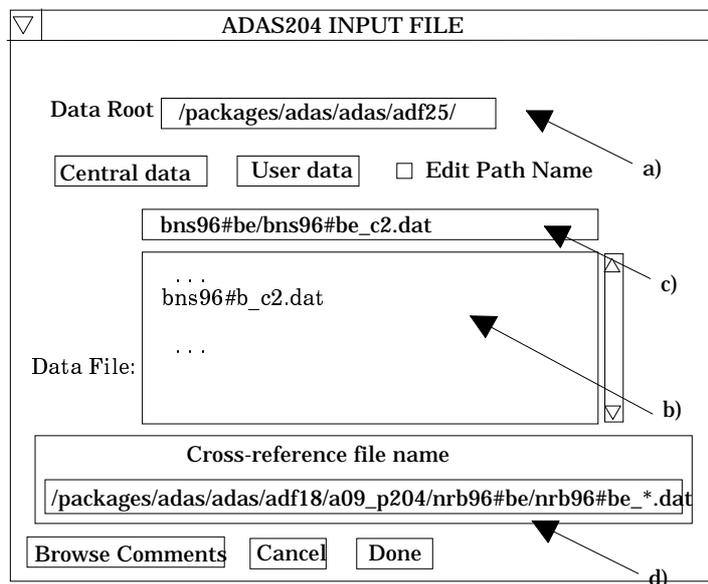


In this release there are two new codes, ADAS411 developed by myself (but derivative on ADAS410 by Martin O'Mullane) and ADAS409 developed by Alessandro Lanzafame and Ricky Martin. ADAS411 supplies the interrogation code on our state resolved radiative recombination data and so partners the code ADAS410 for dielectronic recombination issued in the last release. ADAS409 provides the computation of full two-dimensional $G(\text{Te}, \text{Ne})$ functions. The code is a derivative of ADAS405 and so also provides ionisation balance and radiated power functions. These are also dependent on Te and Ne and so the graphical displays to show them includes some new features. Also, this release, I have included a description of ADAS204. This was released for the first time in 1996 but I see that the bulletin description was faulty, being only a place holder. The code is now of importance for our shared calculation plans with other members of the ADAS Project. In fact, there have been quite a large number of adjustments, dimension extensions etc. to the codes for generating the generalised collisional-radiative coefficients, that is the combination ADAS204 & ADAS208 and their associates in series 2. These codes have the capability to provide very complete and highest quality derived data. Lorne Horton, Martin O'Mullane and Costanza Maggi have been exercising them heavily on hydrogen, helium and carbon and corrections and refinements are from their experience. We now would like others to help us with data generation using these codes. A very substantial amount of new data has been added to the database including more state selective charge exchange data and baseline ionisation/recombination/power data for xenon. The great bulk of the new data are comprehensive generalised collisional radiative data for helium and carbon. The complete sets of fundamental, intermediate and final derived data sets required to generate and provide complete information on these elements are given. These are reworkings of the '93' data over much larger grids and with many improvements. They are called the '96' data. Over the next months, we hope to add nitrogen, oxygen and neon.

