD    = MAXIMUM NUMBER OF METASTABLES
C
C INPUT  : (R*8)  ACDA(,,,) = INTERPOLATION OF ACD COEFFICIENT (CM3 S-1)
C                             1ST DIM: TEMPERATURE INDEX
C                             2ND DIM: CHARGE STATE INDEX
C                             3RD DIM: RECOMBINING METASTABLE INDEX
C                             4TH DIM: RECOMBINED METASTABLE INDEX
C INPUT  : (R*8)  SCDA(,,,) = INTERPOLATION OF SCD COEFFICIENT (CM3 S-1)
C                             1ST DIM: TEMPERATURE INDEX
C                             2ND DIM: CHARGE STATE INDEX
C                             3RD DIM: RECOMBINING METASTABLE INDEX
C                             4TH DIM: RECOMBINED METASTABLE INDEX
C INPUT  : (R*8)  CCDA(,,,) = INTERPOLATION OF CCD COEFFICIENT (CM3 S-1)
C                             1ST DIM: TEMPERATURE INDEX
C                             2ND DIM: CHARGE STATE INDEX
C                             3RD DIM: RECOMBINING METASTABLE INDEX
C                             4TH DIM: RECOMBINED METASTABLE INDEX
C INPUT  : (R*8)  PRBA(,,)  = INTERPOLATION OF PRB COEFFICIENT (W CM3 )
C                             1ST DIM: TEMPERATURE INDEX
C                             2ND DIM: CHARGE STATE INDEX
C                             3RD DIM: RECOMBINING METASTABLE INDEX
C INPUT  : (R*8)  PRCA(,,)  = INTERPOLATION OF PRC COEFFICIENT (W CM3 )
C                             1ST DIM: TEMPERATURE INDEX
C                             2ND DIM: CHARGE STATE INDEX
C                             3RD DIM: RECOMBINING METASTABLE INDEX
C INPUTT : (R*8)  QCDA(,,,) = INTERPOLATION OF QCD COEFFICIENT (CM3 S-1)
C                             1ST DIM: TEMPERATURE INDEX
C                             2ND DIM: CHARGE STATE INDEX
C                             3RD DIM: FIRST METASTABLE INDEX
C                             4TH DIM: SECOND METASTABLE INDEX
C INPUT  : (R*8)  XCDA(,,,) = INTERPOLATION OF XCD COEFFICIENT (CM3 S-1)
C                             1ST DIM: TEMPERATURE INDEX
C                             2ND DIM: CHARGE STATE INDEX
C                             3RD DIM: FIRST PARENT METASTABLE INDEX
C                             4TH DIM: SECOND PARENT METASTABLE INDEX
C INPUT  : (R*8)  PLTA(,,)  = INTERPOLATION OF PLT COEFFICIENT (W CM3 )
C                             1ST DIM: TEMPERATURE INDEX
C                             2ND DIM: CHARGE STATE INDEX
C                             3RD DIM: METASTABLE INDEX
C INPUT  : (I*4)  NMSUM     = TOTAL NUMBER OF POPULATIONS
C
C INPUT  :        IZIP()    = ION CHARGE +1 (IZ1) OF METASTABLE IN LIST
C INPUT  :        IMIP()    = METASTABLE INDEX WITHIN CHARGE STATE IZ1
C                             OF METASTABLE INDEX FROM COMPLETE LIST
C INPUT  :        IPIZM(,)  = METASTABLE INDEX IN COMPLETE LIST
C                             1ST DIM: INDEX IZ1-IZL+1
C                             2ND DIM: METASTABLE COUNT FOR STAGE (IGRD)
C INPUT  : (I*4)  NTDIM     = MAXIMUM NUMBER OF DTEV/DDENS PAIRS
C INPUT  : (I*4)  ITMAX     = NUMBER OF ( DTEV() , DDENS() ) PAIRS
C INPUT  : (R*8)  DENS()    = ELECTRON DENSITIES (CM-3))
C INPUT  : (R*8)  DENSH()   = HYDROGEN DENSITIES (CM-3))
C INPUT  : (R*8)  FPABUN(,) = RESOLVED METASTABLE EQUILIBRIUM
C                             FRACTIONAL ABUNDANCES
C                             1ST DIM: - TEMPERATURE/DENSITY PAIR
C                             2ND DIM: - METASTABLE INDEX
C OUTPUT : (L*4)  LEXSS()   = .TRUE.  => OUTPUT STANDARD MASTER DATA FOR
C                                        THIS INDEX GENERATED
C                             = .FALSE. => OUTPUT STANDARD MASTER DATA FOR
C                                        THIS INDEX NOT GENERATED
C OUTPUT : (R*8)  FSABUN(,) = STAGE EQUILIBRIUM FRACTIONAL ABUNDANCES
C                             1ST DIM: - TEMPERATURE/DENSITY PAIR INDEX
C                             2ND DIM: - CHARGE STATE INDEX (IZ1-IZL+1)
C OUTPUT : (R*8)  PLTPEQ(,) = METASTABLE PARTIAL EQUILIBRIUM RADIATED
C                             LINE POWER FUNCTIONS
C                             1ST DIM: - TEMPERATURE/DENSITY PAIR
C                             2ND DIM: - METASTABLE INDEX
C OUTPUT : (R*8)  ACDSEQ(,) = STANDARD (UNRESOLVED) ACD COEFFICIENT
C                             1ST DIM: - TEMPERATURE/DENSITY PAIR INDEX
C                             2ND DIM: - CHARGE STATE INDEX (IZ1-IZL+1)
C OUTPUT : (R*8)  SCDSEQ(,) = STANDARD (UNRESOLVED) SCD COEFFICIENT
C                             1ST DIM: - TEMPERATURE/DENSITY PAIR INDEX
C                             2ND DIM: - CHARGE STATE INDEX (IZ1-IZL+1)
C OUTPUT : (R*8)  CCDSEQ(,) = STANDARD (UNRESOLVED) CCD COEFFICIENT
C                             1ST DIM: - TEMPERATURE/DENSITY PAIR INDEX
C                             2ND DIM: - CHARGE STATE INDEX (IZ1-IZL+1)
C OUTPUT : (R*8)  PRBSEQ(,) = STANDARD (UNRESOLVED) SCD COEFFICIENT
C                             1ST DIM: - TEMPERATURE/DENSITY PAIR INDEX
C                             2ND DIM: - CHARGE STATE INDEX (IZ1-IZL+1)
C OUTPUT : (R*8)  PRCSEQ(,) = STANDARD (UNRESOLVED) CCD COEFFICIENT
C                             1ST DIM: - TEMPERATURE/DENSITY PAIR INDEX
C                             2ND DIM: - CHARGE STATE INDEX (IZ1-IZL+1)
C OUTPUT : (R*8)  PLTSEQ(,) = STANDARD (UNRESOLVED) CCD COEFFICIENT
C                             1ST DIM: - TEMPERATURE/DENSITY PAIR INDEX
C                             2ND DIM: - CHARGE STATE INDEX (IZ1-IZL+1)
C OUTPUT : (R*8)  PRBEQ()   = TOTAL EQUILIBRIUM RADIATED RECOM-BREMS
C                                   POWER FUNCTION
C OUTPUT : (R*8)  PRCEQ()   = TOTAL EQUILIBRIUM CX RADIATED RECOM POWER
C                                   FUNCTION NORMALISED TO ELECTRON
C                                   DENSITY
C OUTPUT : (R*8)  PLTEQ()   = TOTAL EQUILIBRIUM RADIATED LINE POWER
C                                   FUNCTION
C OUTPUT : (R*8)  PRADA()   = TOTAL EQUILIBRIUM RADIATED POWER FUNCTION
C
C PROGRAM: (I*4)  IT        = GENERAL INDEX FOR TEMPERATURE
```

```
C          (I*4)  IZ        = GENERAL INDEX FOR CHARGE
C          (I*4)  IP        = GENERAL INDEX FOR CHARGE
C          (I*4)  IZ1       = GENERAL INDEX FOR CHARGE+1
C          (I*4)  ICL       = GENERAL INDEX FOR CLASS
C          (I*4)  IPP       = GENERAL PARENT INDEX
C          (I*4)  IPG       = GENERAL GROUND INDEX
C          (I*4)  IZREF     = GENERAL CHARGE STAE POINTER INDEX
C          (I*4)  IPRT      = GENERAL INDEX FOR PARENT METASTABLE
C          (I*4)  IGRD      = GENERAL INDEX FOR METASTABLE
C
C
C ROUTINES:
C          ROUTINE    SOURCE    BRIEF DESCRIPTION
C          ------------------------------------------------------------
C
C
C AUTHOR : H. P. SUMMERS, JET
C          K1/1/57
C          JET  EXT. 4941
C
C DATE   : 28/04/94
C
C UNIX-IDL PORT:
C VERSION:     1.1                          DATE: 31-10-95
C MODIFIED:    TIM HAMMOND (TESSELLA SUPPORT SERVICES PLC)
C              - INITIAL VERSION TO BE USED FOR UNIX PLATFORMS
C
C VERSION:     1.2                          DATE: 08-11-95
C MODIFIED:    TIM HAMMOND
C              - ALTERED LINE 'IF(LEXSA(ICL).OR.LDEFA(ICL))' IN LOOP 1
C                TO 'IF((LEXSA(ICL).OR.LDEFA(ICL)).AND.LSELA(ICL))' TO
C                REFLECT WHETHER OR NOT THE USER HAS ACTUALLY SELECTED
C                THIS PARTICULAR CLASS FOR INCLUSION.
C              - TIDIED UP COMMENTS AND CODE
C
C VERSION:     1.3                          DATE: 08-11-95
C MODIFIED:    TIM HAMMOND
C              - REMOVED SUPERFLUOUS VARIABLES
C
C-----------------------------------------------------------------------
       INTEGER   IZ0
       INTEGER   IZ1     , IZL     , IZH     , NTDIM   , ITMAX   , NMSUM
       INTEGER   ISDIMD  , IZDIMD  , ITDIMD  , IPDIMD  , IMDIMD
       INTEGER   IT      , IPRT    , IGRD
       INTEGER   ICL     , IP      , IZREF   , IPP     , IPG
C-----------------------------------------------------------------------
       INTEGER   NPART(IZDIMD)
       INTEGER   IZIP(IMDIMD)   , IMIP(IMDIMD) ,
     &           IPIZM(IZDIMD,IPDIMD)
C-----------------------------------------------------------------------
       REAL*8    DNS           , DNSH
C-----------------------------------------------------------------------
       REAL*8    DENS(NTDIM)   , DENSH(NTDIM)   ,
     &           PRBEQ(NTDIM)  , PRCEQ(NTDIM)   ,  PLTEQ(NTDIM) ,
     &           PRADA(NTDIM)
       REAL*8    FPABUN(NTDIM,IMDIMD) , PLTPEQ(NTDIM,IMDIMD)
       REAL*8    FSABUN(NTDIM,IZDIMD)
       REAL*8    ACDSEQ(NTDIM,IZDIMD) , SCDSEQ(NTDIM,IZDIMD)   ,
     &           CCDSEQ(NTDIM,IZDIMD) , PRBSEQ(NTDIM,IZDIMD)   ,
     &           PRCSEQ(NTDIM,IZDIMD) , PLTSEQ(NTDIM,IZDIMD)
       REAL*8    ACDA(NTDIM,IZDIMD,IPDIMD,IPDIMD) ,
     &           SCDA(NTDIM,IZDIMD,IPDIMD,IPDIMD) ,
     &           CCDA(NTDIM,IZDIMD,IPDIMD,IPDIMD) ,
     &           PRBA(NTDIM,IZDIMD,IPDIMD)        ,
     &           PRCA(NTDIM,IZDIMD,IPDIMD)        ,
     &           QCDA(NTDIM,IZDIMD,IPDIMD,IPDIMD) ,
     &           XCDA(NTDIM,IZDIMD,IPDIMD,IPDIMD) ,
     &           PLTA(NTDIM,IZDIMD,IPDIMD)
C-----------------------------------------------------------------------
       LOGICAL   LPART
C-----------------------------------------------------------------------
       LOGICAL     LSELA(8)      , LEXSA(8)       , LDEFA(8)  ,
     &             LEXSS(8)
C-----------------------------------------------------------------------
```

D5WR11

```
SUBROUTINE D5WR11( IUNIT  , DSNINC , DSNMTR , ELEMT ,
     &                   UID    , DATE   , IZ0    ,
     &                   NDLINE , NLINE  ,
     &                   TITL   , IZION  , CIMET  ,
     &                   NTDIM  , ITMAX  ,
     &                   TEV    , DENS   ,
     &                   GCF
     &                 )
      IMPLICIT NONE
C-----------------------------------------------------------------------
C
C  ******************** FORTRAN77 SUBROUTINE: D5WR11 ******************
C
C  PURPOSE:  TO OUTPUT DATA TO GCF PASSING FILE.
C
C  CALLING PROGRAM: ADAS405
C
```

```
C
C  SUBROUTINE:
C
C  INPUT : (I*4)  IUNIT   = OUTPUT UNIT NUMBER FOR RESULTS
C  INPUT : (C*80) DSNINC  = INPUT SCRIPT DATA SET NAME
C  INPUT : (C*80) DSNMTR  = INPUT ACD MASTER FILE NAME
C  INPUT : (C*2)  ELEMT   = ELEMENT SYMBOL.
C
C  INPUT : (C*80) UID     = USER IDENIFIER
C  INPUT : (C*8)  DATE    = CURRENT DATE
C  INPUT : (I*4)  IZ0     = NUCLEAR CHARGE
C
C  INPUT : (I*4)  NDLINE  = MAXIMUM NUMBER OF SPECTRUM LINES
C  INPUT : (I*4)  NLINE   = NUMBER OF SPECTRUM LINES
C  INPUT : (C*12) TITL()  = TITLE FOR 1ST COMPONENT OF LINE
C  INPUT : (I*4)  IZION() = ION CHARGE FOR 1ST COMPONENT OF LINE
C  INPUT : (C*1)  CIMET() = +/- SHIFT OF ION CHARGE - 1ST COMPONENT
C
C  INPUT : (I*4)  NTDIM   = AMXIMU, NUMBER OF INPUT TEMPERATURES
C  INPUT : (I*4)  ITMAX   = NUMBER OF INPUT TEMPERATURES
C                           LIST.
C  INPUT : (R*8)  TEV()   = ELECTRON TEMPERATURES (UNITS: EV)
C  INPUT : (R*8)  DENS()  = ELECTRON DENSITIES  (UNITS: CM-3)
C
C  INPUT : (R*4)  GCF(,)  = G(TE) FUNCTION (CM3 S-1)
C                              1ST DIM: TEMPERATURE INDEX
C                              2ND DIM: LINE INDEX
C
C          (I*4) I         = GENERAL USE
C          (I*4) J         = GENERAL USE
C          (I*4) K         = GENERAL USE
C          (I*4) L         = GENERAL USE
C          (I*4) I1        = GENERAL USE
C          (I*4) I2        = GENERAL USE
C          (I*4) IT        = GENERAL USE
C          (C*80)CLINE     = GENERAL USE
C
C
C ROUTINES: NONE
C
C AUTHOR:  H. P. SUMMERS, JET
C          K1/1/57
C          JET EXT. 4941
C
C DATE:    27/04/94
C
C UNIX-IDL PORT:
C
C VERSION: 1.1                          DATE: 08-11-95
C MODIFIED: TIM HAMMOND (TESSELLA SUPPORT SERVICES PLC)
C               - FIRST RELEASE
C
C VERSION: 1.2                          DATE: 08-11-95
C MODIFIED: TIM HAMMOND (TESSELLA SUPPORT SERVICES PLC)
C               - REMOVED SUPERFLUOUS VARIABLES
C
C VERSION: 1.3                          DATE: 09-03-98
C MODIFIED: RICHARD MARTIN
C               - INCREASED UID FROM CHAR*6 TO CHAR*80 IN ACCORDANCE WITH
C                       XXUID.
C
C VERSION: 1.4                          DATE: 20-11-98
C MODIFIED: RICHARD MARTIN & MARTIN O'MULLANE
C                   - REMOVED SEARCH FOR BRACKETS IN DSNINC AND INITIAL STRING
C                       AS STRING = '        '
C
C-----------------------------------------------------------------------
      INTEGER   NDLINE    , NLINE      , NTDIM
      INTEGER   IUNIT     ,
     &          ITMAX     , IZ0
      INTEGER   I
      INTEGER   I1        , I2         , IT
C-----------------------------------------------------------------------
      INTEGER   IZION(NLINE)
C-----------------------------------------------------------------------
      CHARACTER ELEMT*2          , DSNINC*80   , DSNMTR*80
      CHARACTER TITL(NLINE)*12   , CLINE*80
      CHARACTER CODE*8     , SCRIPT*8   , TYPE*4
      CHARACTER UID*80      , DATE*8     , CHZ*5
C-----------------------------------------------------------------------
      CHARACTER CIMET(NLINE)*1
C-----------------------------------------------------------------------
      REAL*8   TEV(NTDIM)  , DENS(NTDIM)
      REAL*8   GCF(NTDIM,NDLINE)
C-----------------------------------------------------------------------
      DATA     CODE/' ADAS405'/ , TYPE/'LINE'/
C-----------------------------------------------------------------------
```

D6DATA

```
       SUBROUTINE D6DATA( DSFLLA , LSELA  , LEXSA  , LDEFA , LPART  ,
     &                    IZ0    , IZ1MIN , IZ1MAX , NPART  ,
     &                    NTDIM  , ITMAX  ,
     &                    ISDIMD , IZDIMD , ITDIMD , IPDIMD , NPARTR,
```

```
     &                    DTEV   , DDENS  ,
     &                    DTEVD  , DDENSD , DRCOFD , ZDATA  ,
     &                    DRCOFI ,
     &                    ACDA   , LACDA  ,
     &                    SCDA   , LSCDA  ,
     &                    CCDA   , LCCDA  ,
     &                    PRBA   , LPRBA  ,
     &                    PRCA   , LPRCA  ,
     &                    QCDA   , LQCDA  ,
     &                    XCDA   , LXCDA  ,
     &                    PLTA   , LPLTA
     &                  )
       IMPLICIT NONE
C
C-----------------------------------------------------------------------
C
C  ****************** FORTRAN77 SUBROUTINE: D6DATA *********************
C
C PURPOSE : TO EXTRACT A COMPLETE SET OF COLLISIONAL DIELECTRONIC DATA
C           FOR A TEMP/DENSITY MODEL
C           FROM EITHER PARTIAL (METASTABLE/PARENT RESOLVED) OR STANDARD
C           (UNRESOLVED) ISONUCLEAR MASTER FILES
C
C NOTE    : THE SOURCE DATA IS CONTAINED AS SEQUENTIAL DATASETS
C           WITH THE FOLLOWING NAMING CONVENTIONS:
C
C                   (1) JETSHP.ACD<YR>#<EL>.<CODE>DATA
C                   (2) JETSHP.SCD<YR>#<EL>.<CODE>DATA
C                   (3) JETSHP.CCD<YR>#<EL>.<CODE>DATA
C                   (4) JETSHP.PRB<YR>#<EL>.<FILT>.<CODE>DATA
C                   (5) JETSHP.PRC<YR>#<EL>.<FILT>.<CODE>DATA
C                   (6) JETSHP.QCD<YR>#<EL>.<CODE>DATA
C                   (7) JETSHP.XCD<YR>#<EL>.<CODE>DATA
C                   (8) JETSHP.PLT<YR>#<EL>.<CODE>DATA
C
C       WHERE, <YR>   = TWO DIGIT YEAR NUMBER
C              <EL>   = ONE OR TWO CHARACTER ELEMENT SYMBOL
C              <CODE> = R       => PARTIAL DATA
C                       U       => PARTIAL DATA
C                       OMITTED => STANDARD DATA
C              <FILT> = SIX CHARACTER POWER FILTER CODE
C
C       AND DATA OF CLASSES 6 AND 7 DO NOT EXIST FOR THE STANDARD CASE.
C
C
C INPUT  : (C*120)DSFLLA()  = MASTER FILE DATA SET NAMES
C INPUT  : (L*4)  LSELA()   = .TRUE.  => INPUT DATA SET TYPE FOR THIS
C                                        INDEX SELECTED
C                           = .FALSE. => INPUT DATA SET FOR THIS INDEX
C                                        NOT SELECTED
C INPUT  : (L*4)  LEXSA()   = .TRUE.  => INPUT DATA SET TYPE FOR THIS
C                                        SELECTED INDEX EXISTS
C                           = .FALSE. => INPUT DATA SET DOES NOT EXIST
C                                        FOR THIS SELECTED INDEX
C INPUT  : (L*4)  LDEFA()   = .TRUE.  => INPUT DATA SET TYPE FOR THIS
C                                        DEFAULT YEAR INDEX EXISTS
C                           = .FALSE. => INPUT DATA SET DOES NOT EXIST
C                                        FOR THIS DEFAULT YEAR INDEX
C INPUT  : (L*4)  LPART     = .TRUE.  => PARTIAL DATA SELECTED
C                           = .FALSE. => STANDARD DATA SELECTED
C INPUT  : (I*4)  IZ0       = NUCLEAR CHARGE
C INPUT  : (I*4)  IZ1MIN    = MINIMUM ION CHARGE+1 IN MASTER DATA FILES
C INPUT  : (I*4)  IZ1MAX    = MAXIMUM ION CHARGE+1 IN MASTER DATA FILES
C INPUT  : (I*4)  NPART()   = METASTABLE PARTITION.  I.E. NUMBER OF
C                             METASTABLES FROM CHARGE STATE IZ1MIN-1 TO
C                             IZ1MAX ON INPUT
C INPUT  : (I*4)  NTDIM     = MAXIMUM NUMBER OF DTEV/DDENS PAIRS
C INPUT  : (I*4)  ITMAX     = NUMBER OF ( DTEV() , DDENS() ) PAIRS
C INPUT  : (I*4)  ISDIMD    = MAXIMUM NUMBER OF (CHARGE, PARENT, GROUND)
C                             BLOCKS IN ISONUCLEAR MASTER FILES
C INPUT  : (I*4)  IZDIMD    = MAXIMUM NUMBER OF CHARGE STATES
C                             IN ISONUCLEAR MASTER FILES
C INPUT  : (I*4)  ITDIMD    = MAXIMUM NUMBER OF TEMP OR DENS VALUES IN
C                             ISOELECTRONIC MASTER FILES
C INPUT  : (I*4)  IPDIMD    = MAXIMUM NUMBER OF METASTABLES FOR EACH
C                             IONISATION STAGE
C INPUT  : (R*8)  DTEV()    = DLOG10(ELECTRON TEMPERATURES (EV))
C INPUT  : (R*8)  DDENS()   = DLOG10(ELECTRON DENSITIES (CM-3))
C
C OUTPUT : (I*4)  NPARTR()  = METASTABLE PARTITION.  I.E. NUMBER OF
C                             METASTABLES FROM CHARGE STATE IZ1MIN-1 TO
C                             IZ1MAX FOUND IN MASTER FILE
C OUTPUT : (R*8)  DTEVD()   = DLOG10(DATA ELECTRON TEMPERATURES (EV))
C                             IN SELECTED MASTER FILE
C OUTPUT : (R*8)  DDENSD()  = DLOG10(DATA ELECTRON DENSITIES (CM-3))
C                             IN SELECTED MASTER FILE
C OUTPUT : (R*8)  DRCOFD(,,)= DLOG10(DATA RATE COEFFICIENTS (CM-3/S))
C                             IN SELECTED MASTER FILE
C                             1ST DIM: (CHARGE,META,GRD) BLOCK INDEX
C                             2ND DIM: TEMPERATURE INDEX
C                             3RD DIM: DENSITY INDEX
C OUTPUT : (R*8)  ZDATA()   = CHARGE + 1 FOR IONS IN SELECTED MASTER
C                             FILE
C                             1ST DIM: (CHARGE,META,GRD) BLOCK INDEX
C OUTPUT : (R*8)  DRCOFI()  = INTERPOLATION OF DRCOFD(,,) FOR
C                             DTEV() & DDENS()
C OUTPUT : (R*8)  ACDA(,,,) = INTERPOLATION OF ACD COEFFICIENT (CM3 S-1)
C                             1ST DIM: TEMPERATURE INDEX
```

```
C                               2ND DIM: CHARGE STATE INDEX
C                               3RD DIM: RECOMBINING METASTABLE INDEX
C                               4TH DIM: RECOMBINED METASTABLE INDEX
C OUTPUT : (L*4)  LACDA(,,) = .TRUE.  => ACD COEFFICIENT AVAILABLE
C                               .FALSE. => ACD COEFFICIENT NOT AVAILABLE
C                               1ST DIM: CHARGE STATE INDEX
C                               2ND DIM: RECOMBINING METASTABLE INDEX
C                               3RD DIM: RECOMBINED METASTABLE INDEX
C OUTPUT : (R*8)  SCDA(,,,) = INTERPOLATION OF SCD COEFFICIENT (CM3 S-1)
C                               1ST DIM: TEMPERATURE INDEX
C                               2ND DIM: CHARGE STATE INDEX
C                               3RD DIM: RECOMBINING METASTABLE INDEX
C                               4TH DIM: RECOMBINED METASTABLE INDEX
C OUTPUT : (L*4)  LSCDA(,,) = .TRUE.  => SCD COEFFICIENT AVAILABLE
C                               .FALSE. => SCD COEFFICIENT NOT AVAILABLE
C                               1ST DIM: CHARGE STATE INDEX
C                               2ND DIM: RECOMBINING METASTABLE INDEX
C                               3RD DIM: RECOMBINED METASTABLE INDEX
C OUTPUT : (R*8)  CCDA(,,,) = INTERPOLATION OF CCD COEFFICIENT (CM3 S-1)
C                               1ST DIM: TEMPERATURE INDEX
C                               2ND DIM: CHARGE STATE INDEX
C                               3RD DIM: RECOMBINING METASTABLE INDEX
C                               4TH DIM: RECOMBINED METASTABLE INDEX
C OUTPUT : (L*4)  LCCDA(,,) = .TRUE.  => CCD COEFFICIENT AVAILABLE
C                               .FALSE. => CCD COEFFICIENT NOT AVAILABLE
C                               1ST DIM: CHARGE STATE INDEX
C                               2ND DIM: RECOMBINING METASTABLE INDEX
C                               3RD DIM: RECOMBINED METASTABLE INDEX
C OUTPUT : (R*8)  PRBA(,,)  = INTERPOLATION OF PRB COEFFICIENT (W CM3 )
C                               1ST DIM: TEMPERATURE INDEX
C                               2ND DIM: CHARGE STATE INDEX
C                               3RD DIM: RECOMBINING METASTABLE INDEX
C OUTPUT : (L*4)  LCCDA(,)  = .TRUE.  => PRB COEFFICIENT AVAILABLE
C                               .FALSE. => PRB COEFFICIENT NOT AVAILABLE
C                               1ST DIM: CHARGE STATE INDEX
C                               2ND DIM: RECOMBINING METASTABLE INDEX
C OUTPUT : (R*8)  PRCA(,,)  = INTERPOLATION OF PRC COEFFICIENT (W CM3 )
C                               1ST DIM: TEMPERATURE INDEX
C                               2ND DIM: CHARGE STATE INDEX
C                               3RD DIM: RECOMBINING METASTABLE INDEX
C OUTPUT : (L*4)  LPRCA(,)  = .TRUE.  => PRC COEFFICIENT AVAILABLE
C                               .FALSE. => PRC COEFFICIENT NOT AVAILABLE
C                               1ST DIM: CHARGE STATE INDEX
C                               2ND DIM: RECOMBINING METASTABLE INDEX
C OUTPUT : (R*8)  QCDA(,,,) = INTERPOLATION OF QCD COEFFICIENT (CM3 S-1)
C                               1ST DIM: TEMPERATURE INDEX
C                               2ND DIM: CHARGE STATE INDEX
C                               3RD DIM: FIRST METASTABLE INDEX
C                               4TH DIM: SECOND METASTABLE INDEX
C OUTPUT : (L*4)  LQCDA(,,) = .TRUE.  => QCD COEFFICIENT AVAILABLE
C                               .FALSE. => QDC COEFFICIENT NOT AVAILABLE
C                               1ST DIM: CHARGE STATE INDEX
C                               2ND DIM: FIRST METASTABLE INDEX
C                               3RD DIM: SECOND METASTABLE INDEX
C OUTPUT : (R*8)  XCDA(,,,) = INTERPOLATION OF XCD COEFFICIENT (CM3 S-1)
C                               1ST DIM: TEMPERATURE INDEX
C                               2ND DIM: CHARGE STATE INDEX
C                               3RD DIM: FIRST PARENT METASTABLE INDEX
C                               4TH DIM: SECOND PARENT METASTABLE INDEX
C OUTPUT : (L*4)  LXCDA(,,) = .TRUE.  => XCD COEFFICIENT AVAILABLE
C                               .FALSE. => XDC COEFFICIENT NOT AVAILABLE
C                               1ST DIM: CHARGE STATE INDEX
C                               2ND DIM: FIRST PARENT METASTABLE INDEX
C                               3RD DIM: SECOND PARENT METASTABLE INDEX
C OUTPUT : (R*8)  PLTA(,,)  = INTERPOLATION OF PLT COEFFICIENT (W CM3 )
C                               1ST DIM: TEMPERATURE INDEX
C                               2ND DIM: CHARGE STATE INDEX
C                               3RD DIM: METASTABLE INDEX
C OUTPUT : (L*4)  LPLTA(,)  = .TRUE.  => PLT COEFFICIENT AVAILABLE
C                               .FALSE. => PLT COEFFICIENT NOT AVAILABLE
C                               1ST DIM: CHARGE STATE INDEX
C                               2ND DIM:  METASTABLE INDEX
C
C PROGRAM: (I*4)  IT        = GENERAL INDEX FOR TEMPERATURE
C          (I*4)  IZ        = GENERAL INDEX FOR CHARGE
C          (I*4)  IZ1       = GENERAL INDEX FOR CHARGE+1
C          (I*4)  IPRT      = GENERAL INDEX FOR PARENT METASTABLE
C          (I*4)  JPRT      = GENERAL INDEX FOR PARENT METASTABLE
C          (I*4)  IGRD      = GENERAL INDEX FOR METASTABLE
C          (I*4)  JGRD      = GENERAL INDEX FOR METASTABLE
C
C
C ROUTINES:
C          ROUTINE    SOURCE    BRIEF DESCRIPTION
C          ------------------------------------------------------------
C
C
C AUTHOR : H. P. SUMMERS, JET
C          K1/1/57
C          JET  EXT. 4941
C
C DATE   : 25/04/94
C
C UPDATE :
C
C UNIX-IDL PORT:
C
C AUTHOR:  WILLIAM OSBORN (TESSELLA SUPPORT SERVICES PLC)
```

```
C
C DATE:    07/06/96
C
C VERSION: 1.1                                  DATE:07/06/96
C MODIFIED: WILLIAM OSBORN
C            - FIRST VERSION
C VERSION: 1.2                                  DATE:27/06/96
C MODIFIED: WILLIAM OSBORN
C             - REMOVED UNUSED VARIABLES
C VERSION: 1.3                                  DATE:27/06/96
C MODIFIED: WILLIAM OSBORN
C             - CHANGED 'DO  2 IT = 1,ITDIMD'
C                    TO  'DO  2 IT = 1,NTDIM'
C                  SO AS NOT TO GO OUTSIDE ARRAY BOUNDS
C             - CHANGED DECISIONS TO 'IF ((LEXSA(I).OR.LDEFA(I)).AND.LSELA(I))'
C               SEE D5DATA FOR MORE INFO.
C
C-----------------------------------------------------------------------
      INTEGER   IFAIL   , IZ0     , ICLASS
      INTEGER   IZ1     , IZ1MIN  , IZ1MAX  , NTDIM   , ITMAX
      INTEGER   ISDIMD  , IZDIMD  , ITDIMD  , IPDIMD
      INTEGER   ISMAXD  , IZMAXD  , ITMAXD  , IDMAXD
      INTEGER   IT      , IZ      , IPRT    , JPRT    , IGRD    , JGRD
C-----------------------------------------------------------------------
      INTEGER   NPART(IZDIMD)     , NPARTR(IZDIMD)
C-----------------------------------------------------------------------
      REAL*8    DTEV(ITMAX)   , DDENS(ITMAX)
      REAL*8    DTEVD(ITDIMD) , DDENSD(ITDIMD) , ZDATA(ISDIMD)
      REAL*8    DRCOFD(ISDIMD,ITDIMD,ITDIMD)
      REAL*8    DRCOFI(ITMAX)
      REAL*8    ACDA(NTDIM,IZDIMD,IPDIMD,IPDIMD)
      REAL*8    SCDA(NTDIM,IZDIMD,IPDIMD,IPDIMD)
      REAL*8    CCDA(NTDIM,IZDIMD,IPDIMD,IPDIMD)
      REAL*8    PRBA(NTDIM,IZDIMD,IPDIMD)
      REAL*8    PRCA(NTDIM,IZDIMD,IPDIMD)
      REAL*8    QCDA(NTDIM,IZDIMD,IPDIMD,IPDIMD)
      REAL*8    XCDA(NTDIM,IZDIMD,IPDIMD,IPDIMD)
      REAL*8    PLTA(NTDIM,IZDIMD,IPDIMD)
C-----------------------------------------------------------------------
      CHARACTER DSFLLA(8)*120 , DSNINC*120
C-----------------------------------------------------------------------
      LOGICAL   LPART
C-----------------------------------------------------------------------
     LOGICAL     LSELA(8)      , LEXSA(8)       , LDEFA(8)
      LOGICAL   LACDA(IZDIMD,IPDIMD,IPDIMD)
      LOGICAL   LSCDA(IZDIMD,IPDIMD,IPDIMD)
      LOGICAL   LCCDA(IZDIMD,IPDIMD,IPDIMD)
      LOGICAL   LPRBA(IZDIMD,IPDIMD)
      LOGICAL   LPRCA(IZDIMD,IPDIMD)
      LOGICAL   LQCDA(IZDIMD,IPDIMD,IPDIMD)
      LOGICAL   LXCDA(IZDIMD,IPDIMD,IPDIMD)
      LOGICAL   LPLTA(IZDIMD,IPDIMD)
C-----------------------------------------------------------------------
```

D6MFLL

```
      SUBROUTINE D6MFLL ( NTDIM  , IZDIMD , IPDIMD , IMDIMD ,          00010001
     &                    NMDIM  ,                                     00010106
     &                    NSTAGE , NPART  ,                            00010203
     &                    ACDA   , SCDA   , CCDA   , QCDA   , XCDA   , 00010301
     &                    DENS   , DENSH  ,                            00010401
     &                    ITEM   ,                                     00010501
     &                    A                                            00010701
     &                  )                                              00010801
      IMPLICIT NONE                                                    00011004
C-----------------------------------------------------------------------00011101
C                                                                      00011201
C  ****************** FORTRAN 77 SUBROUTINE: D6MFLL *******************00011301
C                                                                      00011401
C  PURPOSE: FILLS MATRIX WITH RECOMBINATION, IONISATION  AND METASTABLE 00011501
C           CROSS-COUPLING COEFFICIENTS READY FOR EIGENVECTOR SOLUTION  00011601
C                                                                      00011801
C  CALLING PROGRAM: D6MPOP                                             00011901
C                                                                      00012001
C  SUBROUTINE:                                                         00012101
C                                                                      00012201
C                                                                      00012301
C INPUT  : (I*4)  NTDIM     = MAXIMUM NUMBER OF DTEV/DDENS PAIRS       00012401
C INPUT  : (I*4)  IZDIMD    = MAXIMUM NUMBER OF CHARGE STATES          00012801
C                             IN ISONUCLEAR MASTER FILES               00012901
C INPUT  : (I*4)  IPDIMD    = MAXIMUM NUMBER OF METASTABLES FOR EACH   00013201
C                             IONISATION STAGE                         00013301
C INPUT  : (I*4)  IMDIMD    = MAXIMUM NUMBER OF POPULATIONS            00013801
C                                                                      00013906
C INPUT  : (I*4)  NMDIM     = MAX. NUMBER OF POPULATIONS (FROM D6MPOP) 00014006
C                                                                      00014101
C INPUT  : (I*4)  NSTAGE    = NUMBER OF IONISATION STATES (EXCL.       00014203
C                             EXTRA ONE (BARE NUCLEUS) ADDED AT END    00014303
C INPUT  : (I*4)  NPART()   = METASTABLE PARTITION.  I.E. NUMBER OF    00014401
C                             METASTABLES FROM CHARGE STATE IZ1MIN-1 TO 00015001
C                             IZ1MAX ON INPUT                          00016001
C                                                                      00016201
C INPUT  : (R*8)  ACDA(,,,) = INTERPOLATION OF ACD COEFFICIENT (CM3 S-1)00016301
C                             1ST DIM: TEMPERATURE INDEX               00016401
```

```
C                              2ND DIM: CHARGE STATE INDEX              00016501
C                              3RD DIM: RECOMBINING METASTABLE INDEX    00016601
C                              4TH DIM: RECOMBINED METASTABLE INDEX     00016701
C INPUT  : (R*8)  SCDA(,,,) = INTERPOLATION OF SCD COEFFICIENT (CM3 S-1)00017201
C                              1ST DIM: TEMPERATURE INDEX               00017301
C                              2ND DIM: CHARGE STATE INDEX              00017401
C                              3RD DIM: RECOMBINING METASTABLE INDEX    00017501
C                              4TH DIM: RECOMBINED METASTABLE INDEX     00017601
C INPUT  : (R*8)  CCDA(,,,) = INTERPOLATION OF CCD COEFFICIENT (CM3 S-1)00018201
C                              1ST DIM: TEMPERATURE INDEX               00018301
C                              2ND DIM: CHARGE STATE INDEX              00018401
C                              3RD DIM: RECOMBINING METASTABLE INDEX    00018501
C                              4TH DIM: RECOMBINED METASTABLE INDEX     00018601
C INPUT  : (R*8)  QCDA(,,,) = INTERPOLATION OF QCD COEFFICIENT (CM3 S-1)00020801
C                              1ST DIM: TEMPERATURE INDEX               00020901
C                              2ND DIM: CHARGE STATE INDEX              00021001
C                              3RD DIM: FIRST METASTABLE INDEX          00021101
C                              4TH DIM: SECOND METASTABLE INDEX         00021201
C INPUT  : (R*8)  XCDA(,,,) = INTERPOLATION OF XCD COEFFICIENT (CM3 S-1)00021801
C                              1ST DIM: TEMPERATURE INDEX               00021901
C                              2ND DIM: CHARGE STATE INDEX              00022001
C                              3RD DIM: FIRST PARENT METASTABLE INDEX   00022101
C                              4TH DIM: SECOND PARENT METASTABLE INDEX  00022201
C                                                                       00022301
C INPUT  : (R*8)  DENS()    = ELECTRON DENSITIES FOR MODEL              00022401
C INPUT  : (R*8)  DENSH()   = NEUTRAL HYDROGEN DENSITIES FOR MODEL      00022501
C                                                                       00022601
C INPUT  : (I*4)  ITEM      = CURRENT TEMP/DENSITY INDEX                00023601
C                                                                       00023701
C OUTPUT : (R*8)  A(,)      = RECOMB/IONIS COLL. RAD. MATRIX            00023805
C                                                                       00023901
C          (I*4)  I         = GENERAL INDEX                             00024005
C          (I*4)  IGRD      = GENERAL INDEX                             00025005
C          (I*4)  IND       = GENERAL INDEX                             00026005
C          (I*4)  IND1      = GENERAL INDEX                             00027005
C          (I*4)  IPRT      = GENERAL INDEX                             00028005
C          (I*4)  IZ        = IONISATION STAGE COUNTER                  00029005
C          (I*4)  I         = GENERAL INDEX                             00030005
C          (I*4)  JGRD      = GENERAL INDEX                             00040005
C                                                                       00050005
C                                                                       00060005
C ROUTINES:                                                             00070005
C          ROUTINE    SOURCE    BRIEF DESCRIPTION                      00071005
C          ------------------------------------------------------------ 00072005
C                                                                       00073005
C                                                                       00074005
C AUTHOR : H. P. SUMMERS, JET                                           00075005
C          K1/1/57                                                      00076005
C          JET  EXT. 4941                                               00077005
C                                                                       00078005
C DATE   : 27/07/94                                                     00078105
C UNIX-IDL PORT:
C
C AUTHOR:  WILLIAM OSBORN (TESSELLA SUPPORT SERVICES PLC)
C
C DATE:    07/06/96
C
C VERSION: 1.1                                  DATE:07/06/96
C MODIFIED: WILLIAM OSBORN
C            - FIRST VERSION
C
C-----------------------------------------------------------------------00079000
       INTEGER   NTDIM   , IZDIMD  , IPDIMD  , IMDIMD                   00079101
       INTEGER   NMDIM   , NSTAGE                                       00079207
       INTEGER   ITEM                                                   00079401
       INTEGER   I       , IGRD    , IND     , IND1    , IPRT    ,      00079503
     &           IZ      , J       , JGRD                             00079605
C-----------------------------------------------------------------------00079701
       INTEGER   NPART(IZDIMD)                                          00079801
C-----------------------------------------------------------------------00079901
       REAL*8    ACDA(NTDIM,IZDIMD,IPDIMD,IPDIMD)                       00080001
       REAL*8    SCDA(NTDIM,IZDIMD,IPDIMD,IPDIMD)                       00080101
       REAL*8    CCDA(NTDIM,IZDIMD,IPDIMD,IPDIMD)                       00080201
       REAL*8    QCDA(NTDIM,IZDIMD,IPDIMD,IPDIMD)                       00080301
       REAL*8    XCDA(NTDIM,IZDIMD,IPDIMD,IPDIMD)                       00080401
C                                                                       00080501
       REAL*8    DENS(NTDIM) , DENSH(NTDIM)                             00080601
C                                                                       00080701
       REAL*8    A(NMDIM,NMDIM)                                         00080806
C-----------------------------------------------------------------------
```

D6MPOP

```
       SUBROUTINE D6MPOP( NTDIM  , IZDIMD , IPDIMD , IMDIMD ,
     &                    NSTAGE , ITMAX  , NPRT   , NMSUM  ,
     &                    ACDA   , SCDA   , CCDA   , QCDA   , XCDA   ,
     &                    DENS   , DENSH  ,
     &                    FABUN0 ,
     &                    ITEM   , TIMEF  ,
     &                    POPE   , POPF   , PINTE  , PINTF
     &                  )
       IMPLICIT NONE
C
C-----------------------------------------------------------------------
```

```
C
C  ****************** FORTRAN 77 SUBROUTINE: D6MPOP ********************
C
C  PURPOSE: CALCULATION OF METASTABLE RESOLVED IONISATION STAGE
C           POPULATIONS OF A PARTICULAR ELEMENT FOR A GIVEN TEMPERATURE
C           AND DENSITY
C
C  CALLING PROGRAM: ADAS405
C
C  SUBROUTINE:
C
C
C INPUT :(I*4) NTDIM         = MAXIMUM NUMBER OF MODEL TEMPS/DENSITIES
C INPUT :(I*4) IZDIMD        = MAXIMUM NUMBER OF STAGES-1
C INPUT :(I*4) IPDIMD        = MAXIMUM SIZE OF METASTABLES FRO A STAGE
C INPUT :(I*4) IMDIMD        = MAXIMUM NUMBER OF POPULATIONS
C INPUT :(I*4) NSTAGE        = NUMBER OF STAGES-1
C INPUT :(I*4) ITMAX         = NUMBER OF MODEL TEMPS/DENSITIES
C INPUT :(R*8) NPRT( )       = PARTITION OF TOTAL METASTABLES ACCORDING
C                              TO IONISATION STAGES
C                              1ST DIM: STAGE INDEX
C INPUT :(I*4) NMSUM         = TOTAL NUMBER OF POPULATIONS
C INPUT :(R*8) ACDA(,,,)     = GENERALISED CR RECOMBINATION COEFFICIENT
C                              1ST DIM: TEMPERATURE INDEX
C                              2ND DIM: STAGE INDEX (LESS 1)
C                              3RD DIM: METASTABLE INDEX
C                              4TH DIM: METASTABLE INDEX
C INPUT :(R*8) SCDA(,,,)     = GENERALISED CR IONISATION COEFFICIENT
C                              1ST DIM: TEMPERATURE INDEX
C                              2ND DIM: STAGE INDEX (LESS 1)
C                              3RD DIM: METASTABLE INDEX
C                              4TH DIM: METASTABLE INDEX
C INPUT :(R*8) CCDA(,,,)     = GENERALISED CR CHARGE EXCH. COEFFICIENT
C                              1ST DIM: TEMPERATURE INDEX
C                              2ND DIM: STAGE INDEX (LESS 1)
C                              3RD DIM: METASTABLE INDEX
C                              4TH DIM: METASTABLE INDEX
C INPUT :(R*8) QCDA(,,,)     = GENERALISED CR CROSS-COUPL. COEFFICIENT
C                              1ST DIM: TEMPERATURE INDEX
C                              2ND DIM: STAGE INDEX (LESS 1)
C                              3RD DIM: METASTABLE INDEX
C                              4TH DIM: METASTABLE INDEX
C INPUT :(R*8) XCDA(,,,)     = GENERALISED CR PARENT X-CP. COEFFICIENT
C                              1ST DIM: TEMPERATURE INDEX
C                              2ND DIM: STAGE INDEX (LESS 1)
C                              3RD DIM: METASTABLE INDEX
C                              4TH DIM: METASTABLE INDEX
C INPUT :(R*8) DENS()        = ELECTRON DENSITIES FOR MODEL
C                              1ST DIM: TEMPERATURE INDEX
C INPUT :(R*8) DENSH()       = NEUTRAL HYDROGEN DENSITIES FOR MODEL
C                              1ST DIM: TEMPERATURE INDEX
C
C INPUT :(R*8) FABUN0()      = INITIAL POPULATION ABUNDANCES AT TIME = 0
C                              1ST DIM: POPULATION INDEX
C
C INPUT :(I*4) ITEM          = CURRENT TEMP/DENSITY INDEX
C INPUT :(R*8) TIMEF         = INTEGRATION TIME (SEC)
C
C OUTPUT:(R*8) POPE()        = IONISATION BALANCE POPULATIONS
C OUTPUT:(R*8) POPF()        = POPULATIONS AT T = TIMEF
C OUTPUT:(R*8) PINTE()       = POPULATION EXCESS INTEGRAL TO T = INFIN.
C OUTPUT:(R*8) PINTF()       = POPULATION EXCESS INTEGRAL TO T = TIMEF
C
C        (I*4) ISTATE        = STAGE INDEX
C        (I*4) ITEM          = GENERAL INDEX
C        (I*4) I             = GENERAL INDEX
C        (I*4) J             = GENERAL INDEX
C        (I*4) K             = GENERAL INDEX
C        (R*8) FV1()         = WORK ARRAY USED BY XXEIGN
C        (I*4) IV1()         = WORK ARRAY USED BY XXEIGN
C
C  ROUTINES:
C           ROUTINE    SOURCE    BRIEF DESCRIPTION
C           ------------------------------------------------------------
C           D6MFLL     ADAS      FILL UP IONIS./RECOM. MATRIX
CX           F02AGF     NAG       GENERAL MATRIX DIAGONALISATION
CX           F02ATF     NAG       SIMULTANEOUS EQUATION SOLUTION
C           XXEIGN     ADAS/NETLIB GENERAL MATRIX DIAGONALISATION
C           XXSIM      ADAS/NETLIB SIMULTANEOUS EQUATION SOLUTION
C
C
C  AUTHOR:  H. P. SUMMERS, JET
C           K1/1/57
C           JET EXT. 4941
C
C  DATE:    27/06/94
C
C UNIX-IDL PORT:
C
C AUTHOR:  WILLIAM OSBORN (TESSELLA SUPPORT SERVICES PLC)
C
C DATE:    07/06/96
C
C VERSION: 1.1                                  DATE:07/06/96
C MODIFIED: WILLIAM OSBORN
C            - FIRST VERSION
C VERSION: 1.2                                  DATE:27/06/96
C MODIFIED: WILLIAM OSBORN
```

```
C           - REMOVED UNUSED VARIABLES
C VERSION: 1.3                                    DATE:13/09/96
C MODIFIED: WILLIAM OSBORN
C           - CHANGED PARAMETERS OF XXSIM IN LINE WITH CHANGES FOR
C             NON-SQUARE MATRICES.
C
C-----------------------------------------------------------------------
       INTEGER NMDIM  , NTIME
C-----------------------------------------------------------------------
       PARAMETER ( NMDIM = 61 , NTIME = 11 )
C-----------------------------------------------------------------------
       INTEGER NTDIM  , IZDIMD , IPDIMD , IMDIMD
       INTEGER ITEM   , NMSUM
       INTEGER NSTAGE , ITMAX
       INTEGER I      , I0     , I1     , IAA    , IFAIL  ,
     &         IP     , IV     , IVI    , IVR    ,
     &         J
C-----------------------------------------------------------------------
       REAL*8 AMAXM   , EIVAL  , HMEAN  , R0     , R1     ,
     &         TIME    , TIMEF  , TINT
C-----------------------------------------------------------------------
       INTEGER NPRT(IZDIMD)
C-----------------------------------------------------------------------
       REAL*8 ACDA(NTDIM,IZDIMD,IPDIMD,IPDIMD)
       REAL*8 SCDA(NTDIM,IZDIMD,IPDIMD,IPDIMD)
       REAL*8 QCDA(NTDIM,IZDIMD,IPDIMD,IPDIMD)
       REAL*8 XCDA(NTDIM,IZDIMD,IPDIMD,IPDIMD)
       REAL*8 CCDA(NTDIM,IZDIMD,IPDIMD,IPDIMD)
C
       REAL*8 DENS(NTDIM)      , DENSH(NTDIM)
C
       REAL*8 FABUN0(IMDIMD)   , POPE(IMDIMD)     , POPF(IMDIMD)
       REAL*8 PINTE(IMDIMD)    , PINTF(IMDIMD)
C
       REAL*8 RHS(NMDIM)       , RR(NMDIM)        , RI(NMDIM)
       REAL*8 A(NMDIM,NMDIM)   , WKS(NMDIM*(NMDIM+2))
       REAL*8 VR(NMDIM,NMDIM)  , VI(NMDIM,NMDIM)
       REAL*8 C(NMDIM)         , ERR(NMDIM)
       REAL*8 POP(NTIME,NMDIM)
C-----------------------------------------------------------------------
       REAL*8 FV1(NMDIM)
       INTEGER IV1(NMDIM)
C-----------------------------------------------------------------------
```

D6OTG1

```
      SUBROUTINE D6OTG1( LGHOST , DATE   ,
     &                   IMDIMD , NTDIM  ,
     &                   ELEMT  , TITLE  , GTIT1  , DSNINC ,
     &                   IZ0    , YEAR   , YEARDF ,
     &                   LGRD1  , LDEF1  ,
     &                   XMIN   , XMAX   , YMIN   , YMAX   ,
     &                   NMSUM  , ITMAX  ,
     &                   TEV    ,
     &                   TIMEF  ,
     &                   POPTIT , FABUN0 , FPABUN
     &                 )
      IMPLICIT NONE
C-----------------------------------------------------------------------
C
C  ****************** FORTRAN77 SUBROUTINE: D6OTG1 *********************
C
C  PURPOSE:  PASSES GRAPHICS DATA TO IDL.
C
C            PROVIDES  GRAPH OF METASTABLE FRACTIONAL ABUNDANCES. A
C            SINGLE GRAPH WILL CONTAIN UP TO SEVEN METASTABLES. (IF MORE
C            THAN SEVEN METASTABLES ARE PRESENT EXTRA GRAPHS WILL  BE
C            OUTPUT AS REQUIRED).
C
C            PLOT IS LOG10(N(META.)/N(TOTAL FOR ELEMENT)) VERSUS
C                    LOG10(ELECTRON TEMPERATURE (EV) )
C
C  CALLING PROGRAM: ADAS406
C
C  SUBROUTINE:
C
C  INPUT : (L*4)  LGHOST  = .TRUE.  => GHOST80 INITIALISED
C                           .FALSE. => GHOST80 NOT INITIALISED
C  INPUT : (C*8)  DATE    = CURRENT DATE AS 'DD/MM/YY'
C
C  INPUT : (I*4)  IMDIMD  = MAXIMUM NUMBER OF METASTABLES ALLOWED
C  INPUT : (I*4)  NTDIM   = MAXIMUM NUMBER OF DENSITIES ALLOWED
C
C  INPUT : (C*2)  ELEMT   = ELEMENT SYMBOL.
C  INPUT : (C*40) TITLE   = IDL ENTERED GENERAL TITLE FOR PROGRAM RUN
C  INPUT : (C*40) GTIT1   = IDL ENTERED TITLE FOR GRAPH
C  INPUT : (C*80) DSNINC  = INPUT COPASE DATA SET NAME (MVS DSN)
C
C  INPUT : (I*4)  IZ0     = NUCLEAR CHARGE
C  INPUT : (C*2)  YEAR    = TWO DIGIT YEAR NUMBER
C  INPUT : (C*2)  YEARDF  = TWO DIGIT DEFAULT YEAR NUMBER
C
C  INPUT : (L*4)  LGRD1   = .TRUE.  => PUT GRAPH IN GRID FILE
C                           = .FALSE. => DO NOT PUT GRAPH IN GRID FILE
```