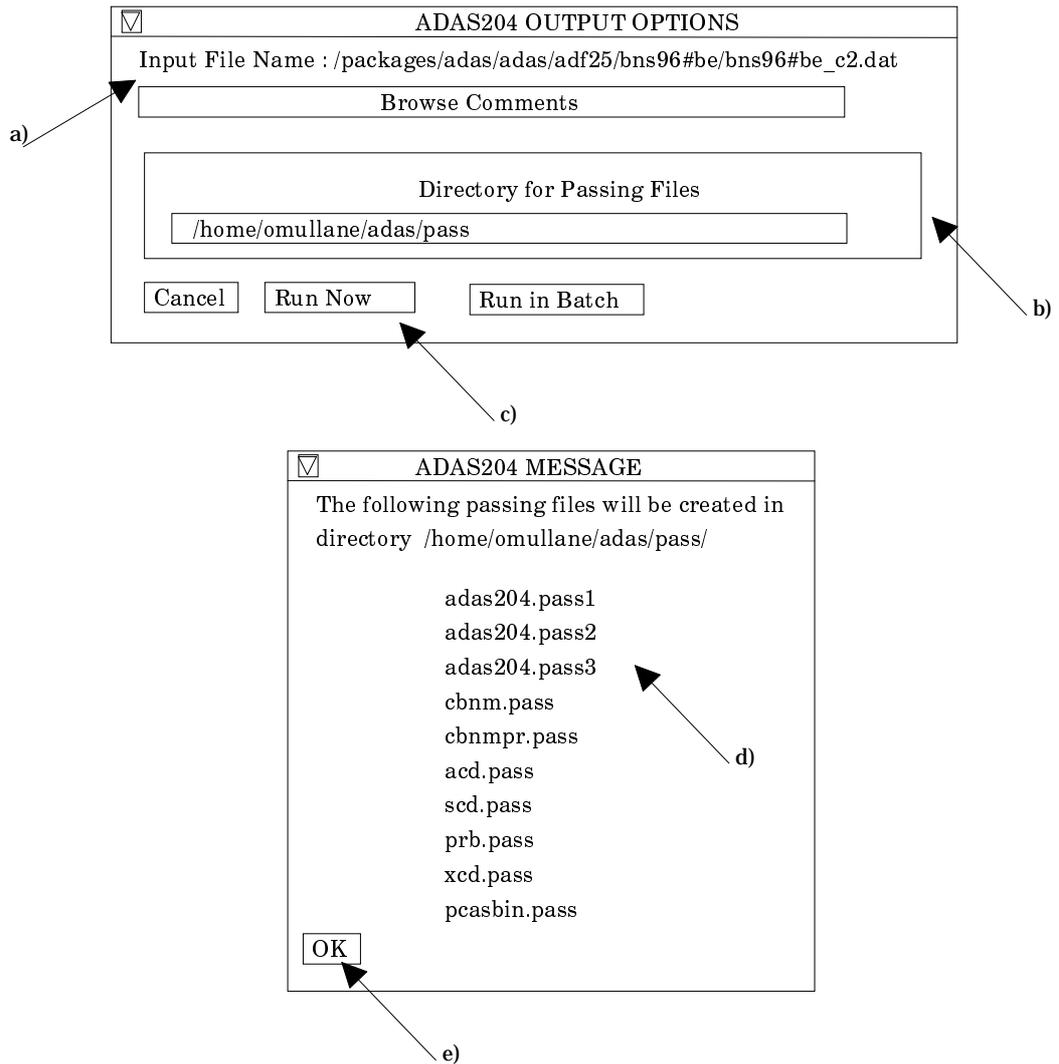
1. **ADAS204** The code is a mass production program for providing collisional-radiative coefficients linking two ionisation stages of an element. It is designed to handle correctly the very many n-shells required for treatment of dielectronic recombination and the influence of finite plasma density upon it. Thus it operates in the bundle-n model but resolved according to initial recombining parent metastable and recombined state spin system. It provides acceptable generalised collisional-radiative recombination, ionisation and recombination / Bremsstrahlung power coefficients. However it cannot handle low level line power and individual line emission with sufficient precision for spectroscopy. Thus we use it in ADAS to provide condensed projection matrices (adf17) which are picked up by the high precision low level population code ADAS208. This code in turn generates the final highest quality, complete generalised collisional-radiative data.
 - 1.1. Move to the directory in which you wish any ADAS created files to appear. These include the output text file produced after executing any ADAS program (*paper.txt* is the default). There is no graphical output from ADAS204. Initiate ADAS204 from the program selection menus in the usual manner.
 - 1.2. The **file selection window** appears first as illustrated below.
 - 1.2.1. Driver data sets for ADAS204 are defined by ADAS data format *adf25*. The program automatically sets the Data Root at a) to this class.
 - 1.2.2. Data root a) shows the full pathway to the appropriate data subdirectories of type *adf25*. Click the *Central Data* button to insert the default central ADAS pathway to the correct data type. Click the *User Data* button to insert the pathway to your own data. Note that your data must be held in a similar file structure to central ADAS, but with your identifier replacing the first *adas*, to use this facility.
 - 1.2.3. The Data root can be edited directly. Click the *Edit Path Name* button first to permit editing.
 - 1.2.4. Available sub-directories are shown in the large file display window b). Scroll bars appear if the number of entries exceed the file display window size.

- 1.2.5. Click on a name to select it. The selected name appears in the smaller selection window c) above the file display window. Then its sub-directories in turn are displayed in the file display window. Ultimately the individual datafiles are presented for selection. Datafiles all have the termination *.dat*.
- 1.2.6. Once a data file is selected, the set of buttons at the bottom of the main window become active.
- 1.2.7. The driver data sets are not very informative with an unhelpful condensed lay-out. However they can be created automatically by execution of the code ADAS407. This latter code has several purposes. When we originally used ADAS407 to produce drivers for ADAS204, they were really just templates and required quite a bit of hand adjustment. The present version of ADAS407 produces an almost ready to use driver. It just requires setting of reference indices if you wish to access ground state ionisation data of better quality than ADAS204's default. This is a worthwhile step if you wish the 'scd' output from ADAS204 to be accurate and are not simply concerned with relaying condensed projection data to ADAS208.
- 1.2.8. A second Cross-reference file must be selected at d). This file specifies what high quality n-shell resolved dielectronic data of ADAS data format adf09 is to be used and how it should be mapped onto the n-shells of the ADAS204 calculation. The file name sub-directory is includes *adf18/a09_p204* which reflects its purpose. *adf18* contains all the ADAS cross-referencing files in various sub-directories. ADAS204 constructs a cross-reference file name automatically according to the choice of driver data set made at c). However the file name is editable. The current default sets the *nrb93* subdirectory. Our newer dielectronic data is in *nrb96*. Note the '_'*' at the end of the name. This is sufficient and a fully resolved name is not required.
- 1.2.9. Clicking on the *Browse Comments* button displays any information stored with the selected driver dataset.
- 1.2.10. There is no Processing Options window with ADAS204.



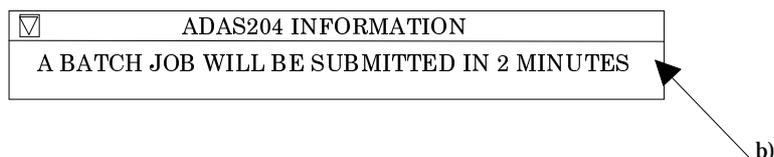
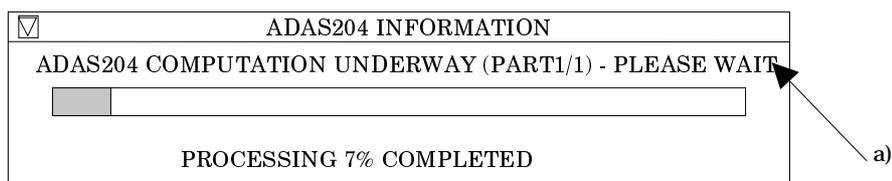
- 1.3. The **output options window** is shown below.
 - 1.3.1. The driver data set name is given at a) for information and comments attached to it can be browsed as usual.
 - 1.3.2. There is no graphical output from ADAS204.
 - 1.3.3. The main output data set production is routed to the directory identified at b). This is your 'pass' directory by default, but the directory name is editable if you wish to change this. Note that several datasets are created by ADAS204 and these can be of quite substantial size if you use the current temperature and density grids set by default in the driver dataset.

1.3.4. The code can be run in foreground or in batch. Make the appropriate selection at c). The message shown below pops up to advise you of the output datasets which will be created. This message may be out of date. We are currently suppressing the *pass1*, *pass2* and *pass3* files internally. There are quite large text files and are of rather specialist interest for the progress of parts of the calculation. The *cbnm.pass* file contains the condensed projection matrices for use by ADAS208. The file is ASCII but with long lines and is not very readable. A shortened version of it is given in *cbnmpr.pass* which can be sent to a line printer. *pcasbin.pass* is a special output created by Billy Dickson and Martin O'Mullane which they may reveal the purpose of in the future! Other output datasets are the conventionally named collisional-radiative datasets.