```
C  INPUT : (L*4)  LDEF1   = .TRUE.  => USE GRAPH DEFAULT SCALING
C                         = .FALSE. => DO NOT USE DEFAULT SCALING
C
C  INPUT : (R*8)  XMIN    = LOWER LIMIT FOR X-AXIS OF GRAPH
C  INPUT : (R*8)  XMAX    = UPPER LIMIT FOR X-AXIS OF GRAPH
C  INPUT : (R*8)  YMIN    = LOWER LIMIT FOR Y-AXIS OF GRAPH
C  INPUT : (R*8)  YMAX    = UPPER LIMIT FOR Y-AXIS OF GRAPH
C
C  INPUT : (I*4)  NMSUM   = NUMBER OF METASTABLES
C  INPUT : (I*4)  ITMAX   = NUMBER OF INPUT ELECTRON DENSITIES
C
C  INPUT : (R*8)  TEV()   = ELECTRON DENSITIES (UNITS: CM-3)
C
C  INPUT : (R*8)  TIMEF   = INTEGRATION TIME (SEC)
C
C  INPUT : (C*10)POPTIT() = METASTABLE DESIGNATIONS
C  INPUT : (R*8) FABUN0() = INITIAL METASTABLE POPULATION FRACTIONS
C                             1ST DIMENSION: METASTABLE INDEX
C  INPUT : (R*8) FPABUN(,)= METASTABLE POPULATION FRACTIONS
C                             1ST DIMENSION: TEMPERATURE INDEX
C                             2ND DIMENSION: METASTABLE INDEX
C
C          (R*4)  GHZERO  = PARAMETER = VALUE BELOW WHICH GHOST80 TAKES
C                           NUMBERS AS BEING ZERO = 1.0E-36
C          (I*4)  NDIM1   = PARAMETER = MAXIMUM NUMBER OF TEMP.   VALUES
C                           (MUST NOT BE LESS THAN 'NTDIM')
C          (I*4)  NDIM2   = PARAMETER = MAXIMUM NUMBER OF METASTABLES
C                           (MUST NOT BE LESS THAN 'IMDIMD')
C          (I*4)  NGPIC   = PARAMETER = MAXIMUM NUMBER OF LEVEL POPULAT-
C                           IONS TO BE DISPLAYED ON A SINGLE GRAPH.
C          (I*4)  NGLEV   = PARAMETER = MAXIMUM NUMBER OF METASTABLES
C                           WHICH CAN BE LISTED ON THE GRAPH.
C
C          (I*4)  IT      = TEMP. INDEX NUMBER FOR ARRAY USE
C          (I*4)  IM      = METASTABLE INDEX NUMBER FOR ARRAY USE
C          (I*4)  IMMAX   = MINIMUM OF: NO. OF METASTABLES OR NGLEV'
C
C          (R*4)  X()     = X-AXIS CO-ORDINATES FOR USE WITH GHOST80
C                           ELECTRON DENSITIES
C          (R*4)  Y(,)    = Y-AXIS CO-ORDINATES FOR USE WITH GHOST80
C                           LEVEL POPULATIONS.
C                           1ST DIMENSION = ELECTRON TEMP.   INDEX
C                           2nd DIMENSION = ORDINARY  LEVEL  INDEX
C
C          (C*80) ISPEC   = GRAPH TITLE (INCORPORATES 'ELEMT,IZ0').
C          (C*13) DNAME   = '       DATE: '
C          (C*23) XTIT    = X-AXIS UNITS/TITLE
C          (C*23) YTIT    = Y-AXIS UNITS/TITLE
C          (C*9)  KEY0    = '    KEY: '
C          (C*9)  MNMX0   = 'MINIMAX: '
C          (C*9)  FILE0   = 'FILE   : '
C          (C*8)  ADAS0   = 'ADAS   :'
C          (C*28) KEY()   = DESCRIPTIVE KEY FOR GRAPH (2 TYPES)
C
C          (C*3)  C3BLNK  = BLANK 3 BYTE STRING
C          (C*30) HEAD1   = HEADING FOR LEVEL ASSIGNMENTS
C          (C*30) STRG1   = HEADING FOR LEVEL ASSIGNMENTS
C
C          (L*4)  LGTXT   = .TRUE.  => LAST SCREEN DUMP WAS TEXT.
C                         = .FALSE. => LAST SCREEN DUMP WAS GHOST80.
C
C ROUTINES:
C          ROUTINE     SOURCE    BRIEF DESCRIPTION
C          ------------------------------------------------------------
C
C AUTHOR:  H. P. SUMMERS, JET
C          K1/1/57
C          JET EXT. 4941
C
C DATE:    28/04/94
C
C UNIX-IDL PORT:
C
C AUTHOR:  WILLIAM OSBORN (TESSELLA SUPPORT SERVICES PLC)
C
C DATE:    07/06/96
C
C VERSION: 1.1                                  DATE:07/06/96
C MODIFIED: WILLIAM OSBORN
C            - FIRST VERSION
C VERSION: 1.2                                  DATE:27/06/96
C MODIFIED: WILLIAM OSBORN
C            - REMOVED UNUSED VARIABLES
C
C VERSION: 1.3                                     DATE: 09-06-98
C MODIFIED: RICHARD MARTIN
C            - INCREASED NTDIM1 TO 30.
C
C-----------------------------------------------------------------------
C
C-----------------------------------------------------------------------
      INTEGER   NDIM1    , NDIM2    , NGPIC    , NGLEV
C-----------------------------------------------------------------------
C-----------------------------------------------------------------------
      PARAMETER ( NDIM1= 30  , NDIM2=200        , NGPIC=7 , NGLEV = 55 )
C-----------------------------------------------------------------------
      INTEGER   IMDIMD   , NTDIM
      INTEGER   NMSUM    , ITMAX    ,
```

```
     &          IZ0
      INTEGER   IT       , IM       ,
     &          IMMAX
C-----------------------------------------------------------------------
      REAL*4    TIME4    , GHZERO
C-----------------------------------------------------------------------
      INTEGER   PIPEIN, PIPEOU
      PARAMETER (PIPEIN=5, PIPEOU=6 , GHZERO = 1.0E-36)
C-----------------------------------------------------------------------
      REAL*8    XMIN     , XMAX     ,
     &          YMIN     , YMAX
      REAL*8    TIMEF
C-----------------------------------------------------------------------
      LOGICAL   LGHOST   , LGRD1    , LDEF1    , LGTXT
C-----------------------------------------------------------------------
      CHARACTER ELEMT*2  , TITLE*40 , GTIT1*40 , DSNINC*80
      CHARACTER YEAR*2   , YEARDF*2
      CHARACTER GRID*1   , PIC*1    , C3BLNK*3 , DATE*8   ,
     &          FILE0*9  , MNMX0*9  , KEY0*9   , ADAS0*8  ,
     &          DNAME*13 , GNAME*10 ,
     &          XTIT*25  , YTIT*25  ,
     &          HEAD1*40 ,
     &          STRG1*40 ,
     &          ISPEC*80
C-----------------------------------------------------------------------
      REAL*4    X(NDIM1)            , Y(NDIM1,NDIM2)
C-----------------------------------------------------------------------
      CHARACTER POPTIT(IMDIMD)*10   , SY0(NDIM2)*10
      CHARACTER KEY(3)*22
C-----------------------------------------------------------------------
      REAL*8    TEV(NTDIM)  , FABUN0(IMDIMD)
      REAL*8    FPABUN(NTDIM,IMDIMD)
C-----------------------------------------------------------------------
      DATA ISPEC(1:40)
     &          /'ION FRACTION  VS  ELECTRON TEMPERATURE: '/
      DATA XTIT  /'ELECTRON TEMPERATURE (eV)'/
      DATA YTIT  /'N(INDX)/N(TOTAL)         '/
      DATA ADAS0 /'ADAS   :'/               ,
     &     FILE0 /'FILE   : '/              ,
     &     MNMX0 /'MINIMAX: '/              ,
     &     KEY0  /'KEY    : '/              ,
     &     KEY(1)/'(FULL LINE - TOTAL   )'/  ,
     &     KEY(2)/' (DASH LINE - PARTIAL)'/  ,
     &     KEY(3)/'                     ) '/
      DATA GRID  /' '/   ,
     &     PIC   /' '/   ,
     &     C3BLNK/'   '/
      DATA DNAME /'       DATE: '/,
     &     GNAME /'SPECIES : '/
      DATA HEAD1 /'--------- METASTABLE ASSIGMENTS --------'/
      DATA STRG1 /'INDX         DESIGNATION     INIT. FRAC.'/
C-----------------------------------------------------------------------
```

D6OTG2

```
      SUBROUTINE D6OTG2( LGHOST , LEXSS , DATE  ,
     &                   IMDIMD , NTDIM ,
     &                   ELEMT  , TITLE , GTIT1  , DSNINC ,
     &                   IZ0    , YEAR  , YEARDF ,
     &                   LGRD1  , LDEF1  ,
     &                   XMIN   , XMAX  , YMIN   , YMAX   ,
     &                   NMSUM  , ITMAX  ,
     &                   TEV    ,
     &                   TIMEF  ,
     &                   POPTIT , FABUN0 , ELTPEQ ,
     &                   ERBEQ  , ERCEQ  , ELTEQ  , ERADA
     &                 )
      IMPLICIT NONE
C-----------------------------------------------------------------------
C
C  ****************** FORTRAN77 SUBROUTINE: D6OTG2 *********************
C
C  PURPOSE:  PASSES GRAPH DATA TO IDL.
C
C            PROVIDES  GRAPH OF METASTABLE FRACTIONAL LINE ENERGY
C            FUNCTIONS. A
C            SINGLE GRAPH WILL CONTAIN UP TO SEVEN METASTABLES. (IF MORE
C            THAN SEVEN METASTABLES ARE PRESENT EXTRA GRAPHS WILL  BE
C            OUTPUT AS REQUIRED).
C
C            PLOT IS LOG10(ENERGY FUNCTION (J CM3 ) ) VERSUS
C                    LOG10(ELECTRON TEMPERATURE (EV) )
C
C  CALLING PROGRAM: ADAS406
C
C  SUBROUTINE:
C
C  INPUT : (L*4)  LGHOST  = .TRUE.  => GHOST80 INITIALISED
C                           .FALSE. => GHOST80 NOT INITIALISED
C  INPUT : (L*4)  LEXSS()   = .TRUE.  => OUTPUT STANDARD MASTER DATA FOR
C                                        THIS INDEX GENERATED
C                           = .FALSE. => OUTPUT STANDARD MASTER DATA FOR
C                                        THIS INDEX NOT GENERATED
C  INPUT : (C*8)  DATE    = CURRENT DATE AS 'DD/MM/YY'
```

```
C
C  INPUT : (I*4)  IMDIMD  = MAXIMUM NUMBER OF METASTABLES ALLOWED
C  INPUT : (I*4)  NTDIM   = MAXIMUM NUMBER OF DENSITIES ALLOWED
C
C  INPUT : (C*2)  ELEMT   = ELEMENT SYMBOL.
C  INPUT : (C*40) TITLE   = IDL ENTERED GENERAL TITLE FOR PROGRAM RUN
C  INPUT : (C*40) GTIT1   = IDL ENTERED TITLE FOR GRAPH
C  INPUT : (C*80) DSNINC  = INPUT COPASE DATA SET NAME
C
C  INPUT : (I*4)  IZ0     = NUCLEAR CHARGE
C  INPUT : (C*2)  YEAR    = TWO DIGIT YEAR NUMBER
C  INPUT : (C*2)  YEARDF  = TWO DIGIT DEFAULT YEAR NUMBER
C
C  INPUT : (L*4)  LGRD1   = .TRUE.  => PUT GRAPH IN GRID FILE
C                         = .FALSE. => DO NOT PUT GRAPH IN GRID FILE
C  INPUT : (L*4)  LDEF1   = .TRUE.  => USE GRAPH DEFAULT SCALING
C                         = .FALSE. => DO NOT USE DEFAULT SCALING
C
C  INPUT : (R*8)  XMIN    = LOWER LIMIT FOR X-AXIS OF GRAPH
C  INPUT : (R*8)  XMAX    = UPPER LIMIT FOR X-AXIS OF GRAPH
C  INPUT : (R*8)  YMIN    = LOWER LIMIT FOR Y-AXIS OF GRAPH
C  INPUT : (R*8)  YMAX    = UPPER LIMIT FOR Y-AXIS OF GRAPH
C
C  INPUT : (I*4)  NMSUM   = NUMBER OF METASTABLES
C  INPUT : (I*4)  ITMAX   = NUMBER OF INPUT ELECTRON DENSITIES
C
C  INPUT : (R*8)  TEV()   = ELECTRON DENSITIES (UNITS: CM-3)
C
C  INPUT : (R*8)  TIMEF   = INTEGRATION TIME (SEC)
C
C  INPUT : (C*10)POPTIT() = METASTABLE DESIGNATIONS
C  INPUT : (R*8) FABUN0() = INITIAL METASTABLE POPULATION FRACTIONS
C                           1ST DIMENSION: METASTABLE INDEX
C  INPUT : (R*8) ELTPEQ(,)= METASTABLE FRACTIONAL LINE ENERGY EXCESS
C                           FUNCTION
C                             1ST DIMENSION: TEMPERATURE INDEX
C                             2ND DIMENSION: METASTABLE INDEX
C  INPUT : (R*8)  ERBEQ() = TOTAL TRANSIENT RADIATED RECOM-BREMS
C                           ENERGY EXCESS FUNCTION
C  INPUT : (R*8)  ERCEQ() = TOTAL TRANSIENT CX RADIATED RECOM ENERGY
C                           EXCESS FUNCTION NORMALISED TO ELECTRON
C                           DENSITY
C  INPUT : (R*8)  ELTEQ() = TOTAL TRANSIENT RADIATED LINE ENERGY EXCESS
C                           FUNCTION
C  INPUT : (R*8)  ERADA() = TOTAL TRANSIENT RADIATED ENERGY EXCESS
C                           FUNCTION
C
C          (I*4)  NDIM1   = PARAMETER = MAXIMUM NUMBER OF TEMP. VALUES
C                           (MUST NOT BE LESS THAN 'NTDIM')
C          (I*4)  NDIM2   = PARAMETER = MAXIMUM NUMBER OF METASTABLES
C                           (MUST NOT BE LESS THAN 'IMDIMD')
C          (I*4)  NGPIC   = PARAMETER = MAXIMUM NUMBER OF LEVEL POPULAT-
C                           IONS TO BE DISPLAYED ON A SINGLE GRAPH.
C          (I*4)  NGLEV   = PARAMETER = MAXIMUM NUMBER OF METASTABLES
C                           WHICH CAN BE LISTED ON THE GRAPH.
C
C          (R*4)  CUTMIN  = PARAMETER = IN DEFAULT GRAPH SCALING IS THE
C                           MINIMUM Y-VALUE THAT IS ALLOWED.
C                           (NOTE: 'CUTMIN' MUST BE > THAN 'GHZERO')
C          (R*4)  GHZERO  = PARAMETER = VALUE BELOW WHICH GHOST80 TAKES
C                           NUMBERS AS BEING ZERO = 1.0E-36
C
C          (I*4)  IT      = TEMP. INDEX NUMBER FOR ARRAY USE
C          (I*4)  IM      = METASTABLE INDEX NUMBER FOR ARRAY USE
C          (I*4)  IMMAX   = MINIMUM OF: NO. OF METASTABLES OR NGLEV'
C
C          (R*4)  X()     = X-AXIS CO-ORDINATES FOR USE WITH GHOST80
C                           ELECTRON DENSITIES
C          (R*4)  Y(,)    = Y-AXIS CO-ORDINATES FOR USE WITH GHOST80
C                           LEVEL POPULATIONS.
C                           1ST DIMENSION = ELECTRON TEMP. INDEX
C                           2ND DIMENSION = METASTABLE  INDEX
C
C          (C*80) ISPEC   = GRAPH TITLE (INCORPORATES 'ELEMT,IZ0').
C          (C*3)  CNAM()  = 3 BYTE STRING FOR POWER FUNCTION TOTAL NAMES
C          (C*13) DNAME   = '       DATE: '
C          (C*23) XTIT    = X-AXIS UNITS/TITLE
C          (C*23) YTIT    = Y-AXIS UNITS/TITLE
C          (C*9)  KEY0    = '    KEY: '
C          (C*9)  MNMX0   = 'MINIMAX: '
C          (C*9)  FILE0   = 'FILE   : '
C          (C*8)  ADAS0   = 'ADAS   :'
C          (C*28) KEY()   = DESCRIPTIVE KEY FOR GRAPH (2 TYPES)
c
C          (C*1)  GRID    = DUMMY NAME VARIABLE FOR USE WITH GHOST80
C          (C*1)  PIC     = DUMMY NAME VARIABLE FOR USE WITH GHOST80
C          (C*3)  C3BLNK  = BLANK 3 BYTE STRING
C          (C*30) HEAD1   = HEADING FOR LEVEL ASSIGNMENTS
C          (C*30) STRG1   = HEADING FOR LEVEL ASSIGNMENTS
C
C          (L*4)  LGTXT   = .TRUE.  => LAST SCREEN DUMP WAS TEXT.
C                         = .FALSE. => LAST SCREEN DUMP WAS GHOST80.
C
C ROUTINES:
C          ROUTINE     SOURCE    BRIEF DESCRIPTION
C          ------------------------------------------------------------
C
C AUTHOR:  H. P. SUMMERS, JET
```

```
C          K1/1/57
C          JET EXT. 4941
C
C DATE:    28/04/94
C
C UNIX-IDL PORT:
C
C AUTHOR:  WILLIAM OSBORN (TESSELLA SUPPORT SERVICES PLC)
C
C DATE:    07/06/96
C
C VERSION: 1.1                                   DATE:07/06/96
C MODIFIED: WILLIAM OSBORN
C           - FIRST VERSION
C VERSION: 1.2                                   DATE:27/06/96
C MODIFIED: WILLIAM OSBORN
C           - REMOVED UNUSED VARIABLES
C
C VERSION: 1.3                                      DATE: 09/06/98
C MODIFIED: RICHARD MARTIN
C           - INCREASED NTDIM1 TO 30.
C
C-----------------------------------------------------------------------
C
C-----------------------------------------------------------------------
      INTEGER   NDIM1    , NDIM2    , NGPIC    , NGLEV
C-----------------------------------------------------------------------
      REAL*4    CUTMIN   , GHZERO
C-----------------------------------------------------------------------
      PARAMETER ( NDIM1= 30  , NDIM2=200        , NGPIC=7 , NGLEV = 55 )
      PARAMETER ( CUTMIN = 1.0E-35 , GHZERO = 1.0E-36 )
C-----------------------------------------------------------------------
      INTEGER   IMDIMD   , NTDIM
      INTEGER   NMSUM    , ITMAX    ,
     &          IZ0
      INTEGER   IT       , IM       ,
     &          IMMAX
C-----------------------------------------------------------------------
      REAL*4    TIME4
C-----------------------------------------------------------------------
      INTEGER   PIPEIN, PIPEOU
      PARAMETER(PIPEIN=5, PIPEOU=6)
C-----------------------------------------------------------------------
      REAL*8    XMIN     , XMAX     ,
     &          YMIN     , YMAX
      REAL*8    TIMEF
C-----------------------------------------------------------------------
      LOGICAL   LGHOST   , LGRD1    , LDEF1    , LGTXT
C-----------------------------------------------------------------------
      LOGICAL   LEXSS(8)
C-----------------------------------------------------------------------
      CHARACTER ELEMT*2  , TITLE*40 , GTIT1*40 , DSNINC*80
      CHARACTER YEAR*2   , YEARDF*2
      CHARACTER GRID*1   , PIC*1    , C3BLNK*3 , DATE*8   ,
     &          FILE0*9  , MNMX0*9  , KEY0*9   , ADAS0*8  ,
     &          DNAME*13 , GNAME*10 ,
     &          XTIT*25  , YTIT*23  ,
     &          HEAD1*40 ,
     &          STRG1*40 ,
     &          ISPEC*80
C-----------------------------------------------------------------------
      REAL*4    X(NDIM1)            , Y(NDIM1,NDIM2)
C-----------------------------------------------------------------------
      CHARACTER POPTIT(IMDIMD)*10   , SY0(NDIM2)*10  , CNAM(4)*3
      CHARACTER KEY(3)*22
C-----------------------------------------------------------------------
      REAL*8    TEV(NTDIM)  , FABUN0(IMDIMD)
      REAL*8    ELTPEQ(NTDIM,IMDIMD) ,
     &          ERBEQ(NTDIM)  , ERCEQ(NTDIM)   ,  ELTEQ(NTDIM) ,
     &          ERADA(NTDIM)
C-----------------------------------------------------------------------
      DATA ISPEC(1:40)
     &          /'ENERGY EXCESS VS ELECTRON TEMPERATURE:  '/
      DATA (CNAM(IM), IM=1,4)
     &          / 'PRB' , 'PRC' , 'PLT' , 'TOT' /
      DATA XTIT  /'ELECTRON TEMPERATURE (eV)'/
      DATA YTIT  /'ENERGY FUNCTION (J cm3)'/
      DATA ADAS0 /'ADAS   :'/               ,
     &     FILE0 /'FILE   : '/              ,
     &     MNMX0 /'MINIMAX: '/              ,
     &     KEY0  /'KEY    : '/              ,
     &     KEY(1)/'(FULL LINE - TOTAL   )'/  ,
     &     KEY(2)/' (DASH LINE - PARTIAL)'/  ,
     &     KEY(3)/'                     ) '/
      DATA GRID  /' '/   ,
     &     PIC   /' '/   ,
     &     C3BLNK/'   '/
      DATA DNAME /'       DATE: '/,
     &     GNAME /'SPECIES : '/
      DATA HEAD1 /'--------- METASTABLE ASSIGMENTS --------'/
      DATA STRG1 /'INDX        DESIGNATION      INIT. FRAC.'/
C-----------------------------------------------------------------------
```

```
      SUBROUTINE D6OTG3( LGHOST , DATE  ,
     &                   IMDIMD , NTDIM , NDLINE , NDCOMP ,
     &                   ELEMT  , TITLE , GTIT1  , DSNINC ,
     &                   IZ0    , YEAR  , YEARDF ,
     &                   LGRD1  , LDEF1 ,
     &                   XMIN   , XMAX  , YMIN   , YMAX   ,
     &                   NMSUM  , ITMAX ,
     &                   TEV    , POPTIT, FABUN0 ,
     &                   TIMEF  ,
     &                   IBSEL  ,
     &                   NLINE  , NCOMP ,
     &                   TITL   , SPECL , IPLINE ,
     &                   GCFPEQ , GCFEQ
     &                 )
      IMPLICIT NONE
C-----------------------------------------------------------------------
C
C  ****************** FORTRAN77 SUBROUTINE: D6OTG3 *********************
C
C  PURPOSE:  COMMUNICATES GRAPH DATA TO IDL
C
C            PROVIDES  GRAPH OF SELECTED GCF FUNCTION AND ITS COMPONENTS
C
C            PLOT IS LOG10(GCF FUNCTION ( CM3 S-1) ) VERSUS
C                    LOG10(ELECTRON TEMPERATURE (EV) )
C
C  CALLING PROGRAM: ADAS406
C
C  SUBROUTINE:
C
C  INPUT : (L*4)  LGHOST   = .TRUE.  => GHOST80 INITIALISED
C                            .FALSE. => GHOST80 NOT INITIALISED
C  INPUT : (C*8)  DATE     = CURRENT DATE AS 'DD/MM/YY'
C
C  INPUT : (I*4)  IMDIMD   = MAXIMUM NUMBER OF METASTABLES ALLOWED
C  INPUT : (I*4)  NTDIM    = MAXIMUM NUMBER OF DENSITIES ALLOWED
C  INPUT : (I*4)  NDLINE   = MAXIMUM NUMBER OF LINES ALLOWED
C  INPUT : (I*4)  NDCOMP   = MAXIMUM NUMBER OF COMPONENT FOR EACH LINE
C
C  INPUT : (C*2)  ELEMT    = ELEMENT SYMBOL.
C  INPUT : (C*40) TITLE    = ISPF ENTERED GENERAL TITLE FOR PROGRAM RUN
C  INPUT : (C*40) GTIT1    = ISPF ENTERED TITLE FOR GRAPH
C  INPUT : (C*80) DSNINC   = INPUT COPASE DATA SET NAME (MVS DSN)
C
C  INPUT : (I*4)  IZ0      = NUCLEAR CHARGE
C  INPUT : (C*2)  YEAR     = TWO DIGIT YEAR NUMBER
C  INPUT : (C*2)  YEARDF   = TWO DIGIT DEFAULT YEAR NUMBER
C
C  INPUT : (L*4)  LGRD1    = .TRUE.  => PUT GRAPH IN GRID FILE
C                            .FALSE. => DO NOT PUT GRAPH IN GRID FILE
C  INPUT : (L*4)  LDEF1    = .TRUE.  => USE GRAPH DEFAULT SCALING
C                            .FALSE. => DO NOT USE DEFAULT SCALING
C
C  INPUT : (R*8)  XMIN     = LOWER LIMIT FOR X-AXIS OF GRAPH
C  INPUT : (R*8)  XMAX     = UPPER LIMIT FOR X-AXIS OF GRAPH
C  INPUT : (R*8)  YMIN     = LOWER LIMIT FOR Y-AXIS OF GRAPH
C  INPUT : (R*8)  YMAX     = UPPER LIMIT FOR Y-AXIS OF GRAPH
C
C  INPUT : (I*4)  NMSUM    = NUMBER OF METASTABLES
C  INPUT : (I*4)  ITMAX    = NUMBER OF INPUT ELECTRON DENSITIES
C
C  INPUT : (R*8)  TEV()    = ELECTRON DENSITIES (UNITS: CM-3)
C
C  INPUT : (C*10) POPTIT() = METASTABLE DESIGNATIONS
C  INPUT : (R*8)  FABUN0() = INITIAL METASTABLE POPULATION FRACTIONS
C                            1ST DIMENSION: METASTABLE INDEX
C  INPUT : (R*8)  TIMEF    = INTEGRATION TIME (SEC)
C  INPUT : (I*4)  NLINE    = NUMBER OF LINES IDENTIFIED IN SCRIPT
C  INPUT : (I*4)  NCOMP()  = NUMBER OF COMPONENTS OF SCRIPT LINE
C  INPUT : (C*12) TITL(,)  = TITLE FOR LINE COMPONENT
C                            1ST DIM: LINE INDEX
C                            2ND DIM: COMPONENT INDEX
C  INPUT : (C*16) SPECL(,) = SPECIFICATION OF POINTERS OF LINE CPTS.
C                            1ST DIM: LINE INDEX
C                            2ND DIM: COMPONENT INDEX
C  INPUT : (I*4)  IPLINE(,)= METASTABLE POINTER OF LINE COMPONENT
C                            1ST DIM: LINE INDEX
C                            2ND DIM: COMPONENT INDEX
C  INPUT : (R*8)  GCFPEQ(,,)=GCF FUNC. COMPONENT (CM3 S-1)
C                           1ST DIM: TEMPERATURE INDEX
C                           2ND DIM: LINE INDEX
C                           3ND DIM: LINE COMPONENT INDEX
C  INPUT : (R*8)  GCFEQ()  = GCF FUNCTION  (CM3 S-1)
C
C           (I*4)  NDIM1    = PARAMETER = MAXIMUM NUMBER OF TEMP. VALUES
C                             (MUST NOT BE LESS THAN 'NTDIM')
C           (I*4)  NDIM2    = PARAMETER = MAXIMUM NUMBER OF METASTABLES
C                             (MUST NOT BE LESS THAN 'IMDIMD')
C           (I*4)  NGPIC    = PARAMETER = MAXIMUM NUMBER OF LEVEL POPUL-
C                             ATIONS TO BE DISPLAYED ON A SINGLE GRAPH.
C           (I*4)  NGLEV    = PARAMETER = MAXIMUM NUMBER OF METASTABLES
C                             WHICH CAN BE LISTED ON THE GRAPH.
C
C           (R*4)  CUTMIN   = PARAMETER = IN DEFAULT GRAPH SCALING IS
C                             THE  MINIMUM Y-VALUE THAT IS ALLOWED.
C                             (NOTE: 'CUTMIN' MUST BE > THAN 'GHZERO')
C           (R*4)  GHZERO   = PARAMETER = VALUE BELOW WHICH GHOST80 TAKES
C                             NUMBERS AS BEING ZERO = 1.0E-36
```