1.3.5. On foreground launch of ADAS204, the progress meter shown at a) below appears. Note that the calculations may be quite long with 20-30 minutes on a medium power workstation typical, so batch processing is probably to be preferred.

1.3.6. On batch submission, the information pop-up at b) below appears and the job initiates in 2 minutes. If your system requires special queuing for long jobs, please let us know and we can include this in the batch submission.



2. **ADAS208** A error in unit numbering whereby the *xcd.pass* file overwrote the *paper.txt* file has been corrected. Also a dimension confusion with the *plt* output has been corrected. We will be making one or two more changes to this code to include state selective ionisation via the *adf04* file as is done for state selective recombination. Also we are going to make ADAS208 write out the *prb* file. We have not quite managed to get these changes in this time, but shall do soon in an early next release in two months time.
 3. **ADAS211** An increase in the size of the box for evaluation of the radial wave functions has been made along with an increase in the density of points for numerical integration. Now the code will work happily for capture into shells up to $n=5$. Note that radiative recombination calculations for many levels of complex ions can be quite long and it may be preferred to use the *Batch* submission option. At JET Joint Undertaking, long background jobs must be submitted to particular queues. We have built a scheduling capability into the background job submission although at the moment it only recognises JET. If you use networked machines with load levelling, let Ricky Martin know and we can program your case in also.
 4. **ADAS212** A bug connected with file name length inconsistency has been corrected.
 5. **ADAS402** We have allowed the numbers of temperature and density values to increase in a number of recently created *adf13* and *adf15* datasets beyond the old limits of 24. The code dimensions have been altered to accommodate this change.
 6. **ADAS404** We have allowed the numbers of temperature and density values to increase in a number of recently created *adf13* and *adf15* datasets beyond the old limits of 24. The code dimensions have been altered to accommodate this change.
 7. **ADAS405 & ADAS406** The range of elements recognised has been extended to include xenon, that is up to nuclear charge 54.
 8. **ADAS407** A problem with the treatment of radiative recombination of bare nuclei has been corrected. Also, when dipole transitions are allocated to groups the nominal maximum number of transitions now works correctly rather than one less as previously.
 9. **ADAS408** The code has been extended to allow xenon, that is nuclear charge 54. A bug is still present if you try to define a Be/Si power filter ('FT****' form) for xenon. Other elements are OK. Martin O'Mullane is tracking this down, but in the meantime, no filter or a filter 'FT0000' works - the latter with some inconsequential warnings.
- ADAS409** The program is an extension of ADAS405 which works two-dimensionally with independent electron temperatures and densities. Recall that ADAS405 used a model,

that is with temperature/density pairs, so that it was a one-dimensional calculation. ADAS409 computes an equilibrium ionisation balance for an element or a range of ions of an element by drawing on relevant iso-nuclear master file data (format *adf11*). These data consist of (generalised) collisional-radiative coefficients for the ions of the element and may be of the stage-to-stage (standard) form or of the metastable distinguishing form (partial). The program calculates also the equilibrium radiated power by the element. A main objective of the code is to generate ionisation equilibrium emissivity functions for specific spectrum lines. These quantities, also known as (generalised) contribution functions, combine emissivity coefficient data with ionisation balance fractional abundances. They are the most relevant quantities for analysis of spectral observations of ionisation equilibrium plasmas (cf. differential emission measure analysis). ADAS409 achieves this by drawing on photon emissivity coefficient data collections in the ADAS database ('*pec*' files of format *adf15*).

ADAS409 INPUT

Enter details of the iso-nuclear master files to be analysed :-

Select iso-nuclear master collisional-dielectronic classes :

Radiated power filter (blank for none) :

Member prefix (blank for none) :

Year of data : Select directory branch :

Default year (if required) :

Iso-electronic sequence symbol :

Type of master files : Specify partial type code :

Input Line and Analysis Selection File :-

Data root

Edit Path Name

Data File

```

..
NULL
test_c_r
test_c_u

```

- 9.1. Move to the directory in which you wish any ADAS created files to appear. These include the output text file produced after executing any ADAS program (*paper.txt* is the default), the graphical output file and the generalised contribution function file formatted to *adf16* specification. Initiate ADAS409 from the program selection menus in the usual manner.
- 9.2. The **file selection window** appears first as illustrated above.
 - 9.2.1. Two types of data file are identified in the file selection, namely, the iso-nuclear master files required for the ionisation balance and power calculations and the script file. The top part of the file selection window is