```
C
C          (I*4)  IT       = TEMP. INDEX NUMBER FOR ARRAY USE
C          (I*4)  IC       = LINE COMPONENT INDEX
C          (I*4)  IM       = METASTABLE INDEX NUMBER FOR ARRAY USE
C          (I*4)  IMMAX    = MINIMUM OF: NO. OF METASTABLES OR NGLEV'
C
C          (R*4)  X()      = X-AXIS CO-ORDINATES FOR USE WITH GHOST80
C                            ELECTRON DENSITIES
C          (R*4)  Y(,)     = Y-AXIS CO-ORDINATES FOR USE WITH GHOST80
C                            LEVEL POPULATIONS.
C                            1ST DIMENSION = ELECTRON TEMP. INDEX
C                            2ND DIMENSION = METASTABLE  INDEX
C
C          (L*4)  LPLINE() = .TRUE.  => META. REFERENCED BY A LINE CPT
C                          = .FALSE. => META. NOT REFERENCED BY LINE CPT
C
C          (C*80) ISPEC    = GRAPH TITLE (INCORPORATES 'ELEMT,IZ0').
C          (C*13) DNAME    = '       DATE: '
C          (C*13) FNAME    = 'INPUT FILE : '
C          (C*13) GNAME    = 'GRAPH TITLE: '
C          (C*23) XTIT     = X-AXIS UNITS/TITLE
C          (C*23) YTIT     = Y-AXIS UNITS/TITLE
C          (C*9)  KEY0    = '    KEY: '
C          (C*9)  MNMX0   = 'MINIMAX: '
C          (C*9)  FILE0   = 'FILE   : '
C          (C*8)  ADAS0   = 'ADAS   :'
C          (C*28) KEY()   = DESCRIPTIVE KEY FOR GRAPH (2 TYPES)
C
C          (C*1)  GRID     = DUMMY NAME VARIABLE FOR USE WITH GHOST80
C          (C*1)  PIC      = DUMMY NAME VARIABLE FOR USE WITH GHOST80
C          (C*3)  C3BLNK   = BLANK 3 BYTE STRING
C          (C*3)  CNAM()   = 3 BYTE STRING FOR POWER FUNCT. TOTAL NAMES
C
C          (C*40) HEAD1    = HEADING FOR METASTABLE ASSIGMENTS
C          (C*30) HEAD2    = HEADING FOR SPECTRUM LINE SPECIFICATIONS
C          (C*40) STRG1    = INDX/DESIGNATION TITLE
C          (C*30) STRG3    = COMPONENT TITLE
C          (C*30) STRG4    = COMPONENT PARAMETER TITLE
C          (C*13) STRG5    = TITLE
C          (C*13) STRG6    = SELECT NO.
C          (C*13) STRG7    = COMPONENTS
C
C          (L*4)  LGTXT    = .TRUE.  => LAST SCREEN DUMP WAS TEXT.
C                          = .FALSE. => LAST SCREEN DUMP WAS GHOST80.
C
C ROUTINES:
C          ROUTINE     SOURCE    BRIEF DESCRIPTION
C          ------------------------------------------------------------
CX          XXLIM4      ADAS      SETS UP DEFAULT X-AXIS (DENS) FOR GRAPH
CX          XXELEM      ADAS      SETS UP ELEMENT NAME AS STRING
CX          BXLIMY      ADAS      SETS UP DEFAULT Y-AXIS (POP.) FOR GRAPH
C
C NOTE: FOR DEFAULT GRAPH SCALING ONLY:
C       IF YLOW=YHIGH => NO OUTPUT DATA FOR PLOTTING
C                        THIS MEANS EITHER NO TRANSITIONS WERE SPECIFIED
C                        TO THE METASTABLE  LEVEL  (IN  WHICH  CASE  ALL
C                        VALUES ARE ZERO) OR ALL VALUES ARE  LESS  THAN
C                        'CUTMIN'.
C
C AUTHOR:  H. P. SUMMERS, JET
C          K1/1/57
C          JET EXT. 4941
C
C DATE:    28/04/94
C
C UNIX-IDL PORT:
C
C AUTHOR:  WILLIAM OSBORN (TESSELLA SUPPORT SERVICES PLC)
C
C DATE:    07/06/96
C
C VERSION: 1.1                                  DATE:07/06/96
C MODIFIED: WILLIAM OSBORN
C           - FIRST VERSION
C VERSION: 1.2                                  DATE:27/06/96
C MODIFIED: WILLIAM OSBORN
C           - REMOVED UNUSED VARIABLES
C
C VERSION: 1.3                                  DATE: 09/06/98
C MODIFIED: RICHARD MARTIN
C           - INCREASED NTDIM1 TO 30.
C
C-----------------------------------------------------------------------
C
C-----------------------------------------------------------------------
      INTEGER   NDIM1    , NDIM2    , NGPIC    , NGLEV
C-----------------------------------------------------------------------
      REAL*4    CUTMIN   , GHZERO
C-----------------------------------------------------------------------
      PARAMETER ( NDIM1= 30  , NDIM2=200        , NGPIC=7 , NGLEV = 55 )
      PARAMETER ( CUTMIN = 1.0E-20 , GHZERO = 1.0E-36 )
C-----------------------------------------------------------------------
      INTEGER   IMDIMD   , NTDIM    , NDLINE   , NDCOMP
      INTEGER   NMSUM    , ITMAX    , NLINE    , IBSEL    ,
     &          IZ0
      INTEGER   IT       , IM       ,
     &          IMMAX    , IC
C-----------------------------------------------------------------------
```

```
      INTEGER   NCOMP(NDLINE)       , IPLINE(NDLINE,NDCOMP)
      INTEGER   PIPEIN   , PIPEOU
      PARAMETER(PIPEIN=5 , PIPEOU=6)
C-----------------------------------------------------------------------
      REAL*4    TIME4
C-----------------------------------------------------------------------
      REAL*8    XMIN     , XMAX     ,
     &          YMIN     , YMAX     ,
     &          TIMEF
C-----------------------------------------------------------------------
      LOGICAL   LGHOST   , LGRD1    , LDEF1    , LGTXT
C-----------------------------------------------------------------------
      LOGICAL   LPLINE(NDIM2)
C-----------------------------------------------------------------------
      CHARACTER ELEMT*2  , TITLE*40 , GTIT1*40 , DSNINC*80
      CHARACTER YEAR*2   , YEARDF*2
      CHARACTER GRID*1   , PIC*1    , C3BLNK*3 , DATE*8   ,
     &          FILE0*9  , MNMX0*9  , KEY0*9   , ADAS0*8  ,
     &          DNAME*13 , GNAME*10 ,
     &          XTIT*25  , YTIT*24  ,
     &          HEAD1*40 , HEAD2*30 ,
     &          STRG1*40 , STRG3*30 , STRG4*30 ,
     &          STRG5*13 , STRG6*13 , STRG7*13 ,
     &          ISPEC*80
C-----------------------------------------------------------------------
      CHARACTER TITL(NDLINE,NDCOMP)*12 , SPECL(NDLINE,NDCOMP)*16     ,
     &          CNAM(1)*3
C-----------------------------------------------------------------------
      REAL*4    X(NDIM1)            , Y(NDIM1,NDIM2)      , Z(NDIM1,1)
      REAL*4    YMAG(NDIM1,NDIM2)   , ZMAG(NDIM1,1)
C-----------------------------------------------------------------------
      CHARACTER POPTIT(IMDIMD)*10   , SY0(NDIM2)*10
      CHARACTER KEY(3)*22
C-----------------------------------------------------------------------
      REAL*8    TEV(NTDIM)
      REAL*8    GCFPEQ(NTDIM,NDLINE,NDCOMP) ,
     &          GCFEQ(NTDIM,NDLINE)
      REAL*8    FABUN0(IMDIMD)
C-----------------------------------------------------------------------
      DATA ISPEC(1:40)
     &          /'CONTRIB. FUNCT. VS ELECTRON TEMPERATURE:'/
      DATA XTIT  /'ELECTRON TEMPERATURE (eV)'/
      DATA YTIT  /'CONTRIB. FUNC. (cm3)    '/
      DATA ADAS0 /'ADAS   :'/               ,
     &     FILE0 /'FILE   : '/              ,
     &     MNMX0 /'MINIMAX: '/              ,
     &     KEY0  /'KEY    : '/              ,
     &     KEY(1)/'(FULL LINE - TOTAL   )'/  ,
     &     KEY(2)/' (DASH LINE - PARTIAL)'/  ,
     &     KEY(3)/'                     ) '/
      DATA GRID  /' '/   ,
     &     PIC   /' '/    ,
     &     C3BLNK/'   '/
      DATA DNAME /'       DATE: '/,
     &     GNAME /'SPECIES : '/
      DATA HEAD1 /'--------- METASTABLE ASSIGMENTS --------'/,
     &     HEAD2 /'--SPECTRUM LINE SPECIFICATION-'/
      DATA STRG1 /'INDX        DESIGNATION      INIT. FRAC.'/,
     &     STRG3 /'COMPONENT PARAMETERS          '/,
     &     STRG4 /'IC IZ IM  IP  IF  INDX        '/,
     &     STRG5 /'TITLE      = '/,
     &     STRG6 /'SELECT NO. = '/,
     &     STRG7 /'COMPONENTS = '/
C-----------------------------------------------------------------------
      DATA CNAM(1) / 'TOT' /
C-----------------------------------------------------------------------
```

D6OTG4

```
      SUBROUTINE D6OTG4( LGHOST , LEXSS , DATE  ,
     &                   IMDIMD , NTDIM ,
     &                   ELEMT  , TITLE , GTIT1  , DSNINC ,
     &                   IZ0    , YEAR  , YEARDF ,
     &                   LGRD1  , LDEF1  ,
     &                   XMIN   , XMAX  , YMIN   , YMAX   ,
     &                   NMSUM  , ITMAX  ,
     &                   TEV    ,
     &                   TIMEF  ,
     &                   POPTIT , FABUN0 , ELTPEQ ,
     &                   ERBEQ  , ERCEQ  , ELTEQ  , ERADA
     &                 )
      IMPLICIT NONE
C-----------------------------------------------------------------------
C
C  ****************** FORTRAN77 SUBROUTINE: D6OTG4 *********************
C
C  PURPOSE:  COMMUNICATES GRAPH DATA TO IDL
C
C            PROVIDES  GRAPH OF ERB, ERC, ELT AND TOTAL ENERGY
C            EXCESS/DEFICIT FUNCTIONS.
C
C            PLOT IS LOG10(|ENERGY| FUNCTION (J CM3 ) ) VERSUS
C                    LOG10(ELECTRON TEMPERATURE (EV) )
C
```

```
C  CALLING PROGRAM: ADAS406
C
C  SUBROUTINE:
C
C  INPUT : (L*4)  LGHOST  = .TRUE.  => GHOST80 INITIALISED
C                           .FALSE. => GHOST80 NOT INITIALISED
C  INPUT : (L*4)  LEXSS()   = .TRUE.  => OUTPUT STANDARD MASTER DATA FOR
C                                        THIS INDEX GENERATED
C                           = .FALSE. => OUTPUT STANDARD MASTER DATA FOR
C                                        THIS INDEX NOT GENERATED
C  INPUT : (C*8)  DATE    = CURRENT DATE AS 'DD/MM/YY'
C
C  INPUT : (I*4)  IMDIMD  = MAXIMUM NUMBER OF METASTABLES ALLOWED
C  INPUT : (I*4)  NTDIM   = MAXIMUM NUMBER OF DENSITIES ALLOWED
C
C  INPUT : (C*2)  ELEMT   = ELEMENT SYMBOL.
C  INPUT : (C*40) TITLE   = ISPF ENTERED GENERAL TITLE FOR PROGRAM RUN
C  INPUT : (C*40) GTIT1   = ISPF ENTERED TITLE FOR GRAPH
C  INPUT : (C*80) DSNINC  = INPUT COPASE DATA SET NAME (MVS DSN)
C
C  INPUT : (I*4)  IZ0     = NUCLEAR CHARGE
C  INPUT : (C*2)  YEAR    = TWO DIGIT YEAR NUMBER
C  INPUT : (C*2)  YEARDF  = TWO DIGIT DEFAULT YEAR NUMBER
C
C  INPUT : (L*4)  LGRD1   = .TRUE.  => PUT GRAPH IN GRID FILE
C                           = .FALSE. => DO NOT PUT GRAPH IN GRID FILE
C  INPUT : (L*4)  LDEF1   = .TRUE.  => USE GRAPH DEFAULT SCALING
C                           = .FALSE. => DO NOT USE DEFAULT SCALING
C
C  INPUT : (R*8)  XMIN    = LOWER LIMIT FOR X-AXIS OF GRAPH
C  INPUT : (R*8)  XMAX    = UPPER LIMIT FOR X-AXIS OF GRAPH
C  INPUT : (R*8)  YMIN    = LOWER LIMIT FOR Y-AXIS OF GRAPH
C  INPUT : (R*8)  YMAX    = UPPER LIMIT FOR Y-AXIS OF GRAPH
C
C  INPUT : (I*4)  NMSUM   = NUMBER OF METASTABLES
C  INPUT : (I*4)  ITMAX   = NUMBER OF INPUT ELECTRON DENSITIES
C
C  INPUT : (R*8)  TEV()   = ELECTRON DENSITIES (UNITS: CM-3)
C
C  INPUT : (R*8)  TIMEF   = INTEGRATION TIME (SEC)
C
C  INPUT : (C*10)POPTIT() = METASTABLE DESIGNATIONS
C  INPUT : (R*8) FABUN0() = INITIAL METASTABLE POPULATION FRACTIONS
C                             1ST DIMENSION: METASTABLE INDEX
C  INPUT : (R*8) ELTPEQ(,)= METASTABLE FRACTIONAL LINE ENERGY EXCESS
C                           FUNCTION
C                             1ST DIMENSION: TEMPERATURE INDEX
C                             2ND DIMENSION: METASTABLE INDEX
C  INPUT : (R*8)  ERBEQ() = TOTAL TRANSIENT RADIATED RECOM-BREMS
C                                 ENERGY EXCESS FUNCTION
C  INPUT : (R*8)  ERCEQ() = TOTAL TRANSIENT CX RADIATED RECOM ENERGY
C                                 EXCESS FUNCTION NORMALISED TO ELECTRON
C                                 DENSITY
C  INPUT : (R*8)  ELTEQ() = TOTAL TRANSIENT RADIATED LINE ENERGY EXCESS
C                                 FUNCTION
C  INPUT : (R*8)  ERADA() = TOTAL TRANSIENT RADIATED ENERGY EXCESS
C                                 FUNCTION
C
C          (I*4)  NDIM1   = PARAMETER = MAXIMUM NUMBER OF TEMP. VALUES
C                           (MUST NOT BE LESS THAN 'NTDIM')
C          (I*4)  NDIM2   = PARAMETER = MAXIMUM NUMBER OF METASTABLES
C                           (MUST NOT BE LESS THAN 'IMDIMD')
C          (I*4)  NGPIC   = PARAMETER = MAXIMUM NUMBER OF LEVEL POPULAT-
C                           IONS TO BE DISPLAYED ON A SINGLE GRAPH.
C          (I*4)  NGLEV   = PARAMETER = MAXIMUM NUMBER OF METASTABLES
C                           WHICH CAN BE LISTED ON THE GRAPH.
C
C          (R*4)  CUTMIN  = PARAMETER = IN DEFAULT GRAPH SCALING IS THE
C                           MINIMUM Y-VALUE THAT IS ALLOWED.
C                           (NOTE: 'CUTMIN' MUST BE > THAN 'GHZERO')
C          (R*4)  GHZERO  = PARAMETER = VALUE BELOW WHICH GHOST80 TAKES
C                           NUMBERS AS BEING ZERO = 1.0E-36
C
C          (I*4)  IT      = TEMP. INDEX NUMBER FOR ARRAY USE
C          (I*4)  IM      = METASTABLE INDEX NUMBER FOR ARRAY USE
C          (I*4)  IC      = GENERAL INDEX
C          (I*4)  IMMAX   = MINIMUM OF: NO. OF METASTABLES OR NGLEV'
C
C          (R*4)  X()     = X-AXIS CO-ORDINATES FOR USE WITH GHOST80
C                            ELECTRON DENSITIES
C          (R*4)  Y(,)    = Y-AXIS CO-ORDINATES FOR USE WITH GHOST80
C                           LEVEL POPULATIONS.
C                           1ST DIMENSION = ELECTRON TEMP. INDEX
C                           2ND DIMENSION = METASTABLE  INDEX
C
C          (C*80) ISPEC   = GRAPH TITLE (INCORPORATES 'ELEMT,IZ0').
C          (C*3)  CNAM()  = 3 BYTE STRING FOR POWER FUNCTION TOTAL NAMES
C          (C*13) DNAME   = '       DATE: '
C          (C*23) XTIT    = X-AXIS UNITS/TITLE
C          (C*23) YTIT    = Y-AXIS UNITS/TITLE
C          (C*9)  KEY0    = '    KEY: '
C          (C*9)  MNMX0   = 'MINIMAX: '
C          (C*9)  FILE0   = 'FILE   : '
C          (C*8)  ADAS0   = 'ADAS   :'
C          (C*28) KEY()   = DESCRIPTIVE KEY FOR GRAPH (2 TYPES)
c
C          (C*1)  GRID    = DUMMY NAME VARIABLE FOR USE WITH GHOST80
C          (C*1)  PIC     = DUMMY NAME VARIABLE FOR USE WITH GHOST80
```

```
C          (C*3)  C3BLNK  = BLANK 3 BYTE STRING
C          (C*30) HEAD1   = HEADING FOR LEVEL ASSIGNMENTS
C          (C*30) STRG1   = HEADING FOR LEVEL ASSIGNMENTS
C
C          (L*4)  LGTXT   = .TRUE.  => LAST SCREEN DUMP WAS TEXT.
C                         = .FALSE. => LAST SCREEN DUMP WAS GHOST80.
C
C ROUTINES:
C          ROUTINE     SOURCE    BRIEF DESCRIPTION
C          ------------------------------------------------------------
C
C AUTHOR:  H. P. SUMMERS, JET
C          K1/1/57
C          JET EXT. 4941
C
C DATE:    05/08/94
C
C UNIX-IDL PORT:
C
C AUTHOR:  WILLIAM OSBORN (TESSELLA SUPPORT SERVICES PLC)
C
C DATE:    07/06/96
C
C VERSION: 1.1                                  DATE:07/06/96
C MODIFIED: WILLIAM OSBORN
C           - FIRST VERSION
C VERSION: 1.2                                  DATE:27/06/96
C MODIFIED: WILLIAM OSBORN
C           - REMOVED UNUSED VARIABLES
C
C VERSION: 1.3                                  DATE: 09/06/98
C MODIFIED: RICHARD MARTIN
C           - INCREASED NTDIM1 TO 30.
C
C-----------------------------------------------------------------------
C
C-----------------------------------------------------------------------
      INTEGER   NDIM1    , NDIM2    , NGPIC    , NGLEV
C-----------------------------------------------------------------------
      REAL*4    CUTMIN   , GHZERO
C-----------------------------------------------------------------------
      PARAMETER ( NDIM1= 30  , NDIM2=200        , NGPIC=7 , NGLEV = 55 )
      PARAMETER ( CUTMIN = 1.0E-35 , GHZERO = 1.0E-36 )
C-----------------------------------------------------------------------
      INTEGER   IMDIMD   , NTDIM
      INTEGER   NMSUM    , ITMAX    ,
     &          IZ0
      INTEGER   IT       , IM       , IC      , IMMAX    ,
     &          IKEY
      INTEGER   PIPEIN   , PIPEOU
      PARAMETER(PIPEIN=5 , PIPEOU=6)
C-----------------------------------------------------------------------
      REAL*4    TIME4
C-----------------------------------------------------------------------
      REAL*8    XMIN     , XMAX     ,
     &          YMIN     , YMAX
      REAL*8    TIMEF
C-----------------------------------------------------------------------
      LOGICAL   LGHOST   , LGRD1    , LDEF1    , LGTXT
C-----------------------------------------------------------------------
      LOGICAL   LEXSS(8)
C-----------------------------------------------------------------------
      CHARACTER ELEMT*2  , TITLE*40 , GTIT1*40 , DSNINC*80
      CHARACTER YEAR*2   , YEARDF*2
      CHARACTER GRID*1   , PIC*1    , C3BLNK*3 , DATE*8   ,
     &          FILE0*9  , MNMX0*9  , KEY0*9   , ADAS0*8  ,
     &          DNAME*13 , GNAME*10 ,
     &          XTIT*25  , YTIT*23  ,
     &          HEAD1*40 ,
     &          STRG1*40 ,
     &          ISPEC*80
C-----------------------------------------------------------------------
      REAL*4    X(NDIM1)           , Z(NDIM1,4)
C-----------------------------------------------------------------------
      CHARACTER POPTIT(IMDIMD)*10   , CNAM(4)*3
      CHARACTER KEY(3)*22
C-----------------------------------------------------------------------
      REAL*8    TEV(NTDIM)  , FABUN0(IMDIMD)
      REAL*8    ELTPEQ(NTDIM,IMDIMD) ,
     &          ERBEQ(NTDIM)  , ERCEQ(NTDIM)   ,  ELTEQ(NTDIM) ,
     &          ERADA(NTDIM)
C-----------------------------------------------------------------------
      DATA ISPEC(1:40)
     &          /'ENERGY EXCESS VS ELECTRON TEMPERATURE:  '/
      DATA (CNAM(IM), IM=1,4)
     &          / 'PRB' , 'PRC' , 'PLT' , 'TOT' /
      DATA XTIT  /'ELECTRON TEMPERATURE (eV)'/
      DATA YTIT  /'ENERGY FUNCTION (J cm3)'/
      DATA ADAS0 /'ADAS   :'/               ,
     &     FILE0 /'FILE   : '/              ,
     &     MNMX0 /'MINIMAX: '/              ,
     &     KEY0  /'KEY    : '/              ,
     &     KEY(1)/'(FULL LINE - POSITIVE)'/  ,
     &     KEY(2)/' (DOT LINE - NEGATIVE)'/  ,
     &     KEY(3)/'                    ) '/
      DATA GRID  /' '/   ,
     &     PIC   /' '/    ,
     &     C3BLNK/'   '/
```

```
      DATA DNAME /'       DATE: '/,
     &     GNAME /'SPECIES : '/
      DATA HEAD1 /'--------- METASTABLE ASSIGMENTS --------'/
      DATA STRG1 /'INDX        DESIGNATION      INIT. FRAC.'/
C-----------------------------------------------------------------------
```

D6OUT0

```
      SUBROUTINE D6OUT0( IWRITE   , IMDIMD , NDLINE , NDCOMP , NDRAT  ,
     &                   NDFILE   ,
     &                   TITLE    , DATE   ,
     &                   IZ0      , LPART  , YEAR   , YEARDF ,
     &                   LSELA    , LEXSA  , LDEFA  , FILTR  , NFILE  ,
     &                   DSNINC   , DSPECA ,
     &                   NTDIM    , ITMAX  ,
     &                   TEV      , TEVH   , DENS   , DENSH  , TIMEF  ,
     &                   IZL      , IZH    , NSTAGE , NMSUM  ,
     &                   POPTIT   , FABUN0 , FPABUN ,
     &                   ERBEQ    , ERCEQ  , ELTEQ  , ERAD   ,
     &                   NLINE    , NCOMP  ,
     &                   IZION    , IMET   , CIMET  , INDPH  , CINDPH ,
     &                   IFILE    , TITL   ,
     &                   GCFPEQ   , LPEC   , GCF    , NRAT     ,
     &                   ILINE    , JLINE  , TITR   , RATA
     &                 )
      IMPLICIT NONE
C-----------------------------------------------------------------------
C
C  ****************** FORTRAN77 SUBROUTINE: D6OUT0 *********************
C
C  PURPOSE:  TO  PRINT PRIMARY OUTPUT FROM TRANSIENT IONISATION PROGRAM
C            ADAS406
C
C  CALLING PROGRAM: ADAS406
C
C  SUBROUTINE:
C
C  INPUT : (I*4)  IWRITE   = OUTPUT UNIT FOR RESULTS
C  INPUT : (I*4)  IMDIMD   = MAXIMUM NUMBER OF CHARGE/MET STATES
C  INPUT : (I*4)  NDLINE   = MAXIMUM NUMBER OF LINES ALLOWED
C  INPUT : (I*4)  NDCOMP   = MAXIMUM NUMBER OF COMPONENT FOR EACH LINE
C  INPUT : (I*4)  NDRAT    = MAXIMUM NUMBER OF LINE RATIOS ALLOWED
C  INPUT : (I*4)  NDFILE   = MAXIMUM NUMBER OF EMISSIVITY FILES
C
C  INPUT : (C*40) TITLE    = TITLE OF RUN (READ FROM ISPF PANEL)
C  INPUT : (C*8)  DATE     = CURRENT DATE (AS 'DD/MM/YY')
C
C  INPUT : (I*4)  IZ0      = INPUT FILE: EMITTING ION NUCLEAR CHARGE
C  INPUT : (L*4)  LPART    = .TRUE.  => PARTIAL DATA SELECTED
C                            = .FALSE. => STANDARD DATA SELECTED
C  INPUT : (C*2)  YEAR     = SELECTED YEAR -  TWO DIGIT YEAR NUMBER
C  INPUT : (C*2)  YEARDF   = DEFAULT YEAR - TWO DIGIT YEAR NUMBER
C  INPUT : (L*4)  LSELA()  = .TRUE.  => INPUT DATA SET TYPE FOR THIS
C                                       INDEX SELECTED
C                            = .FALSE. => INPUT DATA SET FOR THIS INDEX
C                                       NOT SELECTED
C  INPUT : (L*4)  LEXSA()  = .TRUE.  => INPUT DATA SET TYPE FOR THIS
C                                       SELECTED INDEX EXISTS
C                            = .FALSE. => INPUT DATA SET DOES NOT EXIST
C                                       FOR THIS SELECTED INDEX
C  INPUT : (L*4)  LDEFA()  = .TRUE.  => INPUT DATA SET TYPE FOR THIS
C                                       DEFAULT YEAR INDEX EXISTS
C                            = .FALSE. => INPUT DATA SET DOES NOT EXIST
C                                        FOR THIS DEFAULT YEAR INDEX
C  INPUT : (C*7)  FILTR    = STRING GIVING FILTER NAME PART OF FILES
C  INPUT : (I*4)  NFILE    = NUMBER OF PEC FILES ACCESSED
C  INPUT : (C*80) DSNINC   = NAME OF SCRIPT FILE
C  INPUT : (C*44) DSGCFPEQ() = NAMES OF PHOTON EMIISVITY COEFFICIENT FILES
C  INPUT : (I*4)  NTDIM    = MAXIMUM NUMBER OF TE/NE PAIRS
C  INPUT : (I*4)  ITMAX    = NUMBER OF OUTPUT TEMPERATURES
C
C  INPUT : (R*8)  TEV()    = SELECTED ELECTRON TEMPERATURES (EV)
C  INPUT : (R*8)  TEVH()   = SELECTED HYDROGEN TEMPERATURES (EV)
C  INPUT : (R*8)  DENS()   = SELECTED ELECTRON DENSITIES (CM-3)
C  INPUT : (R*8)  DENSH()  = SELECTED HYDROGEN DENSITIES (CM-3)
C  INPUT : (R*8)  TIMEF   = INTEGRATION TIME (SEC)
C  INPUT : (I*4)  IZL      = LOWEST ION CHARGE+1
C  INPUT : (I*4)  IZH      = HIGHEST ION CHARGE +1 (EXCL BARE NUCL.)
C  INPUT : (I*4)  NSTAGE   = NUMBER OF IONISATION STAGES
C  INPUT : (I*4)  NMSUM    = TOTAL METASTABLE STATE SUM
C  INPUT : (R*8)  POPTIT() = (ION/MET) POPULATION TITLE
C  INPUT : (R*8)  FPABUN(,)= (ION/MET) POPULATION FRACTION AT T=TIMEF
C                            1ST.DIM: TEMPERATURE INDEX
C                            2ND.DIM: (ION/MET) STATE INDEX
C  INPUT : (R*8)  FABUN0() = INITIAL METASTABLE POPULATION FRACTIONS
C                            1ST DIMENSION: METASTABLE INDEX
C  INPUT : (R*8)  ERBEQ()  = TRANS. RECOM/BREMS. EN. EXCESS FUNC.(J CM3)
C  INPUT : (R*8)  ERCEQ()  = EQUIL. CX/RECOM. EN. EXCESS FUNC.(J CM3)
C  INPUT : (R*8)  ELTEQ()  = EQUIL. LOW LINE  EN. EXCESS FUNC.(J CM3)
C  INPUT : (R*8)  ERAD()   = EQUIL. TOTAL RAD. EN. EXCESS FUNC.(J CM3)
C  INPUT : (I*4)  NCOMP()  = NUMBER OF COMPONENTS OF SCRIPT LINE
C                            1ST DIM: LINE INDEX
C  INPUT : (I*4)  IZION(,) = CHARGE STATE OF COMPONENT
C                            1ST DIM: LINE INDEX
```

```
C                               2ND DIM: COMPONENT INDEX
C  INPUT : (I*4)  IMET(,)  = NUMBER OF COMPONENTS OF SCRIPT LINE
C                               1ST DIM: LINE INDEX
C                               2ND DIM: COMPONENT INDEX
C  INPUT : (C*1)  CIMET(,) = SIGN (+, BLANK OR -) OF METASTABLE
C                               1ST DIM: LINE INDEX
C                               2ND DIM: COMPONENT INDEX
C  INPUT : (I*4)  INDPH(,) = PEC FILE INDEX OF LINE COMPONENT
C                               1ST DIM: LINE INDEX
C                               2ND DIM: COMPONENT INDEX
C  INPUT : (C*1   CINDPH(,)= DRIVER (E OR BLANK => ELECTRONS)
C                                      (H          => HYDROGEN )
C                                1ST DIM: LINE INDEX
C                                2ND DIM: COMPONENT INDEX
C  INPUT : (I*4)  IFILE(,) = INDEX OF PEC FILE IN FILE LIST
C                               1ST DIM: LINE INDEX
C                               2ND DIM: COMPONENT INDEX
C  INPUT : (R*8)  GCFPEQ(,,)= GCF PHOTON EXCESS FUNC. COMPONENT (CM3)
C                               1ST DIM: TEMPERATURE INDEX
C                               2ND DIM: LINE INDEX
C                               3RD DIM: LINE COMPONENT INDEX
C  INPUT : (L*4)  LPEC(,)  = .TRUE.  => PHOTON EMISSIVITY OBTAINED
C                               .FALSE. => PHOTON EMISSIVITY NOT OBTAINED
C                               1ST DIM: LINE INDEX
C                               2ND DIM: COMPONENT INDEX
C  INPUT : (R*8)  GCF(,)   = LINE PHOTON EXCESS GCF FUNCTIONS (CM3)
C                               1ST IND: TEMPERATURE INDEX
C                               2ND IND: LINE INDEX
C  INPUT : (C*12) TITL(,)  = TITLE FOR LINE COMPONENT
C                               1ST DIM: LINE INDEX
C                               2ND DIM: COMPONENT INDEX
C  INPUT : (I*4)  NRAT     = NUMBER OF RATIOS IDENTIFIED IN SCRIPT
C  INPUT : (I*4)  ILINE()  = INDEX OF NUMERATOR LINE FOR LINE RATIO
C  INPUT : (I*4)  JLINE()  = INDEX OF DENOMINATOR LINE FOR LINE RATIO
C  INPUT : (C*25) TITR()   = TILE FOR LINE RATIO
C  INPUT : (R*8)  RATA(,)  = LINE GCF RATIOS
C                               1ST IND: TEMPERATURE INDEX
C                               2ND IND: RATIO INDEX
C
C
C          (I*4)  I        = GENERAL USE - ARRAY ELEMENT INDEX
C          (I*4)  J        = GENERAL USE - ARRAY ELEMENT INDEX
C          (I*4)  IP       = GENERAL USE - ARRAY ELEMENT INDEX
C          (I*4)  IF       = GENERAL USE
C          (I*4)  IL       = GENERAL USE
C          (I*4)  IC       = GENERAL USE
C          (I*4)  IR       = GENERAL USE
C          (I*4)  ITL      = GENERAL USE
C          (I*4)  ITU      = GENERAL USE
C          (R*8)  EV       = PARAMETER = EV/KELVIN CONVERSION CONSTANT
C
C          (C*12) XFELEM   = FUNCTION - (SEE ROUTINES SECTION BELOW)
C          (C*12) CELEM    = EMITTING ION  ELEMENT NAME
C          (C*80) CADAS    = ADAS HEADER: INCLUDES RELEASE,PROGRAM,TIME
C
C ROUTINES:
C          ROUTINE    SOURCE    BRIEF DESCRIPTION
C          ------------------------------------------------------------
C          XXADAS     ADAS      GATHERS ADAS HEADER INFORMATION
C          XFELEM     ADAS      CHARACTER*12 FUNCTION -
C                               RETURNS ELEMENT NAME   FOR GIVEN Z0
C
C AUTHOR  : H. P. Summers, JET
C           K1/1/57
C           JET EXT. 4941
C
C DATE:    27/04/44
C
C UNIX-IDL PORT:
C
C AUTHOR:  WILLIAM OSBORN (TESSELLA SUPPORT SERVICES PLC)
C
C DATE:    07/06/96
C
C VERSION: 1.1                                  DATE:07/06/96
C MODIFIED: WILLIAM OSBORN
C            - FIRST VERSION
C
C VERSION: 1.2                                  DATE:17/07/96
C MODIFIED: WILLIAM OSBORN
C            - JOINED LINES IN SUBROUTINE DEFINITION SO AS TO AVOID >20
C              CONTINUATION CHARACTERS
C
C VERSION: 1.3                                  DATE:17/07/96
C MODIFIED: WILLIAM OSBORN
C            - SPLIT 1023 FORMAT STATEMENT SO AS TO AVOID >20 CONT LINES
C
C VERSION: 1.4                                  DATE:25/03/97
C MODIFIED: RICHARD MARTIN
C            - CHANGED FILTR FROM C*6 TO C*7 TO ACCOMODATE LONGER FILTER
C              NAMES IN ACCORDANCE WITH ADAS405 AND ADAS408
C
C-----------------------------------------------------------------------
      REAL*8     EV
C-----------------------------------------------------------------------
      PARAMETER ( EV = 11605.4 )
C-----------------------------------------------------------------------
      INTEGER    IWRITE        , IMDIMD       , NDLINE      , NDCOMP
```

```
      INTEGER    NDRAT         , NDFILE       , NTDIM
      INTEGER    IZ0           , I            , J           , ITMAX
      INTEGER    IZL           , IZH          , NSTAGE      , NMSUM
      INTEGER    ITL           , ITU          , IP          , IF
      INTEGER    IL            , IC           , IR
      INTEGER    NFILE         , NLINE        , NRAT
C-----------------------------------------------------------------------
      REAL*8     TIMEF
C-----------------------------------------------------------------------
      INTEGER    NCOMP(NDLINE)         ,
     &           IZION(NDLINE,NDCOMP) , IMET(NDLINE,NDCOMP)  ,
     &           INDPH(NDLINE,NDCOMP) , IFILE(NDLINE,NDCOMP)
      INTEGER    ILINE(NDRAT)         , JLINE(NDRAT)
C-----------------------------------------------------------------------
      LOGICAL    LPART
C-----------------------------------------------------------------------
      CHARACTER  TITLE*(*)     , DATE*8    , CRESOL*12
      CHARACTER  XFELEM*12     ,
     &           CELEM*12      , CADAS*80  ,
     &           YEAR*2        , YEARDF*2  , FILTR*7   ,
     &           CT*1          , CS*1
      CHARACTER  CCLASS(8)*3
      CHARACTER  DASHES*10     , BLANKS*10 , CLINE*100
      CHARACTER  DSNINC*80
C-----------------------------------------------------------------------
      CHARACTER  POPTIT(IMDIMD)*10
      CHARACTER  TITL(NDLINE,NDCOMP)*12 , TITR(NDRAT)*25
      CHARACTER  CIMET(NDLINE,NDCOMP)*1 , CINDPH(NDLINE,NDCOMP)*1
      CHARACTER  DSPECA(NDFILE)*120
C-----------------------------------------------------------------------
      REAL*8     TEV(NTDIM)  , TEVH(NTDIM) , DENS(NTDIM) , DENSH(NTDIM)
      REAL*8     ERBEQ(NTDIM), ERCEQ(NTDIM), ELTEQ(NTDIM), ERAD(NTDIM)
      REAL*8     FPABUN(NTDIM,IMDIMD)      , FABUN0(IMDIMD)
      REAL*8     GCFPEQ(NTDIM,NDLINE,NDCOMP)
      REAL*8     GCF(NTDIM,NDLINE)
      REAL*8     RATA(NTDIM,NDRAT)
C-----------------------------------------------------------------------
      LOGICAL    LSELA(8)    , LEXSA(8)    , LDEFA(8)
      LOGICAL    LPEC(NDLINE,NDCOMP)
C-----------------------------------------------------------------------
      SAVE       CADAS
C-----------------------------------------------------------------------
      DATA       CADAS /' '/
      DATA       (CCLASS(I),I=1,8)/'ACD','SCD','CCD','PRB',
     &                             'PRC','QCD','XCD','PLT'/
      DATA       DASHES/'----------'/ , BLANKS/'          '/
C-----------------------------------------------------------------------
```

D6SCRP

```
       SUBROUTINE D6SCRP( LRSCRP , LSNULL  ,
     &                    DSNINC , DSPECA  ,
     &                    NDLINE , NDCOMP  , NDRAT  , NDFILE ,
     &                    NFILE  , LFILE   ,
     &                    UID    , GROUP   , TYPE   , EXT    , ION    ,
     &                    MEMB   , IZ0     ,
     &                    NLINE  , NCOMP   ,
     &                    IZION  , IMET    , CIMET  , INDPH  , CINDPH ,
     &                    IFILE  , TITL    ,
     &                    NRAT   ,
     &                    ILINE  , JLINE   , TITR   , IRCODE
     &                  )
       IMPLICIT NONE
C-----------------------------------------------------------------------
C
C  ****************** FORTRAN77 SUBROUTINE: D6SCRP  *******************
C
C  PURPOSE: TO READ SCRIPT FILE AND ACCESS EMISSIVITY DATA
C           ON SPECTRAL LINES REQUESTED FOR FURTHER PROCESSING IN
C           EQUILIBRIUM IONISATION CODES.
C
C  CALLING PROGRAM: ADAS406
C
C  SUBROUTINE:
C
C  INPUT : (C*80)  DSNINC   = SCRIPT DATA SET NAME (FULL MVS DSN)
C                             (IN FORM SUITABLE FOR DYNAMIC ALLOCATION)
C  INPUT : (I*4)   NDLINE   = MAXIMUM NUMBER OF LINES ALLOWED
C  INPUT : (I*4)   NDCOMP   = MAXIMUM NUMBER OF COMPONENT FOR EACH LINE
C  INPUT : (I*4)   NDRAT    = MAXIMUM NUMBER OF LINE RATIOS ALLOWED
C  INPUT : (I*4)   NDFILE   = MAXIMUM NUMBER OF EMISSIVITY FILES WHICH
C                             CAN BE SEARCHED
C
C  OUTPUT: (L*4)   LRSCRP   = .TRUE.  => SCRIPT FILE READ
C                             .FALSE. => SCRIPT FILE NOT READ
C  OUTPUT: (L*4)   LSNULL   = .TRUE.  => SCRIPT FILE SET TO NULL
C                             .FALSE. => SCRIPT FILE VALID
C  OUTPUT: (C*120) DSPECA() = PHOTON EMISSIVITY SOURCE FILES
C  OUTPUT: (I*4)   NFILE    = NUMBER OF PEC FILES TO BE SCANNED
C  OUTPUT: (L*4)   LFILE()  = .TRUE.  => PEC FILE EXISTS AND MATCHES
C                             .FALSE. => PEC FILE DOES NOT EXIST/MATCH
C  OUTPUT: (C*6)   UID()    = USER IDENTIFIER OF PEC FILE
C  OUTPUT: (C*8)   GROUP()  = GROUP IDENTIFIER OF PEC FILE
C  OUTPUT: (C*5)   TYPE()   = TYPE IDENTIFIER OF PEC FILE
```

```
C  OUTPUT: (C*3)   EXT()    = EXTENSION OF PEC FILE MEMBER NAME
C  OUTPUT: (C*4)   ION()    = ION NAME OF PEC FILE MEMBER NAME
C  OUTPUT: (C*8)   MEMB()   = MEMBER NAME OF PEC FILE
C  OUTPUT: (I*4)   NLINE    = NUMBER OF LINES IDENTIFIED IN SCRIPT
C  OUTPUT: (I*4)   NCOMP()  = NUMBER OF COMPONENTS OF SCRIPT LINE
C                             1ST DIM: LINE INDEX
C  OUTPUT: (I*4)   IZION(,) = CHARGE STATE OF COMPONENT
C                             1ST DIM: LINE INDEX
C                             2ND DIM: COMPONENT INDEX
C  OUTPUT: (I*4)   IMET(,)  = NUMBER OF COMPONENTS OF SCRIPT LINE
C                             1ST DIM: LINE INDEX
C                             2ND DIM: COMPONENT INDEX
C  OUTPUT: (C*1)   CIMET(,) = SIGN (+, BLANK OR -) OF METASTABLE
C                             1ST DIM: LINE INDEX
C                             2ND DIM: COMPONENT INDEX
C  OUTPUT: (I*4)   INDPH(,) = PEC FILE INDEX OF LINE COMPONENT
C                             1ST DIM: LINE INDEX
C                             2ND DIM: COMPONENT INDEX
C  OUTPUT: (C*1)   CINDPH(,)= DRIVER (E OR BLANK => ELECTRONS)
C                                    (H          => HYDROGEN )
C                             1ST DIM: LINE INDEX
C                             2ND DIM: COMPONENT INDEX
C  OUTPUT: (I*4)   IFILE(,) = INDEX OF PEC FILE IN FILE LIST
C                             1ST DIM: LINE INDEX
C                             2ND DIM: COMPONENT INDEX
C  OUTPUT: (C*12)  TITL(,)  = TITLE FOR LINE COMPONENT
C                             1ST DIM: LINE INDEX
C                             2ND DIM: COMPONENT INDEX
C  OUTPUT: (I*4)   NRAT     = NUMBER OF RATIOS IDENTIFIED IN SCRIPT
C  OUTPUT: (I*4)   ILINE()  = INDEX OF NUMERATOR LINE FOR LINE RATIO
C  OUTPUT: (I*4)   JLINE()  = INDEX OF DENOMINATOR LINE FOR LINE RATIO
C  OUTPUT: (C*25)  TITR()   = TILE FOR LINE RATIO
C  OUTPUT: (I*4)   IRCODE   = ERROR FLAG:
C                             0 => SCRIPT FILE WAS READ OKAY
C                             1 => SCRIPT FILE DOES NOT EXIST
C                             2 => I/O ERROR READING THE SCRIPT FILE
C                             3 => 1 OR MORE FILE NAMES IN SCRIPT FILE
C                                  IS/ARE INVALID.
C
C          (I*4)   IUNT10  = PARAMETER = INPUT UNIT FOR DATA
C          (L*4)   OPEN10  = .TRUE.  => FILE ALLOCATED TO UNIT 10.
C                            .FALSE. => NO FILE ALLOCATED TO UNIT 10.
C
C ROUTINES:
C          ROUTINE    SOURCE   BRIEF DESCRIPTION
C          ------------------------------------------------------------
C          XXSLEN     ADAS      FIND NON-BLANK CHARACTERS IN STRING
C
C
C AUTHOR:  H. P. SUMMERS, JET
C          K1/1/57
C          JET EXT. 4941
C
C DATE:    20/04/94
C
C UNIX-IDL PORT:
C
C AUTHOR:  WILLIAM OSBORN (TESSELLA SUPPORT SERVICES PLC)
C
C DATE:    07/06/96
C
C VERSION: 1.1                                  DATE:07/06/96
C MODIFIED: WILLIAM OSBORN
C           - FIRST VERSION. USED SOME CODE FROM D5SCRP.FOR V1.3 IN
C             ADDING IRCODE PARAMETER.
C VERSION: 1.2                                  DATE:27/06/96
C MODIFIED: WILLIAM OSBORN
C           - REMOVED UNUSED VARIABLES
C VERSION: 1.3                                  DATE:27/06/96
C MODIFIED: WILLIAM OSBORN
C           - INCREASED LENGTH OF CLINE AND DSNPEC TO 120
C
C-----------------------------------------------------------------------
C
C-----------------------------------------------------------------------
      INTEGER    IUNT10  , IRCODE
C-----------------------------------------------------------------------
      PARAMETER( IUNT10 = 10 )
C-----------------------------------------------------------------------
      INTEGER    NDLINE  , NDCOMP  , NDRAT   , NDFILE ,
     &           NLINE   , NRAT    , NFILE   , IFIRST , ILAST ,
     &           INDL    , INDC    , INDR    , I       , J      ,
     &           IZ      , IZ0
C-----------------------------------------------------------------------
      INTEGER    NCOMP(NDLINE)        ,
     &           IZION(NDLINE,NDCOMP) , IMET(NDLINE,NDCOMP)  ,
     &           INDPH(NDLINE,NDCOMP) , IFILE(NDLINE,NDCOMP) ,
     &           ILINE(NDRAT)         , JLINE(NDRAT)
C-----------------------------------------------------------------------
      CHARACTER  DSNINC*80   , CLINE*120 , ELEM*2    , CSTRNG*5  ,
     &           DSNPEC*120   , IONT*4    , CIZ*2
C-----------------------------------------------------------------------
      CHARACTER  CIMET(NDLINE,NDCOMP)*1 , CINDPH(NDLINE,NDCOMP)*1 ,
     &           TITL(NDLINE,NDCOMP)*12 , TITR(NDRAT)*25          ,
     &           UID(NDFILE)*6  , GROUP(NDFILE)*8, TYPE(NDFILE)*5 ,
     &           MEMB(NDFILE)*8 , EXT(NDFILE)*3  , ION(NDFILE)*4
      CHARACTER  DSPECA(NDFILE)*120
C-----------------------------------------------------------------------
```

```
      LOGICAL    OPEN10      , LRSCRP    , LEXIST   , LSNULL
C-----------------------------------------------------------------------
      LOGICAL    LFILE(NDFILE)
C-----------------------------------------------------------------------
      DATA OPEN10 /.FALSE./
C-----------------------------------------------------------------------
```

D6SGCF

```
       SUBROUTINE D6SGCF( IZ0    , IZL    , IZH    ,
     &                    ISDIMD , IZDIMD , ITDIMD , IPDIMD , IMDIMD ,
     &                    NMSUM  , IZIP   , IMIP   , IPIZM  ,
     &                    NDLINE , NDCOMP ,
     &                    NLINE  , NCOMP  , SPECL  , IPLINE ,
     &                    IZION  , IMET   , CIMET  , INDPH  , CINDPH ,
     &                    IFILE  ,
     &                    NTDIM  , ITMAX  ,
     &                    DENS   , DENSH  ,
     &                    PECA   , LPEC   ,
     &                    FPABUN ,
     &                    GCFPEQ , GCFEQ  ,
     &                    NDRAT  , NRAT   ,
     &                    ILINE  , JLINE  ,
     &                    RATA
     &                  )
       IMPLICIT NONE
C
C-----------------------------------------------------------------------
C
C  ****************** FORTRAN77 SUBROUTINE: D6SGCF *********************
C
C PURPOSE : TO ASSEMBLE GCF FUNCTIONS AND THEIR COMPONENTS USING
C           FRACTIONAL METASTABLE ABUNDANCES.
C
C
C
C INPUT  : (I*4)  IZ0       = NUCLEAR CHARGE
C INPUT  : (I*4)  IZL       = MINIMUM ION CHARGE+1 IN MASTER DATA FILES
C INPUT  : (I*4)  IZH       = MAXIMUM ION CHARGE+1 IN MASTER DATA FILES
C INPUT  : (I*4)  ISDIMD    = MAXIMUM NUMBER OF (CHARGE, PARENT, GROUND)
C                             BLOCKS IN ISONUCLEAR MASTER FILES
C INPUT  : (I*4)  IZDIMD    = MAXIMUM NUMBER OF CHARGE STATES
C                             IN ISONUCLEAR MASTER FILES
C INPUT  : (I*4)  ITDIMD    = MAXIMUM NUMBER OF TEMP OR DENS VALUES IN
C                             ISOELECTRONIC MASTER FILES
C INPUT  : (I*4)  IPDIMD    = MAXIMUM NUMBER OF METASTABLES FOR EACH
C                             IONISATION STAGE
C INPUT  : (I*4)  IMDIMD    = MAXIMUM NUMBER OF METASTABLES
C
C INPUT  : (I*4)  NMSUM     = TOTAL NUMBER OF POPULATIONS
C
C INPUT  :        IZIP()    = ION CHARGE +1 (IZ1) OF METASTABLE IN LIST
C INPUT  :        IMIP()    = METASTABLE INDEX WITHIN CHARGE STATE IZ1
C                             OF METASTABLE INDEX FROM COMPLETE LIST
C INPUT  :        IPIZM(,)  = METASTABLE INDEX IN COMPLETE LIST
C                             1ST DIM: INDEX IZ1-IZL+1
C                             2ND DIM: METASTABLE COUNT FOR STAGE (IGRD)
C INPUT  : (I*4)  NDLINE    = MAXIMUM NUMBER OF LINES ALLOWED
C INPUT  : (I*4)  NDCOMP    = MAXIMUM NUMBER OF COMPONENT FOR EACH LINE
C INPUT  : (I*4)  NLINE     = NUMBER OF LINES IDENTIFIED IN SCRIPT
C INPUT  : (I*4)  NCOMP()   = NUMBER OF COMPONENTS OF SCRIPT LINE
C INPUT  : (I*4)  IZION(,)  = CHARGE STATE OF COMPONENT
C                             1ST DIM: LINE INDEX
C                             2ND DIM: COMPONENT INDEX
C INPUT  : (I*4)  IMET(,)   = METASTABLE INDEX OF COMPONENT OF
C                             SCRIPT LINE WITHIN CHARGE STATE
C                             1ST DIM: LINE INDEX
C                             2ND DIM: COMPONENT INDEX
C INPUT  : (C*1)  CIMET(,)  = SIGN (+, BLANK OR -) OF METASTABLE
C                             1ST DIM: LINE INDEX
C                             2ND DIM: COMPONENT INDEX
C INPUT  : (I*4)  INDPH(,)  = PEC FILE INDEX OF LINE COMPONENT
C                             1ST DIM: LINE INDEX
C                             2ND DIM: COMPONENT INDEX
C INPUT  : (C*1   CINDPH(,) = DRIVER (E OR BLANK => ELECTRONS)
C                                    (H          => HYDROGEN )
C                              1ST DIM: LINE INDEX
C                              2ND DIM: COMPONENT INDEX
C INPUT  : (I*4)  IFILE(,)  = INDEX OF PEC FILE IN FILE LIST
C                             1ST DIM: LINE INDEX
C                             2ND DIM: COMPONENT INDEX
C INPUT  : (I*4)  NTDIM     = MAXIMUM NUMBER OF DTEV/DDENS PAIRS
C INPUT  : (I*4)  ITMAX     = NUMBER OF ( DTEV() , DDENS() ) PAIRS
C INPUT  : (R*8)  DENS()    = ELECTRON DENSITIES (CM-3))
C INPUT  : (R*8)  DENSH()   = HYDROGEN DENSITIES (CM-3))
C INPUT  : (R*8)  PECA(,,)  = PHOTON EMISSIVITY COEFFICIENTS (CM3 S-1)
C                             1ST DIM: TEMPERATURE INDEX
C                             2ND DIM: LINE INDEX
C                             3RD DIM: COMPONENT INDEX
C INPUT  : (L*4)  LPEC(,)   = .TRUE.  => PHOTON EMISSIVITY OBTAINED
C                             .FALSE. => PHOTON EMISSIVITY NOT OBTAINED
C                             2ND DIM: LINE INDEX
C                             3RD DIM: COMPONENT INDEX
C INPUT  : (R*8)  FPABUN(,) = RESOLVED METASTABLE EQUILIBRIUM
```