- concerned with identifying the master file data required and the lower part with identifying the script file.
- 9.2.2. *adf11* is the appropriate data format for use by the program ADAS405. Your personal data of this type should be held in a similar file structure to central ADAS, but with your identifier replacing the first *adas*. The central ADAS database has extensive data of this form and the collection is steadily being extended. It is also subject to periodic revision as the influences of improved fundamental data are computed.
 - 9.2.3. Click on the *Select* button at (a) to drop down a selection list of master file data classes. Activate the buttons at the data classes required for your analysis. It is obligatory to select the '*acd*' and '*scd*' electron impact effective recombination and ionisation data classes since otherwise an ionisation balance cannot proceed. However the other data classes selected are at the user's choice. This enables investigative studies of the importance of different contributions for example to radiated power.
 - 9.2.4. At JET Joint Undertaking, effective radiated power coefficients ('*prb*', '*plt*' and '*prc*') are often made available both as the whole emitted power and as the power which would pass through certain filters (such as Be/Si windows). The filter is specified either simply as an energy cut-off (eg. *ev2000*) or as filter specification (eg. *ft1235*). These codes appear as an extension in the relevant master file names. Specify the filter choice at (b). **Note the present IDL-ADAS database contains very little filtered power data but it can be added if there is an interest amongst users.**
 - 9.2.5. The remainder of the file identification (c) follows the general pattern described for ADAS401 above. Note that a default year must be specified. Often the complete set of data classes for a particular year and type are not available and the capability of filling in from a default (perhaps less accurate but more complete) year is allowed.
 - 9.2.6. In general the two digit year number is used to provide the main groupings of data. Thus '89' is the standard, unresolved, JET base line data of low precision but fairly complete. '93' is metastable resolved data, but available only for light elements of primary importance to fusion. Some flexibility for subdivision within a year is provided by allowing a two character 'member prefix' (eg. '*pj*') which may be present in the final part of a file name (eg. '*./../acd93r/acd93r_pj#c.dat*').
 - 9.2.7. The distinctions between *standard* and *partial* master file types and *resolved* and *unresolved* types must be clarified. *Standard* data is stage -to stage and has a specific layout. *Partial* data distinguishes metastables and has a different layout. Within the partial data layout it is possible simply to have each stage represented only by its ground state and therefore to be similar to standard data. However the layout is the partial one. We call such data *partial* but *unresolved*. The usual *partial* data with metastables present is called *resolved*. This distinction and added flexibility are helpful in iso-nuclear master file preparation and archiving.
 - 9.2.8. Clicking the *Display data set availability* button at (d) causes display of a file availability summary window as illustrated below. It is important to use this facility since it shows which master files classes sought by the user were not available, where default data files were substituted etc.
 - 9.2.9. Script file selection is made in the conventional manner at (e). We have found it convenient to group script files in a personal ADAS database under a subdirectory classification */scripts409*. Also, it is possible to bypass contribution function calculation and display by selecting the '*NULL*' script. You may find it helpful to copy the '*NULL*' script from the central ADAS database to your own space. Note that scripts apply to particular cases. Thus the references to emissivity coefficient data in a script applying to metastable resolved will not in general work for unresolved data, indeed will probably crash. We have not built much protection against faulty references into script files at the moment. More protection may be added if this proves

a stumbling point for users. You may find it helpful to fetch the *test_c* script from central ADAS for first trials.

ADAS409 Input									
Class selection and file availability :-									
Class	Year	Element	Member Prefix	Power Filter	Type	USER DATA		DEFAULT DATA (93)	
-----	-----	-----	-----	-----	-----	Selected	Availability	Used	Available
acd	93	c			Rpartial	YES	YES	no	YES
scd	93	c			Rpartial	YES	YES	no	YES
ccd	93	c			Rpartial	no	no	no	no
prb	93	c			Rpartial	YES	YES	no	YES
prc	93	c			Rpartial	no	no	no	no
qcd	93	c			Rpartial	YES	YES	no	YES
xcd	93	c			Rpartial	YES	YES	no	YES
plt	93	c			Rpartial	YES	YES	no	YES

All requested files available from user data sets.