```
C                              FRACTIONAL ABUNDANCES
C                              1ST DIM: - TEMPERATURE/DENSITY PAIR
C                              2ND DIM: - METASTABLE INDEX
C INPUT  : (I*4)  NDRAT     = MAXIMUM NUMBER OF LINE RATIOS ALLOWED
C INPUT  : (I*4)  NRAT      = NUMBER OF RATIOS IDENTIFIED IN SCRIPT
C INPUT  : (I*4)  ILINE()   = INDEX OF NUMERATOR LINE FOR LINE RATIO
C INPUT  : (I*4)  JLINE()   = INDEX OF DENOMINATOR LINE FOR LINE RATIO
C
C OUTPUT : (C*16) SPECL(,)  = SPEC. OF POINTERS OF LINE COMPONENT
C                              1ST DIM: LINE INDEX
C                              2ND DIM: COMPONENT INDEX
C OUTPUT : (I*4)  IPLINE(,) = METASTABLE POINTER OF LINE COMPONENT
C                              1ST DIM: LINE INDEX
C                              2ND DIM: COMPONENT INDEX
C OUTPUT : (R*8)  GCFPEQ(,,)= GCF FUNC. COMPONENT (CM3 S-1)
C                              1ST DIM: TEMPERATURE INDEX
C                              2ND DIM: LINE INDEX
C                              3ND DIM: LINE COMPONENT INDEX
C OUTPUT : (R*8)  GCFEQ(,)  = GCF FUNCTION  (CM3 S-1)
C                              1ST DIM: TEMPERATURE INDEX
C                              2ND DIM: LINE INDEX
C OUTPUT : (R*8)  RATA(,)   = LINE GCF RATIOS
C                              1ST IND: TEMPERATURE INDEX
C                              2ND IND: RATIO INDEX
C
C
C PROGRAM: (I*4)  IT        = GENERAL INDEX FOR TEMPERATURE
C          (I*4)  IP        = GENERAL INDEX FOR CHARGE
C          (I*4)  IZ1       = GENERAL INDEX FOR CHARGE+1
C          (I*4)  IL        = GENERAL INDEX FOR LINE
C          (I*4)  IR        = GENERAL INDEX FOR RATIO
C          (I*4)  ICPT      = GENERAL INDEX FOR LINE COMPONENT
C
C
C ROUTINES:
C          ROUTINE    SOURCE    BRIEF DESCRIPTION
C          ------------------------------------------------------------
C
C
C AUTHOR : H. P. SUMMERS, JET
C          K1/1/57
C          JET  EXT. 4941
C
C DATE   : 03/05/94
C
C UNIX-IDL PORT:
C
C AUTHOR:  WILLIAM OSBORN (TESSELLA SUPPORT SERVICES PLC)
C
C DATE:    07/06/96
C
C VERSION: 1.1                                  DATE:07/06/96
C MODIFIED: WILLIAM OSBORN
C            - FIRST VERSION
C VERSION: 1.2                                  DATE:27/06/96
C MODIFIED: WILLIAM OSBORN
C            - REMOVED UNUSED VARIABLES
C
C-----------------------------------------------------------------------
       INTEGER   IZ0
       INTEGER   IZ1     , IZL     , IZH     , NTDIM   , ITMAX   , NMSUM
       INTEGER   ISDIMD  , IZDIMD  , ITDIMD  , IPDIMD  , IMDIMD
       INTEGER   NDLINE  , NDCOMP  , NLINE   , NDRAT   , NRAT
       INTEGER   IT
       INTEGER   IL      , IR      , ICPT
C-----------------------------------------------------------------------
       INTEGER   IZIP(IMDIMD)   , IMIP(IMDIMD) ,
     &           IPIZM(IZDIMD,IPDIMD)
       INTEGER   NCOMP(NDLINE)        ,
     &           IZION(NDLINE,NDCOMP) , IMET(NDLINE,NDCOMP)  ,
     &           INDPH(NDLINE,NDCOMP) , IFILE(NDLINE,NDCOMP) ,
     &           IPLINE(NDLINE,NDCOMP)
       INTEGER   ILINE(NDRAT)         , JLINE(NDRAT)
C-----------------------------------------------------------------------
       REAL*8    DNS           , DNSH
C-----------------------------------------------------------------------
       REAL*8    DENS(NTDIM)   , DENSH(NTDIM)   ,
     &           GCFEQ(NTDIM,NDLINE)
C
       REAL*8    FPABUN(NTDIM,IMDIMD)
C
       REAL*8    PECA(NTDIM,NDLINE,NDCOMP) , GCFPEQ(NTDIM,NDLINE,NDCOMP)
C
       REAL*8    RATA(NTDIM,NDRAT)
C
C-----------------------------------------------------------------------
       CHARACTER SPECL(NDLINE,NDCOMP)*16
       CHARACTER CIMET(NDLINE,NDCOMP)*1 , CINDPH(NDLINE,NDCOMP)*1
C-----------------------------------------------------------------------
       LOGICAL   LPEC(NDLINE,NDCOMP)
C-----------------------------------------------------------------------
```

```
      SUBROUTINE D6SPEC( LRSPEC ,
     &                   NDLINE , NDCOMP  , NDRAT  , NDFILE ,
     &                   NFILE  , LFILE   ,
     &                   UID    , GROUP   , TYPE   , EXT    ,
     &                   IZ0    , DSPECA  ,
     &                   NLINE  , NCOMP   ,
     &                   IZION  , IMET    , CIMET  , INDPH  ,
     &                   IFILE  ,
     &                   NTDIM  , ITMAX   ,
     &                   TEIN   , DEIN    , THIN   , DHIN   ,
     &                   PECA   ,
     &                   LPEC   , LTRNG   , LDRNG
     &                 )
      IMPLICIT NONE
C-----------------------------------------------------------------------
C
C  ****************** FORTRAN77 SUBROUTINE: D6SPEC  *******************
C
C  PURPOSE: TO CALCULATE PHOTON EMISSIVITY COEFFICIENTS FOR
C           SPECTRAL LINES IDENTIFIED IN SCRIPT FILE
C
C  CALLING PROGRAM: ADAS406
C
C  SUBROUTINE:
C
C  INPUT : (I*4)   NDLINE   = MAXIMUM NUMBER OF LINES ALLOWED
C  INPUT : (I*4)   NDCOMP   = MAXIMUM NUMBER OF COMPONENT FOR EACH LINE
C  INPUT : (I*4)   NDRAT    = MAXIMUM NUMBER OF LINE RATIOS ALLOWED
C  INPUT : (I*4)   NDFILE   = MAXIMUM NUMBER OF EMISSIVITY FILES WHICH
C                             CAN BE SEARCHED
C  INPUT : (I*4)   NFILE    = NUMBER OF PEC FILES TO BE SCANNED
C  INPUT : (L*4)   LFILE()  = .TRUE.  => PEC FILE EXISTS AND MATCHES
C                             .FALSE. => PEC FILE DOES NOT EXIST/MATCH
C  INPUT : (C*6)   UID()    = USER IDENTIFIER OF PEC FILE
C  INPUT : (C*8)   GROUP()  = GROUP IDENTIFIER OF PEC FILE
C  INPUT : (C*5)   TYPE()   = TYPE IDENTIFIER OF PEC FILE
C  INPUT : (C*3)   EXT()    = EXTENSION OF PEC FILE MEMBER NAME
C  INPUT : (I*4)   IZ0      = NUCLEAR CHARGE OF IMPURITY
C  INPUT : (C*120) DSPECA() = PHOTON EMISSIVITY SOURCE FILES
C  INPUT : (I*4)   NLINE    = NUMBER OF LINES IDENTIFIED IN SCRIPT
C  INPUT : (I*4)   NCOMP()  = NUMBER OF COMPONENTS OF SCRIPT LINE
C                             1ST DIM: LINE INDEX
C  INPUT : (I*4)   IZION(,) = CHARGE STATE OF COMPONENT
C                             1ST DIM: LINE INDEX
C                             2ND DIM: COMPONENT INDEX
C  INPUT : (I*4)   IMET(,)  = NUMBER OF COMPONENTS OF SCRIPT LINE
C                             1ST DIM: LINE INDEX
C                             2ND DIM: COMPONENT INDEX
C  INPUT : (C*1)   CIMET(,) = SIGN (+, BLANK OR -) OF METASTABLE
C                             1ST DIM: LINE INDEX
C                             2ND DIM: COMPONENT INDEX
C  INPUT : (I*4)   INDPH(,) = PEC FILE INDEX OF LINE COMPONENT
C                             1ST DIM: LINE INDEX
C                             2ND DIM: COMPONENT INDEX
C  INPUT : (I*4)   IFILE(,) = INDEX OF PEC FILE IN FILE LIST
C                             1ST DIM: LINE INDEX
C                             2ND DIM: COMPONENT INDEX
C  INPUT : (I*4)   NTDIM    = MAXIMUM NUMBER OF TEMP/DENSITY SETS
C  INPUT : (I*4)   ITMAX    = NUMBER OF TEMP/DENSITY SETS
C  INPUT : (R*8)   TEIN()   = ELECTRON TEMPERATURES (EV)
C  INPUT : (R*8)   DEIN()   = ELECTRON DENSITIES (CM-3)
C  INPUT : (R*8)   THIN()   = HYDROGEN TEMPERATURES (EV)
C  INPUT : (R*8)   DHIN()   = HYDROGEN DENSITIES (CM-3)
C
C  OUTPUT: (L*4)   LRSPEC   = .TRUE.  => PEC PROCESSING DONE
C                             .FALSE. => PEC PROCESSING NOT DONE
C  OUTPUT: (R*8)   PECA(,,) = PHOTON EMISSIVITY COEFFICIENTS (CM3 S-1)
C                             1ST DIM: TEMPERATURE INDEX
C                             2ND DIM: LINE INDEX
C                             3RD DIM: COMPONENT INDEX
C  OUTPUT: (L*4)   LPEC(,)  = .TRUE.  => PHOTON EMISSIVITY OBTAINED
C                             .FALSE. => PHOTON EMISSIVITY NOT OBTAINED
C                             2ND DIM: LINE INDEX
C                             3RD DIM: COMPONENT INDEX
C
C          (I*4)   IUNT10  = PARAMETER = INPUT UNIT FOR DATA
C          (L*4)   OPEN10  = .TRUE.  => FILE ALLOCATED TO UNIT 10.
C                            .FALSE. => NO FILE ALLOCATED TO UNIT 10.
C
C ROUTINES:
C          ROUTINE    SOURCE   BRIEF DESCRIPTION
C          ------------------------------------------------------------
C           D5SPC2   IDL-ADAS  OBTAIN PHOTON EMISSIVITY COEFFICIENT
C
C AUTHOR:  H. P. SUMMERS, JET
C          K1/1/57
C          JET EXT. 4941
C
C DATE:    20/04/94
C
C UNIX-IDL PORT:
C
C AUTHOR:  WILLIAM OSBORN (TESSELLA SUPPORT SERVICES PLC)
C
C DATE:    07/06/96
C
C VERSION: 1.1                                DATE:07/06/96
C MODIFIED: WILLIAM OSBORN
```

```
C           - FIRST VERSION
C VERSION: 1.2                                      DATE:27/06/96
C MODIFIED: WILLIAM OSBORN
C            - REMOVED UNUSED VARIABLES
C
C-----------------------------------------------------------------------
C
C-----------------------------------------------------------------------
      INTEGER    IRCODE
      INTEGER    NDLINE  , NDCOMP  , NDRAT   , NDFILE ,
     &           NLINE   , NFILE   , NTDIM   ,
     &           INDL    , INDC    ,
     &           IZ      , IZ0     , ITMAX
C-----------------------------------------------------------------------
      INTEGER    NCOMP(NDLINE)         ,
     &           IZION(NDLINE,NDCOMP) , IMET(NDLINE,NDCOMP)  ,
     &           INDPH(NDLINE,NDCOMP) , IFILE(NDLINE,NDCOMP)
C-----------------------------------------------------------------------
      REAL*8     WLNGTH
C-----------------------------------------------------------------------
      REAL*8     TEIN(NTDIM) , DEIN(NTDIM) , THIN(NTDIM) , DHIN(NTDIM) ,
     &           PECA(NTDIM,NDLINE,NDCOMP)
C-----------------------------------------------------------------------
      CHARACTER  TITLX*120
C-----------------------------------------------------------------------
      CHARACTER  CIMET(NDLINE,NDCOMP)*1 , DSPECA(NDFILE)*120,
     &           UID(NDFILE)*6  , GROUP(NDFILE)*8, TYPE(NDFILE)*5 ,
     &           EXT(NDFILE)*3
C-----------------------------------------------------------------------
      LOGICAL    OPEN10      , LRSPEC
C-----------------------------------------------------------------------
      LOGICAL    LFILE(NDFILE) , LPEC(NDLINE,NDCOMP)
      LOGICAL    LTRNG(NTDIM)  , LDRNG(NTDIM)
C-----------------------------------------------------------------------
      DATA OPEN10 /.FALSE./
C-----------------------------------------------------------------------
```

D6SPOW

```
       SUBROUTINE D6SPOW( LSELA  , LEXSA  , LDEFA  , LPART  , LEXSS  ,
     &                    IZ0    , IZL    , IZH    , NPART  ,
     &                    ISDIMD , IZDIMD , ITDIMD , IPDIMD , IMDIMD ,
     &                    ACDA   , SCDA   , CCDA   , PRBA   ,
     &                    PRCA   , QCDA   , XCDA   , PLTA   ,
     &                    NMSUM  , IZIP   , IMIP   , IPIZM  ,
     &                    NTDIM  , ITMAX  ,
     &                    DENS   , DENSH  ,
     &                    FPABUN , FSABUN , FPINTG , FSINTG ,
     &                    ELTPEQ ,
     &                    ACDSEQ , SCDSEQ , CCDSEQ , ERBSEQ ,
     &                    ERCSEQ , ELTSEQ ,
     &                    ERBEQ  , ERCEQ  , ELTEQ  , ERADA
     &                  )
       IMPLICIT NONE
C
C-----------------------------------------------------------------------
C
C  ***************** FORTRAN77 SUBROUTINE: D6SPOW *********************
C
C PURPOSE : TO ASSEMBLE RADIATED ENERGY EXCESS FUNCTIONS USING
C           FRACTIONAL METASTABLE ABUNDANCES INTEGRAL EXCESSES
C
C NOTE    : THE SOURCE ISONUCLEAR MASTER FILE DATA ARE OBTAINED BY A
C           PRIOR CALL TO SUBROUTINE D6DATA FROM SEQUENTIAL FILES
C           WITH THE FOLLOWING NAMING CONVENTIONS:
C
C                  (1) JETSHP.ACD<YR>#<EL).<CODE>DATA
C                  (2) JETSHP.SCD<YR>#<EL>.<CODE>DATA
C                  (3) JETSHP.CCD<YR>#<EL>.<CODE>DATA
C                  (4) JETSHP.PRB<YR>#<EL>.<FILT>.<CODE>DATA
C                  (5) JETSHP.PRC<YR>#<EL>.<FILT>.<CODE>DATA
C                  (6) JETSHP.QCD<YR>#<EL>.<CODE>DATA
C                  (7) JETSHP.XCD<YR>#<EL>.<CODE>DATA
C                  (8) JETSHP.PLT<YR>#<EL>.<CODE>DATA
C
C       WHERE, <YR>   = TWO DIGIT YEAR NUMBER
C              <EL>   = ONE OR TWO CHARACTER ELEMENT SYMBOL
C              <CODE> = R       => PARTIAL DATA
C                       U       => PARTIAL DATA
C                       OMITTED => STANDARD DATA
C              <FILT> = SIX CHARACTER POWER FILTER CODE
C
C       AND DATA OF CLASSES 6 AND 7 DO NOT EXIST FOR THE PARTIAL CASE.
C
C
C INPUT  : (L*4)  LSELA()   = .TRUE.  => INPUT DATA SET TYPE FOR THIS
C                                        INDEX SELECTED
C                           = .FALSE. => INPUT DATA SET FOR THIS INDEX
C                                        NOT SELECTED
C INPUT  : (L*4)  LEXSA()   = .TRUE.  => INPUT DATA SET TYPE FOR THIS
C                                        SELECTED INDEX EXISTS
C                           = .FALSE. => INPUT DATA SET DOES NOT EXIST
C                                        FOR THIS SELECTED INDEX
C INPUT  : (L*4)  LDEFA()   = .TRUE.  => INPUT DATA SET TYPE FOR THIS
```

```
C                                        DEFAULT YEAR INDEX EXISTS
C                               = .FALSE. => INPUT DATA SET DOES NOT EXIST
C                                        FOR THIS DEFAULT YEAR INDEX
C INPUT  : (L*4)  LPART     = .TRUE.  => PARTIAL DATA SELECTED
C                               = .FALSE. => STANDARD DATA SELECTED
C INPUT  : (I*4)  IZ0       = NUCLEAR CHARGE
C INPUT  : (I*4)  IZL       = MINIMUM ION CHARGE+1 IN MASTER DATA FILES
C INPUT  : (I*4)  IZH       = MAXIMUM ION CHARGE+1 IN MASTER DATA FILES
C INPUT  : (I*4)  NPART()   = METASTABLE PARTITION.  I.E. NUMBER OF
C                               METASTABLES FROM CHARGE STATE IZL-1 TO
C                               IZH ON INPUT
C INPUT  : (I*4)  ISDIMD    = MAXIMUM NUMBER OF (CHARGE, PARENT, GROUND)
C                               BLOCKS IN ISONUCLEAR MASTER FILES
C INPUT  : (I*4)  IZDIMD    = MAXIMUM NUMBER OF CHARGE STATES
C                               IN ISONUCLEAR MASTER FILES
C INPUT  : (I*4)  ITDIMD    = MAXIMUM NUMBER OF TEMP OR DENS VALUES IN
C                               ISOELECTRONIC MASTER FILES
C INPUT  : (I*4)  IPDIMD    = MAXIMUM NUMBER OF METASTABLES FOR EACH
C                               IONISATION STAGE
C INPUT  : (I*4)  IMDIMD    = MAXIMUM NUMBER OF METASTABLES
C
C INPUT  : (R*8)  ACDA(,,,) = INTERPOLATION OF ACD COEFFICIENT (CM3 S-1)
C                               1ST DIM: TEMPERATURE INDEX
C                               2ND DIM: CHARGE STATE INDEX
C                               3RD DIM: RECOMBINING METASTABLE INDEX
C                               4TH DIM: RECOMBINED METASTABLE INDEX
C INPUT  : (R*8)  SCDA(,,,) = INTERPOLATION OF SCD COEFFICIENT (CM3 S-1)
C                               1ST DIM: TEMPERATURE INDEX
C                               2ND DIM: CHARGE STATE INDEX
C                               3RD DIM: RECOMBINING METASTABLE INDEX
C                               4TH DIM: RECOMBINED METASTABLE INDEX
C INPUT  : (R*8)  CCDA(,,,) = INTERPOLATION OF CCD COEFFICIENT (CM3 S-1)
C                               1ST DIM: TEMPERATURE INDEX
C                               2ND DIM: CHARGE STATE INDEX
C                               3RD DIM: RECOMBINING METASTABLE INDEX
C                               4TH DIM: RECOMBINED METASTABLE INDEX
C INPUT  : (R*8)  PRBA(,,)  = INTERPOLATION OF PRB COEFFICIENT (W CM3 )
C                               1ST DIM: TEMPERATURE INDEX
C                               2ND DIM: CHARGE STATE INDEX
C                               3RD DIM: RECOMBINING METASTABLE INDEX
C INPUT  : (R*8)  PRCA(,,)  = INTERPOLATION OF PRC COEFFICIENT (W CM3 )
C                               1ST DIM: TEMPERATURE INDEX
C                               2ND DIM: CHARGE STATE INDEX
C                               3RD DIM: RECOMBINING METASTABLE INDEX
C INPUTT : (R*8)  QCDA(,,,) = INTERPOLATION OF QCD COEFFICIENT (CM3 S-1)
C                               1ST DIM: TEMPERATURE INDEX
C                               2ND DIM: CHARGE STATE INDEX
C                               3RD DIM: FIRST METASTABLE INDEX
C                               4TH DIM: SECOND METASTABLE INDEX
C INPUT  : (R*8)  XCDA(,,,) = INTERPOLATION OF XCD COEFFICIENT (CM3 S-1)
C                               1ST DIM: TEMPERATURE INDEX
C                               2ND DIM: CHARGE STATE INDEX
C                               3RD DIM: FIRST PARENT METASTABLE INDEX
C                               4TH DIM: SECOND PARENT METASTABLE INDEX
C INPUT  : (R*8)  PLTA(,,)  = INTERPOLATION OF PLT COEFFICIENT (W CM3 )
C                               1ST DIM: TEMPERATURE INDEX
C                               2ND DIM: CHARGE STATE INDEX
C                               3RD DIM: METASTABLE INDEX
C INPUT  : (I*4)  NMSUM     = TOTAL NUMBER OF POPULATIONS
C
C INPUT  :        IZIP()    = ION CHARGE +1 (IZ1) OF METASTABLE IN LIST
C INPUT  :        IMIP()    = METASTABLE INDEX WITHIN CHARGE STATE IZ1
C                               OF METASTABLE INDEX FROM COMPLETE LIST
C INPUT  :        IPIZM(,)  = METASTABLE INDEX IN COMPLETE LIST
C                               1ST DIM: INDEX IZ1-IZL+1
C                               2ND DIM: METASTABLE COUNT FOR STAGE (IGRD)
C INPUT  : (I*4)  NTDIM     = MAXIMUM NUMBER OF DTEV/DDENS PAIRS
C INPUT  : (I*4)  ITMAX     = NUMBER OF ( DTEV() , DDENS() ) PAIRS
C INPUT  : (R*8)  DENS()    = ELECTRON DENSITIES (CM-3))
C INPUT  : (R*8)  DENSH()   = HYDROGEN DENSITIES (CM-3))
C INPUT  : (R*8)  FPABUN(,) = RESOLVED METASTABLE EQUILIBRIUM
C                               FRACTIONAL ABUNDANCES
C                               1ST DIM: - TEMPERATURE/DENSITY PAIR
C                               2ND DIM: - METASTABLE INDEX
C INPUT  : (R*8)  FPINTG(,) = RESOLVED TRANSIENT METASTABLE POPULATION
C                               EXCESS INTEGRALS
C                               1ST DIM: - TEMPERATURE/DENSITY PAIR
C                               2ND DIM: - METASTABLE INDEX
C OUTPUT : (L*4)  LEXSS()   = .TRUE.  => OUTPUT STANDARD MASTER DATA FOR
C                                        THIS INDEX GENERATED
C                               = .FALSE. => OUTPUT STANDARD MASTER DATA FOR
C                                        THIS INDEX NOT GENERATED
C OUTPUT : (R*8)  FSABUN(,) = STAGE EQUILIBRIUM FRACTIONAL ABUNDANCES
C                               1ST DIM: - TEMPERATURE/DENSITY PAIR INDEX
C                               2ND DIM: - CHARGE STATE INDEX (IZ1-IZL+1)
C OUTPUT : (R*8)  FSINTG(,) = STAGE TRANSIENT FRACTIONAL ABUNDANCES
C                               EXCESSES
C                               1ST DIM: - TEMPERATURE/DENSITY PAIR INDEX
C                               2ND DIM: - CHARGE STATE INDEX (IZ1-IZL+1)
C OUTPUT : (R*8)  ELTPEQ(,) = METASTABLE PARTIAL TRANSIENT RADIATED
C                               LINE ENERGY EXCESS FUNCTIONS
C                               1ST DIM: - TEMPERATURE/DENSITY PAIR
C                               2ND DIM: - METASTABLE INDEX
C OUTPUT : (R*8)  ACDSEQ(,) = STANDARD (UNRESOLVED) ACD COEFFICIENT
C                               1ST DIM: - TEMPERATURE/DENSITY PAIR INDEX
C                               2ND DIM: - CHARGE STATE INDEX (IZ1-IZL+1)
C OUTPUT : (R*8)  SCDSEQ(,) = STANDARD (UNRESOLVED) SCD COEFFICIENT
C                               1ST DIM: - TEMPERATURE/DENSITY PAIR INDEX
```

```
C                               2ND DIM: - CHARGE STATE INDEX (IZ1-IZL+1)
C OUTPUT : (R*8)  CCDSEQ(,) = STANDARD (UNRESOLVED) CCD COEFFICIENT
C                               1ST DIM: - TEMPERATURE/DENSITY PAIR INDEX
C                               2ND DIM: - CHARGE STATE INDEX (IZ1-IZL+1)
C OUTPUT : (R*8)  ERBSEQ(,) = STANDARD (UNRESOLVED) RB ENERGY EXCESS
C                               COEFFICIENT
C                               1ST DIM: - TEMPERATURE/DENSITY PAIR INDEX
C                               2ND DIM: - CHARGE STATE INDEX (IZ1-IZL+1)
C OUTPUT : (R*8)  ERCSEQ(,) = STANDARD (UNRESOLVED) RC ENERGY EXCESS
C                               COEFFICIENT
C                               1ST DIM: - TEMPERATURE/DENSITY PAIR INDEX
C                               2ND DIM: - CHARGE STATE INDEX (IZ1-IZL+1)
C OUTPUT : (R*8)  ELTSEQ(,) = STANDARD (UNRESOLVED) LT ENERGY EXCESS
C                               COEFFICIENT
C                               1ST DIM: - TEMPERATURE/DENSITY PAIR INDEX
C                               2ND DIM: - CHARGE STATE INDEX (IZ1-IZL+1)
C OUTPUT : (R*8)  ERBEQ()   = TOTAL TRANSIENT RADIATED RECOM-BREMS
C                               ENERGY EXCESS FUNCTION
C OUTPUT : (R*8)  ERCEQ()   = TOTAL TRANSIENT CX RADIATED RECOM ENERGY
C                               EXCESS FUNCTION NORMALISED TO
C                               ELECTRON DENSITY
C OUTPUT : (R*8)  ELTEQ()   = TOTAL TRANSIENT RADIATED LINE ENERGY
C                               EXCESS FUNCTION
C OUTPUT : (R*8)  ERADA()   = TOTAL TRANSIENT RADIATED ENERGY EXCESS
C                               FUNCTION
C
C PROGRAM: (I*4)  IT        = GENERAL INDEX FOR TEMPERATURE
C          (I*4)  IP        = GENERAL INDEX FOR CHARGE
C          (I*4)  IZ1       = GENERAL INDEX FOR CHARGE+1
C          (I*4)  ICL       = GENERAL INDEX FOR CLASS
C          (I*4)  IPP       = GENERAL PARENT INDEX
C          (I*4)  IPG       = GENERAL GROUND INDEX
C          (I*4)  IZREF     = GENERAL CHARGE STAE POINTER INDEX
C          (I*4)  IPRT      = GENERAL INDEX FOR PARENT METASTABLE
C          (I*4)  IGRD      = GENERAL INDEX FOR METASTABLE
C
C
C ROUTINES:
C          ROUTINE    SOURCE    BRIEF DESCRIPTION
C          ------------------------------------------------------------
C
C
C AUTHOR : H. P. SUMMERS, JET
C          K1/1/57
C          JET  EXT. 4941
C
C DATE   : 28/04/94
C
C UNIX-IDL PORT:
C
C AUTHOR:  WILLIAM OSBORN (TESSELLA SUPPORT SERVICES PLC)
C
C DATE:    07/06/96
C
C VERSION: 1.1                                  DATE:07/06/96
C MODIFIED: WILLIAM OSBORN
C           - FIRST VERSION
C VERSION: 1.2                                  DATE:27/06/96
C MODIFIED: WILLIAM OSBORN
C           - REMOVED UNUSED VARIABLES
C
C-----------------------------------------------------------------------
      INTEGER   IZ0
      INTEGER   IZ1     , IZL     , IZH     , NTDIM   , ITMAX   , NMSUM
      INTEGER   ISDIMD  , IZDIMD  , ITDIMD  , IPDIMD  , IMDIMD
      INTEGER   IT      , IPRT    , IGRD
      INTEGER   ICL     , IP      , IZREF   , IPP     , IPG
C-----------------------------------------------------------------------
      INTEGER   NPART(IZDIMD)
      INTEGER   IZIP(IMDIMD)   , IMIP(IMDIMD) ,
     &          IPIZM(IZDIMD,IPDIMD)
C-----------------------------------------------------------------------
      REAL*8    DNS           , DNSH
C-----------------------------------------------------------------------
      REAL*8    DENS(NTDIM)   , DENSH(NTDIM)   ,
     &          ERBEQ(NTDIM)  , ERCEQ(NTDIM)   ,  ELTEQ(NTDIM) ,
     &          ERADA(NTDIM)
C
      REAL*8    FPABUN(NTDIM,IMDIMD) , ELTPEQ(NTDIM,IMDIMD)
      REAL*8    FSABUN(NTDIM,IZDIMD)
C
      REAL*8    FSINTG(NTDIM,IZDIMD) , FPINTG(NTDIM, IZDIMD)
C
      REAL*8    ACDSEQ(NTDIM,IZDIMD) , SCDSEQ(NTDIM,IZDIMD)   ,
     &          CCDSEQ(NTDIM,IZDIMD) , ERBSEQ(NTDIM,IZDIMD)   ,
     &          ERCSEQ(NTDIM,IZDIMD) , ELTSEQ(NTDIM,IZDIMD)
C
      REAL*8    ACDA(NTDIM,IZDIMD,IPDIMD,IPDIMD) ,
     &          SCDA(NTDIM,IZDIMD,IPDIMD,IPDIMD) ,
     &          CCDA(NTDIM,IZDIMD,IPDIMD,IPDIMD) ,
     &          PRBA(NTDIM,IZDIMD,IPDIMD)        ,
     &          PRCA(NTDIM,IZDIMD,IPDIMD)        ,
     &          QCDA(NTDIM,IZDIMD,IPDIMD,IPDIMD) ,
     &          XCDA(NTDIM,IZDIMD,IPDIMD,IPDIMD) ,
     &          PLTA(NTDIM,IZDIMD,IPDIMD)
C-----------------------------------------------------------------------
      LOGICAL   LPART
C-----------------------------------------------------------------------
```

```
       LOGICAL     LSELA(8)      , LEXSA(8)       , LDEFA(8)  ,
     &             LEXSS(8)
C-----------------------------------------------------------------------
```

D6WR11

```
      SUBROUTINE D6WR11( IUNIT  , DSNINC , DSNMTR , ELEMT ,
     &                   UID    , DATE   , IZ0    ,
     &                   NDLINE , NLINE  ,
     &                   TITL   , IZION  , CIMET  ,
     &                   NTDIM  , ITMAX  ,
     &                   TEV    , DENS   ,
     &                   GCF
     &                 )
       IMPLICIT NONE
C-----------------------------------------------------------------------
C
C  ******************** FORTRAN77 SUBROUTINE: D6WR11 ******************
C
C  PURPOSE:  TO OUTPUT DATA TO GCF PASSING FILE.
C
C  CALLING PROGRAM: ADAS406
C
C
C  SUBROUTINE:
C
C  INPUT : (I*4)  IUNIT   = OUTPUT UNIT NUMBER FOR RESULTS
C  INPUT : (C*80) DSNINC  = INPUT SCRIPT DATA SET NAME
C  INPUT : (C*120)DSNMTR  = INPUT ACD MASTER FILE NAME
C  INPUT : (C*2)  ELEMT   = ELEMENT SYMBOL.
C
C  INPUT : (C*80)  UID    = USER IDENIFIER
C  INPUT : (C*8)  DATE    = CURRENT DATE
C  INPUT : (I*4)  IZ0     = NUCLEAR CHARGE
C
C  INPUT : (I*4)  NDLINE  = MAXIMUM NUMBER OF SPECTRUM LINES
C  INPUT : (I*4)  NLINE   = NUMBER OF SPECTRUM LINES
C  INPUT : (C*12) TITL()  = TITLE FOR 1ST COMPONENT OF LINE
C  INPUT : (I*4)  IZION() = ION CHARGE FOR 1ST COMPONENT OF LINE
C  INPUT : (C*1)  CIMET() = +/- SHIFT OF ION CHARGE - 1ST COMPONENT
C
C  INPUT : (I*4)  NTDIM   = AMXIMU, NUMBER OF INPUT TEMPERATURES
C  INPUT : (I*4)  ITMAX   = NUMBER OF INPUT TEMPERATURES
C                           LIST.
C  INPUT : (R*8)  TEV()   = ELECTRON TEMPERATURES (UNITS: EV)
C  INPUT : (R*8)  DENS()  = ELECTRON DENSITIES  (UNITS: CM-3)
C
C  INPUT : (R*4)  GCF(,)  = G(TE) FUNCTION (CM3 S-1)
C                              1ST DIM: TEMPERATURE INDEX
C                              2ND DIM: LINE INDEX
C
C          (I*4) I         = GENERAL USE
C          (I*4) I1        = GENERAL USE
C          (I*4) I2        = GENERAL USE
C          (I*4) IT        = GENERAL USE
C          (C*80)CLINE     = GENERAL USE
C
C
C ROUTINES: NONE
C
C AUTHOR:  H. P. SUMMERS, JET
C          K1/1/57
C          JET EXT. 4941
C
C DATE:    27/04/94
C
C
C UNIX-IDL PORT:
C
C AUTHOR:  WILLIAM OSBORN (TESSELLA SUPPORT SERVICES PLC)
C
C DATE:    07/06/96
C
C VERSION: 1.1                                  DATE:07/06/96
C MODIFIED: WILLIAM OSBORN
C            - FIRST VERSION
C VERSION: 1.2                                  DATE:27/06/96
C MODIFIED: WILLIAM OSBORN
C            - REMOVED UNUSED VARIABLES
C
C VERSION: 1.3                                  DATE:03/07/96
C MODIFIED: WILLIAM OSBORN
C            - TIDIED UP OUTPUT - GOT SCRIPT FILE NAME FOR UNIX PROPERLY
C
C VERSION: 1.4                                  DATE:17/07/96
C MODIFIED: WILLIAM OSBORN
C            - CHANGED SCRIPT FILENAME GENERATION CODE SO AS NOT TO
C              ASSIGN TO A DO-LOOP COUNTER
C
C VERSION: 1.5                                  DATE:09/03/98
C MODIFIED: RICHARD MARTIN
C            - INCREASED UID FROM CHAR*6 TO CHAR*80 IN ACCORDANCE WITH
C                XXUID.
C
```

```
C-----------------------------------------------------------------------
      INTEGER   NDLINE    , NLINE      , NTDIM
      INTEGER   IUNIT     ,
     &          ITMAX     , IZ0
      INTEGER   I         , L
      INTEGER   I1        , I2         , IT
C-----------------------------------------------------------------------
      INTEGER   IZION(NLINE)
C-----------------------------------------------------------------------
      CHARACTER ELEMT*2          , DSNINC*80   , DSNMTR*120, DSNTEMP*80
      CHARACTER TITL(NLINE)*12   , CLINE*80
      CHARACTER CODE*8     , SCRIPT*8   , TYPE*4
      CHARACTER UID*80      , DATE*8     , CHZ*5
C-----------------------------------------------------------------------
      CHARACTER CIMET(NLINE)*1
C-----------------------------------------------------------------------
      REAL*8   TEV(NTDIM)  , DENS(NTDIM)
      REAL*8   GCF(NTDIM,NDLINE)
C-----------------------------------------------------------------------
      DATA     CODE/' ADAS406'/ , TYPE/'LINE'/
C-----------------------------------------------------------------------
```

DPMPAR

```
      double precision function dpmpar(i)
      integer i
c     **********
c
c     function dpmpar
c
c     This function provides double precision machine parameters
c     when the appropriate set of data statements is activated (by
c     removing the c from column 1) and all other data statements are
c     rendered inactive. Most of the parameter values were obtained
c     from the corresponding Bell Laboratories Port Library function.
c
c     The function statement is
c
c       double precision function dpmpar(i)
c
c     where
c
c       i is an integer input variable set to 1, 2, or 3 which
c         selects the desired machine parameter. If the machine has
c         t base b digits and its smallest and largest exponents are
c         emin and emax, respectively, then these parameters are
c
c         dpmpar(1) = b**(1 - t), the machine precision,
c
c         dpmpar(2) = b**(emin - 1), the smallest magnitude,
c
c         dpmpar(3) = b**emax*(1 - b**(-t)), the largest magnitude.
c
c     Argonne National Laboratory. MINPACK Project. June 1983.
c     Burton S. Garbow, Kenneth E. Hillstrom, Jorge J. More
c
C UNIX-IDL PORT:
C          WILLIAM OSBORN, TESSELLA SUPPORT SERVICES PLC.
C
C DATE:    25TH APRIL 1996
C
C VERSION: 1.1                           DATE: 25-04-96
C MODIFIED: WILLIAM OSBORN
C           - COPIED FROM WWW.NETLIB.ORG/MINPACK/ . DEC ALPHA AND SUN ADDED
C             AT END FROM d1mach.f
C
c     **********
      integer mcheps(4)
      integer minmag(4)
      integer maxmag(4)
      double precision dmach(3)
      equivalence (dmach(1),mcheps(1))
      equivalence (dmach(2),minmag(1))
      equivalence (dmach(3),maxmag(1))
c
c     Machine constants for the IBM 360/370 series,
c     the Amdahl 470/V6, the ICL 2900, the Itel AS/6,
c     the Xerox Sigma 5/7/9 and the Sel systems 85/86.
c
c     data mcheps(1),mcheps(2) / z34100000, z00000000 /
c     data minmag(1),minmag(2) / z00100000, z00000000 /
c     data maxmag(1),maxmag(2) / z7fffffff, zffffffff /
c
c     Machine constants for the Honeywell 600/6000 series.
c
c     data mcheps(1),mcheps(2) / o606400000000, o000000000000 /
c     data minmag(1),minmag(2) / o402400000000, o000000000000 /
c     data maxmag(1),maxmag(2) / o376777777777, o777777777777 /
c
c     Machine constants for the CDC 6000/7000 series.
c
c     data mcheps(1) / 15614000000000000000b /
c     data mcheps(2) / 15010000000000000000b /
c
```

```
c     data minmag(1) / 0060400000000000000b /
c     data minmag(2) / 0000000000000000000b /
c
c     data maxmag(1) / 3776777777777777777b /
c     data maxmag(2) / 3716777777777777777b /
c
c     Machine constants for the PDP-10 (KA processor).
c
c     data mcheps(1),mcheps(2) / "114400000000, "000000000000 /
c     data minmag(1),minmag(2) / "033400000000, "000000000000 /
c     data maxmag(1),maxmag(2) / "377777777777, "344777777777 /
c
c     Machine constants for the PDP-10 (KI processor).
c
c     data mcheps(1),mcheps(2) / "104400000000, "000000000000 /
c     data minmag(1),minmag(2) / "000400000000, "000000000000 /
c     data maxmag(1),maxmag(2) / "377777777777, "377777777777 /
c
c     Machine constants for the PDP-11.
c
c     data mcheps(1),mcheps(2) /   9472,      0 /
c     data mcheps(3),mcheps(4) /      0,      0 /
c
c     data minmag(1),minmag(2) /    128,      0 /
c     data minmag(3),minmag(4) /      0,      0 /
c
c     data maxmag(1),maxmag(2) /  32767,     -1 /
c     data maxmag(3),maxmag(4) /     -1,     -1 /
c
c     Machine constants for the Burroughs 6700/7700 systems.
c
c     data mcheps(1) / o1451000000000000 /
c     data mcheps(2) / o0000000000000000 /
c
c     data minmag(1) / o1771000000000000 /
c     data minmag(2) / o7770000000000000 /
c
c     data maxmag(1) / o0777777777777777 /
c     data maxmag(2) / o7777777777777777 /
c
c     Machine constants for the Burroughs 5700 system.
c
c     data mcheps(1) / o1451000000000000 /
c     data mcheps(2) / o0000000000000000 /
c
c     data minmag(1) / o1771000000000000 /
c     data minmag(2) / o0000000000000000 /
c
c     data maxmag(1) / o0777777777777777 /
c     data maxmag(2) / o0007777777777777 /
c
c     Machine constants for the Burroughs 1700 system.
c
c     data mcheps(1) / zcc6800000 /
c     data mcheps(2) / z000000000 /
c
c     data minmag(1) / zc00800000 /
c     data minmag(2) / z000000000 /
c
c     data maxmag(1) / zdfffffff /
c     data maxmag(2) / zfffffffff /
c
c     Machine constants for the Univac 1100 series.
c
c     data mcheps(1),mcheps(2) / o170640000000, o000000000000 /
c     data minmag(1),minmag(2) / o000040000000, o000000000000 /
c     data maxmag(1),maxmag(2) / o377777777777, o777777777777 /
c
c     Machine constants for the Data General Eclipse S/200.
c
c     Note - it may be appropriate to include the following card -
c     static dmach(3)
c
c     data minmag/20k,3*0/,maxmag/77777k,3*177777k/
c     data mcheps/32020k,3*0/
c
c     Machine constants for the Harris 220.
c
c     data mcheps(1),mcheps(2) / '20000000, '00000334 /
c     data minmag(1),minmag(2) / '20000000, '00000201 /
c     data maxmag(1),maxmag(2) / '37777777, '37777577 /
c
c     Machine constants for the Cray-1.
c
c     data mcheps(1) / 0376424000000000000000b /
c     data mcheps(2) / 0000000000000000000000b /
c
c     data minmag(1) / 0200034000000000000000b /
c     data minmag(2) / 0000000000000000000000b /
c
c     data maxmag(1) / 0577777777777777777777b /
c     data maxmag(2) / 0000077777777777777776b /
c
c     Machine constants for the Prime 400.
c
c     data mcheps(1),mcheps(2) / :10000000000, :00000000123 /
c     data minmag(1),minmag(2) / :10000000000, :00000100000 /
c     data maxmag(1),maxmag(2) / :17777777777, :37777677776 /
```

```
c
c     Machine constants for the VAX-11.
c
c      data mcheps(1),mcheps(2) /   9472,  0 /
c      data minmag(1),minmag(2) /    128,  0 /
c      data maxmag(1),maxmag(2) / -32769, -1 /
c
C     MACHINE CONSTANTS FOR BIG-ENDIAN IEEE ARITHMETIC (BINARY FORMAT)
C     MACHINES IN WHICH THE MOST SIGNIFICANT BYTE IS STORED FIRST,
C     SUCH AS THE AT&T 3B SERIES, MOTOROLA 68000 BASED MACHINES (E.G.
C     SUN 3), AND MACHINES THAT USE SPARC, HP, OR IBM RISC CHIPS.
C
      DATA MINMAG(1),MINMAG(2) /    1048576,          0 /
      DATA MAXMAG(1),MAXMAG(2) / 2146435071,         -1 /
      DATA MCHEPS(1),MCHEPS(2) / 1018167296,          0 /
C
C     MACHINE CONSTANTS FOR LITTLE-ENDIAN (BINARY) IEEE ARITHMETIC
C     MACHINES IN WHICH THE LEAST SIGNIFICANT BYTE IS STORED FIRST,
C     E.G. IBM PCS AND OTHER MACHINES THAT USE INTEL 80X87 OR DEC
C     ALPHA CHIPS.
C
C      DATA MINMAG(1),MINMAG(2) /          0,    1048576 /
C      DATA MAXMAG(1),MAXMAG(2) /         -1, 2146435071 /
C      DATA MCHEPS(1),MCHEPS(2) /          0, 1018167296 /

      dpmpar = dmach(i)
      return
c
c     Last card of function dpmpar.
c
      end
```

LH404RR

```
      SUBROUTINE LH404RR(DATE, IZ0, IZL, IZH, CHPRFIX, MAXT, MAXD, TEK,
     &     DENSA, DSNIN, DSNO , LDTYP, YEAR, OPEN17
     &     )
C-----------------------------------------------------------------------
C
C ************ FORTRAN 77 PROGRAM: LH404RR *****************************
C
C   VERSION 1.0
C
C   PURPOSE:
C           TO FETCH DATA FROM MASTER CONDENSED PARENT/METASTABLE
C           RESOLVED COLLISIONAL DIELECTRONIC FILES AND PREPARE
C           RESOLVED ISONUCLEAR (ADF11) MASTER FILES.
C
C           BASED UPON LH404RU
C
C   PROGRAM:
C
C   PARAMETER : (I*4)  NUTMAX - OUTPUT  ELEMENT MASTER FILE
C                               MAXIMUM NUMBER OF TEMPERATURES
C   PARAMETER : (I*4)  NUDMAX - OUTPUT  ELEMENT MASTER FILE
C                               MAXIMUM NUMBER OF DENSITIES
C   PARAMETER : (I*4)  NUZMAX - OUTPUT  ELEMENT MASTER FILE
C                               MAXIMUM NUMBER OF CHARGE STATES
C   PARAMETER : (I*4)  NUMMAX - METASTABLE FRACTIONS
C                               MAXIMUM NUMBER OF METASTABLES
C
C       (R*8)  DENSA()        - OUTPUT ELEMENT MASTER FILE
C                               SET OF MAXD DENSITIES
C       (R*8)  TEK()          - OUTPUT ELEMENT MASTER FILE
C                               SET OF MAXT TEMPERATURES
C       (R*8)  DENSL()        - OUTPUT ELEMENT MASTER FILE
C                               SET OF MAXD DENSITIES IN LOGARITHM
C       (R*8)  TEVL()         - OUTPUT ELEMENT MASTER FILE
C                               SET OF MAXT TEMPERATURES IN LOGARITHM
C
C
C     ROUTINES:
C     ---------
C         XUFLOW   - VS FORTRAN UNDERFLOW EXCEPTION HANDLER
C         CL3270   - JET-SPECIFIC CLEAR SCREEN ROUTINE
C         XXDATE   - ADAS - GATHER CURRENT DATE
C         XXOPEN   - ADAS - OPEN FILE
C         XXSLEN   - ADAS - GET FIRST AND LAST CHAR. POS. IN A STRING
C         DMGUID   - JET-SPECIFIC - GATHER USERS ID
C         FILEINF  - VS FORTRAN FILE INFORMATION ROUTINE
C         CNV404A  - READ ACD,SCD,CCD,PRB,PRC,QCD,XCD RESOLVED
C                    ADF10 FILES AND WRITE RESOLVED ADF11 FILES
C         CNV404B  - READ PLT,PLS RESOLVED ADF10 FILES
C                    AND WRITE RESOLVED ADF11 FILES
C
C-----------------------------------------------------------------------
C AUTHOR:  LORNE D. HORTON
C          ROOM K1/1/58, JET JOINT UNDERTAKING
C
C   DATE:   5TH AUGUST 1996
C
C-----------------------------------------------------------------------
C UNIX-IDL PORT:
C
```

```
C VERSION: 1.1                          DATE: 11-11-96
C MODIFIED: WILLIAM OSBORN (TESSELLA SUPPORT SERVICES PLC)
C                - FIRST CONVERTED
C              - MADE A SUBROUTINE OF ADAS404
C
C-----------------------------------------------------------------------
C
       INTEGER   NUTMAX, NUDMAX, NUZMAX, NUMMAX
       INTEGER   IST1, IST2, IST4, IST5
       REAL*8    DLOGMIN, DMIN
       PARAMETER (NUTMAX = 35, NUDMAX = 30, NUZMAX = 50, NUMMAX = 4)
       PARAMETER (IST1 = 5, IST2 = 17, IST4 = 11, IST5 = 12)
       PARAMETER (DLOGMIN = -74.0 , DMIN = 1.0D-74)
C-----------------------------------------------------------------------
C      DECLARATIONS FOR INPUT DATA
C-----------------------------------------------------------------------
       INTEGER   IZ0, IZL, IZH
       CHARACTER DATE*8 , YEAR*2, USERID*6, CHPRFIX*2
       CHARACTER SYSUID*7, PREFIX*7
       LOGICAL   LPRFIX, OPEN17
C-----------------------------------------------------------------------
C      VARIABLES LOADED BY DATA STATEMENTS IN THE SOURCE CODE
C-----------------------------------------------------------------------
       INTEGER   NGRD(50)
       INTEGER   MAXT, MAXD
       REAL*8    TEK(NUTMAX), DENSA(NUDMAX)
       CHARACTER CDTYP(9)*3
       LOGICAL   LDTYP(9)
       CHARACTER  DSNO(10)*80 , DSNIN(50,10)*80
C-----------------------------------------------------------------------
C      VARIABLES FOR BUILDING FILE NAMES
C-----------------------------------------------------------------------
       INTEGER   LSE
       CHARACTER DSNOUT*35
       CHARACTER ELEMT*2, ELEMN*12, XFESYM*2, XFELEM*12
       LOGICAL   LEXIST
C-----------------------------------------------------------------------
C      VARIABLES FOR WRITING TO PASS FILES
C-----------------------------------------------------------------------
       INTEGER   ITYPE, ISWIT, IWRITE
       INTEGER   NELH, NELL, NEL
C-----------------------------------------------------------------------
C      LOG TEMPERATURE AND DENSITY VECTORS FOR OUTPUT
C-----------------------------------------------------------------------
       REAL*8    TEVL(NUTMAX), DENSL(NUDMAX)
C-----------------------------------------------------------------------
C      MISCELLANEOUS COUNTERS, ETC.
C-----------------------------------------------------------------------
       INTEGER   IT, ID, IZ, IGRD, IRCODE, LEN1, LEN2
       REAL*8    SUM
C
C-----------------------------------------------------------------------
C
       DATA NGRD  /  1 , 2 , 1 , 2 , 2 , 4 , 3 , 4 , 1 , 1 ,
     &               1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 ,
     &               1 , 1 , 3 , 2 , 1 , 1 , 1 , 1 , 1 , 1 ,
     &               1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 ,
     &               3 , 2 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 /
C
       DATA CDTYP / 'ACD' , 'SCD' , 'CCD' , 'PRB' , 'PRC' ,
     &              'QCD' , 'XCD' , 'PLT' , 'PLS' /
C-----------------------------------------------------------------------
C   DETERMINE WHICH DATA TYPES SHOULD BE INCLUDED IN THE CONVERSION
C   FROM ADF10 TO ADF11.  MISSING FILES WILL BE ASSUMED ZERO AND
C   WRITTEN TO ADF11 FORMAT IF LDTYP = .TRUE.
C-----------------------------------------------------------------------
C   NOW READ IN FROM IDL
C-----------------------------------------------------------------------
CX       DATA LDTYP / .TRUE. ,.TRUE. ,.TRUE. ,.TRUE. ,.TRUE. ,
CX     &              .TRUE. ,.TRUE. ,.TRUE. ,.TRUE. /
C-----------------------------------------------------------------------
C   DATA FOR 96 FILE GENERATION
C-----------------------------------------------------------------------
C      DATA MAXT / 30 /
C      DATA MAXD / 24 /
C      DATA TEK   / 2.3208D+03 , 3.4812D+03 , 5.8020D+03 , 8.1228D+03,
C    &              1.1604D+04 , 1.7406D+04 , 2.3208D+04 , 3.4812D+04,
C    &              5.8020D+04 , 8.1228D+04 , 1.1604D+05 , 1.7406D+05,
C    &              2.3208D+05 , 3.4812D+05 , 5.8020D+05 , 8.1228D+05,
C    &              1.1604D+06 , 1.7406D+06 , 2.3208D+06 , 3.4812D+06,
C    &              5.8020D+06 , 8.1228D+06 , 1.1604D+07 , 1.7406D+07,
C    &              2.3208D+07 , 3.4812D+07 , 5.8020D+07 , 8.1228D+07,
C    &              1.1604D+08 , 1.7406D+08 , 5*0.0D0/
C      DATA DENSA / 5.0000D+07 , 1.0000D+08 , 2.0000D+08 ,
C    &              5.0000D+08 , 1.0000D+09 , 2.0000D+09 ,
C    &              5.0000D+09 , 1.0000D+10 , 2.0000D+10 ,
C    &              5.0000D+10 , 1.0000D+11 , 2.0000D+11 ,
C    &              5.0000D+11 , 1.0000D+12 , 2.0000D+12 ,
C    &              5.0000D+12 , 1.0000D+13 , 2.0000D+13 ,
C    &              5.0000D+13 , 1.0000D+14 , 2.0000D+14 ,
C    &              5.0000D+14 , 1.0000D+15 , 2.0000D+15 ,
C    &              6*0.0D0/
C-----------------------------------------------------------------------
C   DATA FOR 96 HELIUM STUDY - REMOVE BOTTOM 3 AND TOP TEMPERATURES
C-----------------------------------------------------------------------
CX       DATA MAXT / 26 /
CX       DATA MAXD / 24 /
CX       DATA TEK   / 8.1228D+03,
```

```
CX     &             1.1604D+04 , 1.7406D+04 , 2.3208D+04 , 3.4812D+04,
CX     &             5.8020D+04 , 8.1228D+04 , 1.1604D+05 , 1.7406D+05,
CX     &             2.3208D+05 , 3.4812D+05 , 5.8020D+05 , 8.1228D+05,
CX     &             1.1604D+06 , 1.7406D+06 , 2.3208D+06 , 3.4812D+06,
CX     &             5.8020D+06 , 8.1228D+06 , 1.1604D+07 , 1.7406D+07,
CX     &             2.3208D+07 , 3.4812D+07 , 5.8020D+07 , 8.1228D+07,
CX     &             1.1604D+08 , 9*0.0D0/
CX       DATA DENSA / 5.0000D+07 , 1.0000D+08 , 2.0000D+08 ,
CX     &             5.0000D+08 , 1.0000D+09 , 2.0000D+09 ,
CX     &             5.0000D+09 , 1.0000D+10 , 2.0000D+10 ,
CX     &             5.0000D+10 , 1.0000D+11 , 2.0000D+11 ,
CX     &             5.0000D+11 , 1.0000D+12 , 2.0000D+12 ,
CX     &             5.0000D+12 , 1.0000D+13 , 2.0000D+13 ,
CX     &             5.0000D+13 , 1.0000D+14 , 2.0000D+14 ,
CX     &             5.0000D+14 , 1.0000D+15 , 2.0000D+15 ,
CX     &             6*0.0D0/
C-----------------------------------------------------------------------
C   DATA FOR SANCO FILE FORMATION
C-----------------------------------------------------------------------
C      DATA MAXT / 35 /
C      DATA MAXD / 26 /
C      DATA TEK   / 1.1604D+04 , 1.4609D+04 , 1.8391D+04 , 2.3153D+04,
C    &              2.9148E+04 , 3.6695D+04 , 4.6196D+04 , 5.8158D+04,
C    &              7.3216E+04 , 9.2174E+04 ,
C    &              1.1604D+05 , 1.4609D+05 , 1.8391D+05 , 2.3153D+05,
C    &              2.9148E+05 , 3.6695D+05 , 4.6196D+05 , 5.8158D+05,
C    &              7.3216E+05 , 9.2174E+05 ,
C    &              1.1604D+06 , 1.8391D+06 ,
C    &              2.9148E+06 , 4.6196D+06 ,
C    &              7.3216E+06 ,
C    &              1.1604D+07 , 1.8391D+07 ,
C    &              2.9148E+07 , 4.6196D+07 ,
C    &              7.3216E+07 ,
C    &              1.1604D+08 , 1.8391D+08 ,
C    &              2.9148E+08 , 4.6196D+08 ,
C    &              5.8158E+08 /
C      DATA DENSA / 1.000D+10 , 1.585D+10, 2.512D+10 ,
C    &              3.981D+10 , 6.310D+10,
C    &              1.000D+11 , 1.585D+11, 2.512D+11 ,
C    &              3.981D+11 , 6.310D+11,
C    &              1.000D+12 , 1.585D+12, 2.512D+12 ,
C    &              3.981D+12 , 6.310D+12,
C    &              1.000D+13 , 1.585D+13, 2.512D+13 ,
C    &              3.981D+13 , 6.310D+13,
C    &              1.000D+14 , 1.585D+14, 2.512D+14 ,
C    &              3.981D+14 , 6.310D+14,
C    &              1.00D+15  , 0,0,0,0 /
C-----------------------------------------------------------------------
C   DATA FOR NORMAL FILES
C-----------------------------------------------------------------------
C      DATA MAXT / 20 /
C      DATA MAXD / 13 /
C      DATA TEK   / 4.62E+3, 7.32E+3
C    &            , 1.16D+4, 1.84D+4, 2.91D+4, 4.62D+4, 7.32D+4
C    &            , 1.16D+5, 1.84D+5, 2.91D+5, 4.62D+5, 7.32D+5
C    &            , 1.16D+6, 1.84D+6, 2.91D+6, 4.62D+6, 7.32D+6
C    &            , 1.16D+7, 1.84D+7, 2.91D+7, 4.62D+7, 7.32D+7
C    &            , 1.16D+8,
C    &              0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0 /
C
C      DATA DENSA / 1.000D+04 , 1.000D+05, 1.000D+06 ,
C    &              1.000D+07 , 1.000D+08, 1.000D+09 ,
C    &              1.000D+10 , 1.000D+11, 1.000D+12 ,
C    &              1.000D+13 , 1.000D+14, 1.000D+15 ,
C    &              1.000D+16 , 0, 0, 0, 0, 0, 0, 0,
C    &                 0, 0, 0, 0, 0, 0, 0, 0, 0, 0 /
C
C-----------------------------------------------------------------------
C   DATA FOR CHROMIUM AND MOLYBDENUM STUDY
C-----------------------------------------------------------------------
C      DATA MAXT / 12 /
C      DATA MAXD / 13 /
C      DATA TEK   /
C    &              1.16D+4, 1.84D+4, 2.91D+4, 4.62D+4, 7.32D+4
C    &            , 1.16D+5, 1.84D+5, 2.91D+5, 4.62D+5, 7.32D+5
C    &            , 1.16D+6, 1.84D+6
C    &            , 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0
C    &            , 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0 /
C
C      DATA DENSA / 1.000D+04 , 1.000D+05, 1.000D+06 ,
C    &              1.000D+07 , 1.000D+08, 1.000D+09 ,
C    &              1.000D+10 , 1.000D+11, 1.000D+12 ,
C    &              1.000D+13 , 1.000D+14, 1.000D+15 ,
C    &              1.000D+16 , 0, 0, 0, 0, 0, 0, 0,
C    &                 0, 0, 0, 0, 0, 0, 0, 0, 0, 0 /
C
C-----------------------------------------------------------------------
```

LH404RU

```
      SUBROUTINE LH404RU(DATE, IZ0, IZL, IZH, CHPRFIX, MAXT, MAXD, TEK,
     &     DENSA, DSNIN, DSNO , LDTYP, YEAR, OPEN17
     &     )
      IMPLICIT NONE
```

```
C-----------------------------------------------------------------------
C
C ************ FORTRAN 77 PROGRAM: LH404RU ****************************
C
C   VERSION 1.0
C
C   PURPOSE:
C           TO FETCH DATA FROM MASTER CONDENSED PARENT/METASTABLE
C           RESOLVED COLLISIONAL DIELECTRONIC FILES, BUNDLE
C           THEM, AND PREPARE UNRESOLVED ISONUCLEAR (ADF11) MASTER
C           FILES.  ALSO CHECK FOR AN EQUIVALENTLY NAMED ADF15 FILES
C           AND BUNDLE RESOLVED DATA BLOCKS INTO UNRESOLVED ONES.
C
C           LOOSELY BASED UPON WJD404R
C
C   PROGRAM:
C
C   PARAMETER : (I*4)  NUTMAX - OUTPUT  ELEMENT MASTER FILE
C                               MAXIMUM NUMBER OF TEMPERATURES
C   PARAMETER : (I*4)  NUDMAX - OUTPUT  ELEMENT MASTER FILE
C                               MAXIMUM NUMBER OF DENSITIES
C   PARAMETER : (I*4)  NUZMAX - OUTPUT  ELEMENT MASTER FILE
C                               MAXIMUM NUMBER OF CHARGE STATES
C   PARAMETER : (I*4)  NUMMAX - METASTABLE FRACTIONS
C                               MAXIMUM NUMBER OF METASTABLES
C
C       (R*8)  DENSA()        - OUTPUT ELEMENT MASTER FILE
C                               SET OF MAXD DENSITIES
C       (R*8)  TEK()          - OUTPUT ELEMENT MASTER FILE
C                               SET OF MAXT TEMPERATURES
C       (R*8)  DENSL()        - OUTPUT ELEMENT MASTER FILE
C                               SET OF MAXD DENSITIES IN LOGARITHM
C       (R*8)  TEVL()         - OUTPUT ELEMENT MASTER FILE
C                               SET OF MAXT TEMPERATURES IN LOGARITHM
C
C
C     ROUTINES:
C     ---------
C         XUFLOW   - VS FORTRAN UNDERFLOW EXCEPTION HANDLER
C         CL3270   - JET-SPECIFIC CLEAR SCREEN ROUTINE
C         XXDATE   - ADAS - GATHER CURRENT DATE
C         XXOPEN   - ADAS - OPEN FILE
C         XXSLEN   - ADAS - GET FIRST AND LAST CHAR. POS. IN A STRING
C         DMGUID   - JET-SPECIFIC - GATHER USERS ID
C         METRD    - READ MET FILES AND SPLINE ONTO TEMP/DENS ARRAY
C         FILEINF  - VS FORTRAN FILE INFORMATION ROUTINE
C         BND404A  - READ ACD,SCD,CCD,PRB,PRC RESOLVED ADF10 FILES
C                    AND BUNDLE THEM INTO UNRESOLVED ADF11 FILES
C         BND404B  - READ PLT,PLS RESOLVED ADF10 FILES
C                    AND BUNDLE THEM INTO UNRESOLVED ADF11 FILES
C         BND404C  - READ ADF10 FILES AND BUNDLE THE RESOLVED
C                    BLOCKS INTO UNRESOLVED BLOCKS TO BE TACKED
C                    ONTO THE BOTTOM OF THE FILE
C
C-----------------------------------------------------------------------
C AUTHOR:  LORNE D. HORTON
C          ROOM K1/1/58, JET JOINT UNDERTAKING
C
C   DATE:  21ST FEBRUARY 1996
C
C-----------------------------------------------------------------------
C
C VERSION: 1.2                                                  DATE: 20-10-97
C MODIFIED: LORNE HORTON
C                - MODIFIED CALL TO BND404A and BND404B.
C
C-----------------------------------------------------------------------
C
       INTEGER   NUTMAX, NUDMAX, NUZMAX, NUMMAX
       INTEGER   IST1, IST2, IST4, IST5
       REAL*8    DLOGMIN, DMIN
       PARAMETER (NUTMAX = 35, NUDMAX = 30, NUZMAX = 50, NUMMAX = 4)
       PARAMETER (IST1 = 5, IST2 = 17, IST4 = 11, IST5 = 12)
       PARAMETER (DLOGMIN = -74.0 , DMIN = 1.0D-74)
C-----------------------------------------------------------------------
C      DECLARATIONS FOR INPUT DATA
C-----------------------------------------------------------------------
       INTEGER   IZ0, IZL, IZH
       CHARACTER DATE*8 , YEAR*2, USERID*6, CHPRFIX*2
       CHARACTER SYSUID*7, PREFIX*7
       LOGICAL   LPRFIX, OPEN17
C-----------------------------------------------------------------------
C      VARIABLES LOADED BY DATA STATEMENTS IN THE SOURCE CODE
C-----------------------------------------------------------------------
       INTEGER   NGRD(50)
       INTEGER   MAXT, MAXD
       REAL*8    TEK(NUTMAX), DENSA(NUDMAX)
       CHARACTER CDTYP(12)*3
       LOGICAL   LDTYP(9)
C-----------------------------------------------------------------------
C      VARIABLES FOR BUILDING FILE NAMES
C-----------------------------------------------------------------------
       INTEGER   LSE
       CHARACTER DSNAME*80, DSNOUT*80
       CHARACTER ELEMT*2, ELEMN*12, XFESYM*2, XFELEM*12
       LOGICAL   LEXIST
       CHARACTER  DSNO(10)*80 , DSNIN(50,10)*80
C-----------------------------------------------------------------------
```

```
C      VARIABLES FOR METRD
C-----------------------------------------------------------------------
       REAL*8    METFRC(NUDMAX, NUTMAX, NUZMAX, NUMMAX)
C-----------------------------------------------------------------------
C      VARIABLES FOR WRITING TO PASS FILES
C-----------------------------------------------------------------------
       INTEGER   ITYPE, IWRITE
       INTEGER   NELH, NELL, NEL
C-----------------------------------------------------------------------
C      LOG TEMPERATURE AND DENSITY VECTORS FOR OUTPUT
C-----------------------------------------------------------------------
       REAL*8    TEVL(NUTMAX), DENSL(NUDMAX)
C-----------------------------------------------------------------------
C      MISCELLANEOUS COUNTERS, ETC.
C-----------------------------------------------------------------------
       INTEGER   IT, ID, IZ, IGRD, IRCODE, LEN1, LEN2
       REAL*8    SUM
C
C-----------------------------------------------------------------------
C
       DATA NGRD  /  1 , 2 , 1 , 2 , 2 , 4 , 3 , 4 , 1 , 1 ,
     &               1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 ,
     &               1 , 1 , 3 , 2 , 1 , 1 , 1 , 1 , 1 , 1 ,
     &               1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 ,
     &               3 , 2 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1 /
C
       DATA CDTYP / 'acd' , 'scd' , 'ccd' , 'prb' , 'prc' ,
     &              'qcd' , 'xcd' , 'plt' , 'pls' , 'met' ,
     &              'pec' , 'sxb' /
C-----------------------------------------------------------------------
C   DETERMINE WHICH DATA TYPES SHOULD BE INCLUDED IN THE MERGING
C   FROM RESOLVED TO UNRESOLVED.  'QCD' AND 'XCD' SHOULD ALWAYS
C   BE OFF.  'MET' FILES ARE READ IN ALL CASES AND MUST EXIST
C   FOR THE CODE TO WORK.
C-----------------------------------------------------------------------
C   NOW READ IN FROM IDL
C-----------------------------------------------------------------------
CX       DATA LDTYP / .TRUE. ,.TRUE. ,.TRUE. ,.TRUE. ,.TRUE. ,
CX     &              .FALSE.,.FALSE.,.TRUE. ,.TRUE. /
C-----------------------------------------------------------------------
C   DATA FOR 96 FILE GENERATION
C-----------------------------------------------------------------------
C      DATA MAXT / 30 /
C      DATA MAXD / 24 /
C      DATA TEK   / 2.3208D+03 , 3.4812D+03 , 5.8020D+03 , 8.1228D+03,
C    &              1.1604D+04 , 1.7406D+04 , 2.3208D+04 , 3.4812D+04,
C    &              5.8020D+04 , 8.1228D+04 , 1.1604D+05 , 1.7406D+05,
C    &              2.3208D+05 , 3.4812D+05 , 5.8020D+05 , 8.1228D+05,
C    &              1.1604D+06 , 1.7406D+06 , 2.3208D+06 , 3.4812D+06,
C    &              5.8020D+06 , 8.1228D+06 , 1.1604D+07 , 1.7406D+07,
C    &              2.3208D+07 , 3.4812D+07 , 5.8020D+07 , 8.1228D+07,
C    &              1.1604D+08 , 1.7406D+08 , 5*0.0D0/
C      DATA DENSA / 5.0000D+07 , 1.0000D+08 , 2.0000D+08 ,
C    &              5.0000D+08 , 1.0000D+09 , 2.0000D+09 ,
C    &              5.0000D+09 , 1.0000D+10 , 2.0000D+10 ,
C    &              5.0000D+10 , 1.0000D+11 , 2.0000D+11 ,
C    &              5.0000D+11 , 1.0000D+12 , 2.0000D+12 ,
C    &              5.0000D+12 , 1.0000D+13 , 2.0000D+13 ,
C    &              5.0000D+13 , 1.0000D+14 , 2.0000D+14 ,
C    &              5.0000D+14 , 1.0000D+15 , 2.0000D+15 ,
C    &              6*0.0D0/
C-----------------------------------------------------------------------
C   DATA FOR 96 HELIUM STUDY - REMOVE BOTTOM 3 AND TOP TEMPERATURES
C-----------------------------------------------------------------------
CX       DATA MAXT / 26 /
CX       DATA MAXD / 24 /
CX       DATA TEK   / 8.1228D+03,
CX     &              1.1604D+04 , 1.7406D+04 , 2.3208D+04 , 3.4812D+04,
CX     &              5.8020D+04 , 8.1228D+04 , 1.1604D+05 , 1.7406D+05,
CX     &              2.3208D+05 , 3.4812D+05 , 5.8020D+05 , 8.1228D+05,
CX     &              1.1604D+06 , 1.7406D+06 , 2.3208D+06 , 3.4812D+06,
CX     &              5.8020D+06 , 8.1228D+06 , 1.1604D+07 , 1.7406D+07,
CX     &              2.3208D+07 , 3.4812D+07 , 5.8020D+07 , 8.1228D+07,
CX     &              1.1604D+08 , 9*0.0D0/
CX       DATA DENSA / 5.0000D+07 , 1.0000D+08 , 2.0000D+08 ,
CX     &              5.0000D+08 , 1.0000D+09 , 2.0000D+09 ,
CX     &              5.0000D+09 , 1.0000D+10 , 2.0000D+10 ,
CX     &              5.0000D+10 , 1.0000D+11 , 2.0000D+11 ,
CX     &              5.0000D+11 , 1.0000D+12 , 2.0000D+12 ,
CX     &              5.0000D+12 , 1.0000D+13 , 2.0000D+13 ,
CX     &              5.0000D+13 , 1.0000D+14 , 2.0000D+14 ,
CX     &              5.0000D+14 , 1.0000D+15 , 2.0000D+15 ,
CX     &              6*0.0D0/
C-----------------------------------------------------------------------
C   DATA FOR SANCO FILE FORMATION
C-----------------------------------------------------------------------
C      DATA MAXT / 35 /
C      DATA MAXD / 26 /
C      DATA TEK   / 1.1604D+04 , 1.4609D+04 , 1.8391D+04 , 2.3153D+04,
C    &              2.9148E+04 , 3.6695D+04 , 4.6196D+04 , 5.8158D+04,
C    &              7.3216E+04 , 9.2174E+04 ,
C    &              1.1604D+05 , 1.4609D+05 , 1.8391D+05 , 2.3153D+05,
C    &              2.9148E+05 , 3.6695D+05 , 4.6196D+05 , 5.8158D+05,
C    &              7.3216E+05 , 9.2174E+05 ,
C    &              1.1604D+06 , 1.8391D+06 ,
C    &              2.9148E+06 , 4.6196D+06 ,
C    &              7.3216E+06 ,
C    &              1.1604D+07 , 1.8391D+07 ,
```

```
C     &              2.9148E+07 , 4.6196D+07 ,
C     &              7.3216E+07 ,
C     &              1.1604D+08 , 1.8391D+08 ,
C     &              2.9148E+08 , 4.6196D+08 ,
C     &              5.8158E+08 /
C       DATA DENSA / 1.000D+10 , 1.585D+10, 2.512D+10 ,
C     &              3.981D+10 , 6.310D+10,
C     &              1.000D+11 , 1.585D+11, 2.512D+11 ,
C     &              3.981D+11 , 6.310D+11,
C     &              1.000D+12 , 1.585D+12, 2.512D+12 ,
C     &              3.981D+12 , 6.310D+12,
C     &              1.000D+13 , 1.585D+13, 2.512D+13 ,
C     &              3.981D+13 , 6.310D+13,
C     &              1.000D+14 , 1.585D+14, 2.512D+14 ,
C     &              3.981D+14 , 6.310D+14,
C     &              1.00D+15  , 0,0,0,0 /
C-----------------------------------------------------------------------
C   DATA FOR NORMAL FILES
C-----------------------------------------------------------------------
C       DATA MAXT / 20 /
C       DATA MAXD / 13 /
C       DATA TEK   / 4.62E+3, 7.32E+3
C     &            , 1.16D+4, 1.84D+4, 2.91D+4, 4.62D+4, 7.32D+4
C     &            , 1.16D+5, 1.84D+5, 2.91D+5, 4.62D+5, 7.32D+5
C     &            , 1.16D+6, 1.84D+6, 2.91D+6, 4.62D+6, 7.32D+6
C     &            , 1.16D+7, 1.84D+7, 2.91D+7, 4.62D+7, 7.32D+7
C     &            , 1.16D+8,
C     &              0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0 /
C
C       DATA DENSA / 1.000D+04 , 1.000D+05, 1.000D+06 ,
C     &              1.000D+07 , 1.000D+08, 1.000D+09 ,
C     &              1.000D+10 , 1.000D+11, 1.000D+12 ,
C     &              1.000D+13 , 1.000D+14, 1.000D+15 ,
C     &              1.000D+16 , 0, 0, 0, 0, 0, 0, 0,
C     &                 0, 0, 0, 0, 0, 0, 0, 0, 0, 0 /
C
C-----------------------------------------------------------------------
C   DATA FOR CHROMIUM AND MOLYBDENUM STUDY
C-----------------------------------------------------------------------
C       DATA MAXT / 12 /
C       DATA MAXD / 13 /
C       DATA TEK   /
C     &              1.16D+4, 1.84D+4, 2.91D+4, 4.62D+4, 7.32D+4
C     &            , 1.16D+5, 1.84D+5, 2.91D+5, 4.62D+5, 7.32D+5
C     &            , 1.16D+6, 1.84D+6
C     &            , 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0
C     &            , 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0 /
C
C       DATA DENSA / 1.000D+04 , 1.000D+05, 1.000D+06 ,
C     &              1.000D+07 , 1.000D+08, 1.000D+09 ,
C     &              1.000D+10 , 1.000D+11, 1.000D+12 ,
C     &              1.000D+13 , 1.000D+14, 1.000D+15 ,
C     &              1.000D+16 , 0, 0, 0, 0, 0, 0, 0,
C     &                 0, 0, 0, 0, 0, 0, 0, 0, 0, 0 /
C
C-----------------------------------------------------------------------
```

METRD

```
      SUBROUTINE METRD(NUTMAX , NUDMAX , NUZMAX , NUMMAX ,
     &                 MAXT   , MAXD   , DSNIN  ,
     &                 IZL    , IZH    , IZ0    ,
     &                 TEK    , DENSA  ,
     &                 METFRC ,
     &                 NGRD   ,
     &                 IST2   , IST5 )
      IMPLICIT NONE
C
C-----------------------------------------------------------------------
C
C ************ FORTRAN 77 SUBROUTINE METRD *****************************
C
C   VERSION 1.0
C
C   PURPOSE:
C           TO FETCH DATA FROM ADF10 'MET' FILES AND SPLINE ONTO
C           THE REQUESTED TEMPERATURE/DENSITY GRID.
C
C           CALLING PROGRAM LH404RU
C
C   SUBROUTINE:
C
C   INPUT : (I*4)  NUTMAX - OUTPUT ELEMENT MASTER FILE
C                           MAXIMUM NUMBER OF TEMPERATURES
C   INPUT : (I*4)  NUDMAX - OUTPUT ELEMENT MASTER FILE
C                           MAXIMUM NUMBER OF DENSITIES
C   INPUT : (I*4)  NUZMAX - OUTPUT ELEMENT MASTER FILE
C                           MAXIMUM NUMBER OF CHARGE STATES
C   INPUT : (I*4)  NUMMAX - OUTPUT ELEMENT MASTER FILE
C                           MAXIMUM NUMBER OF METASTABLES
C   INPUT : (I*4)  MAXT   - OUTPUT ELEMENT MASTER FILE
C                           ACTUAL NUMBER OF TEMPERATURES
C   INPUT : (I*4)  MAXD   - OUTPUT ELEMENT MASTER FILE
C                           ACTUAL NUMBER OF DENSITIES
```

```
C   INPUT : (C*80) DSNIN(,) - NAMES OF MASTER CONDENSED FILES
C                             TO BE OPENED
C   INPUT : (I*4)  IZL     - LOWEST ION CHARGE TO READ
C   INPUT : (I*4)  IZH     - HIGHEST ION CHARGE TO READ
C                            ACTUALLY READ ONE MORE IF IZH<IZ0
C   INPUT : (I*4)  IZ0     - NUCLEAR CHARGE TO READ
C   INPUT : (R*8)  DENSA()- OUTPUT ELEMENT MASTER FILE
C                                 SET OF MAXD DENSITIES
C   INPUT : (R*8)  TEK()   - OUTPUT ELEMENT MASTER FILE
C                                 SET OF MAXT TEMPERATURES
C   OUTPUT: (R*8)  METFRC(,,,) - METASTABLE POPULATION FRACTIONS,
C                                 SPLINED ONTO THE OUTPUT TEMPERATURES
C                                 AND DENSITIES
C                                 1ST DIMENSION - DENSITY INDEX
C                                 2ND DIMENSION - TEMPERATURE INDEX
C                                 3RD DIMENSION - CHARGE STATE INDEX
C                                 4TH DIMENSION - METASTABLE INDEX
C   INPUT : (I*4)  NGRD() - NUMBER OF GROUND STATES OF THE FIRST
C                           50 ISOELECTRONIC SEQUENCES
C   INPUT : (I*4)  IST2   - UNIT NUMBER FOR OUTPUT INFORMATION
C                           AND ERROR MESSAGES
C   INPUT : (I*4)  IST5   - UNIT NUMBER FOR READING MASTER CONDENSED
C                           FILE
C
C   PARAMETER : (I*4)  NTDMAX - SIZE OF LOCAL WORKING SPACE
C                               (MUST BE GREATER THAN NUTMAX & NUDMAX)
C   PARAMETER : (I*4)  NDZ1V  - MASTER CONDENSED FILE
C                               MAXIMUM NUMBER OF CHARGE STATES
C   PARAMETER : (I*4)  NDTIN  - MASTER CONDENSED FILE
C                               MAXIMUM NUMBER OF TEMPERATURES
C   PARAMETER : (I*4)  NDDEN  - MASTER CONDENSED FILE
C                               MAXIMUM NUMBER OF DENSITIES
C   PARAMETER : (I*4)  NDMET  - MASTER CONDENSED FILE
C                               MAXIMUM NUMBER OF METASTABLES
C
C         : (R*8)  DENSR()    - INPUT MASTER CONDENSED FILE
C                               SET OF IDE REDUCED DENSITIES
C         : (R*8)  TR()       - INPUT MASTER CONDENSED FILE
C                               SET OF ITE REDUCED TEMPERATURES
C         : (R*8)  ZIPT()     - INPUT MASTER CONDENSED FILE
C                               SET OF IZE RECOMBINING ION CHARGES
C         : (R*8)  AIPTM(,,)  - INPUT MASTER CONDENSED FILE
C                               RATIO OF METASTABLE TO GROUND POP.
C                               1ST DIMENSION - DENSITY INDEX
C                               2ND DIMENSION - TEMPERATURE INDEX
C                               3RD DIMENSION - CHARGE STATE INDEX
C                               4TH DIMENSION - METASTABLE INDEX
C         : (R*8)  EIA()      - INPUT MASTER CONDENSED FILE
C                               SET OF IONISATION POTENTIALS (CM-1)
C
C         : (R*8)  ATTY(,)    - WORK SPACE FOR INTERPOLATION
C                             - STORES LOG10(INTERPOLATED VALUES)
C                               1ST DIMENSION - TEMPERATURE
C                               2ND DIMENSION - DENSITY
C         : (R*8)  ARRAY(,)   - STORES LOG10(INTERPOLATED VALUES)
C                               1ST DIMENSION - TEMPERATURE
C                               2ND DIMENSION - DENSITY
C
C     ROUTINES:
C     ---------
C         XXOPEN   -
C         XXTERM   -
C         XXIN80   -  FETCH DATA FROM MASTER CONDENSED FILE
C         D4SPLN   -  INTERPOLATE CONDENSED MASTER FILE
C                     UPDATED VERSION OF D1SPLN
C
C-----------------------------------------------
C AUTHOR:  LORNE D. HORTON
C          ROOM K1/1/58, JET JOINT UNDERTAKING
C
C   DATE:  21ST FEBRUARY 1996
C-----------------------------------------------------------------------
C UNIX-IDL PORT:
C
C VERSION: 1.1                          DATE: 11-11-96
C MODIFIED: WILLIAM OSBORN (TESSELLA SUPPORT SERVICES PLC)
C     - FIRST CONVERTED
C
C VERSION: 1.2                          DATE: 20-11-96
C MODIFIED: WILLIAM OSBORN (TESSELLA SUPPORT SERVICES PLC)
C     - REMOVED DIAGNOSTIC WRITE STATEMENTS
C
C VERSION: 1.3                          DATE: 20-10-97
C MODIFIED: LORNE HORTON
C     - REMOVED WHITE SPACE FROM DATA FILENAME.
C
C-----------------------------------------------------------------------
C
       INTEGER   NUTMAX, NUDMAX, NUZMAX, NUMMAX
       INTEGER   MAXT, MAXD
       INTEGER   IZL, IZH, IZ0
       INTEGER   NGRD(50), IST2, IST5
       REAL*8    TEK(NUTMAX), DENSA(NUDMAX)
       REAL*8    METFRC(NUDMAX,NUTMAX,NUZMAX,NUMMAX)
       CHARACTER DSNAME*80
       CHARACTER DSNIN(50,10)*80
C
       INTEGER   NTDMAX, NDZ1V, NDTIN, NDDEN, NDMET
```

```
      REAL*8    DMIN
      PARAMETER (NTDMAX = 40)
      PARAMETER (NDZ1V  = 20, NDTIN  = 24, NDDEN  = 24 , NDMET = 4)
      PARAMETER (DMIN = 1.0D-74)
C-----------------------------------------------------------------------
C     VARIABLES FOR DSNAME PARSING AND OPENING
C-----------------------------------------------------------------------
      LOGICAL   LEXIST
      INTEGER   INDS, NELEC, LS, L1, L2
      CHARACTER SEQUA*2, XFESYM*2
      CHARACTER STRING*132
C-----------------------------------------------------------------------
C     VARIABLES FOR XXIN80
C-----------------------------------------------------------------------
      LOGICAL   LERROR , LSWIT
      INTEGER   IDE, ITE, IZE, IME, NPRNT
      INTEGER   IMETR(NDMET), IPRNT(NDMET), IPSYS(NDMET)
      REAL*8    DENSR(NDDEN) ,TR(NDTIN), ZIPT(NDZ1V)
      REAL*8    EIA(50)
      REAL*8    AIPTM(NDDEN,NDTIN,NDZ1V,NDMET)
      CHARACTER CSTRGA(NDMET)*12
C-----------------------------------------------------------------------
C     VARIABLES FOR D4SPLN
C-----------------------------------------------------------------------
      LOGICAL   LZRNG(1), LDRNG(NTDMAX), LTRNG(NTDMAX)
      INTEGER   ISWIT, IZ1
      REAL*8    TUSR(NTDMAX) , DUSR(NTDMAX)
      REAL*8    ARRAY(NTDMAX, NTDMAX)
      REAL*8    ATTY(NTDMAX, NTDMAX)
C-----------------------------------------------------------------------
C     MISCELLANEOUS COUNTERS, ETC.
C-----------------------------------------------------------------------
      INTEGER   I, IT, ID, IZ, IGRD, NGRDI
      INTEGER   ZERO, PIPEOU
      PARAMETER (PIPEOU = 6)
      DATA      ZERO/0/
C
C-----------------------------------------------------------------------
```