OK

- 9.3. The **processing options window** has the appearance shown below
- 9.3.1. The script file selected by the user is identified at (a). The *Browse Comments* button displays the comments field at the foot of the script file.
 - 9.3.2. Information is presented at (b) of the element and master files classes selected in the previous file selection option step.
 - 9.3.3. Enter isotope mass numbers for the selected element and background neutral hydrogen in the plasma at (c). This information is only used if charge exchange recombination master file data has been selected.
 - 9.3.4. The spectrum lines set up in the script file are shown in the display window at (d). This operates in the same manner as line display and selection windows in interrogation codes such as ADAS503 (see bulletin *nov19-94*). Click on a line to select it. The selected line is shown in the selection window above the display window. Only one line is treated at a time for graphical display. However all lines and line ratios in the script file are computed and tabulated in the output text file.
 - 9.3.5. The selection of temperature and density values for data output are made at (e). Note the difference from ADAS405 in that the temperatures and densities are independent sets.
 - 9.3.6. Clicking the *Done* button causes the output options window to be displayed. Remember that *Cancel* takes you back to the previous window.

ADAS409 PROCESSING OPTIONS

Title for Run

Script file : /disk2/adas/adas/scripts409/test_c_r

Browse Comments

Data file information :-

Selected master file element : C

Selected master classes : ACD, SCD, PRB, QCD, XCD, PLT

Enter isotope information :-

Enter element isotope mass number (amu) :

Enter hydrogen isotope mass number (amu) :

Select spectral line for analysis :-

Number of listed lines in script file : 2

LINE INDEX	RADIATING ION CHARGE	NUMBER OF COMPONENTS	TITLE AND WAVELENGTH
1	0	4	CI 1561
1	0	4	CI 1561
2	1	2	CII 904

Enter Output Temperature - Density data

Temperatures			Densities		
Index	Electron Output values	Hydrogen Output values	Index	Electron Output values	Hydrogen Output values
1	1.000E+00	1.000E+00	1	1.000E+12	1.000E+11
2	2.000E+00	2.000E+00	2	1.000E+12	2.000E+11
3	5.000E+00	5.000E+00	3	1.000E+12	5.000E+11
4	1.000E+01	1.000E+01	4	1.000E+12	1.000E+12

Temperature Units : eV Density Units : cm-3

Edit Table Edit Table

Default Temperature values Default Density values

Edit the processing options data and press Done to proceed

9.4. The **output options window** is shown below.

9.4.1. It follows the usual pattern except that there is a choice of graphs to display. Thus the fractional abundances, power functions and contribution functions are all of potential interest. Click on the appropriate button at (a). Generally, we find that on the first one or two occasions we wish to see the fractional abundances and powers but then have a more sustained interest in the contribution function shapes and their location in temperature. All the graphs are provided as a function of electron temperature.

9.4.2. The window presented at (b) depends on the graph choice above. The default scaling may be over-riden and explicit values for the graph limits entered.

9.4.3. Graphical output is enabled in the window at (c) together with hard copy device and output file name. This follows the pattern of other ADAS programs. Likewise text output selection at (d) is standard.

9.4.4. The 'Goft Passing File' is the name used for the output data of calculated contribution functions. It is organised according to an ADAS data format *adf16*. The output file name is specified at (e). The expected practice is that ADAS409 will be used either recursively or in distinct runs to examine contribution functions and then decide which to put into the Goft file. Thus an *Append* button has been provided to allow an existing output Goft file to be extended. The *Replace* and *Default file name* buttons have their usual meanings.

ADAS409 OUTPUT OPTIONS

Script file : /disk2/hammond/adas/script405/test_c

Browse Comments

Graphical Output

Graph Title

Fractional abundance plot
 Power function plot
 Contribution function plot

Fractional abundance plot :-

Explicit Scaling
 X-min :
X-max :
Y-min :
Y-max :

Enable Hard Copy Replace
 Select Device

File name :

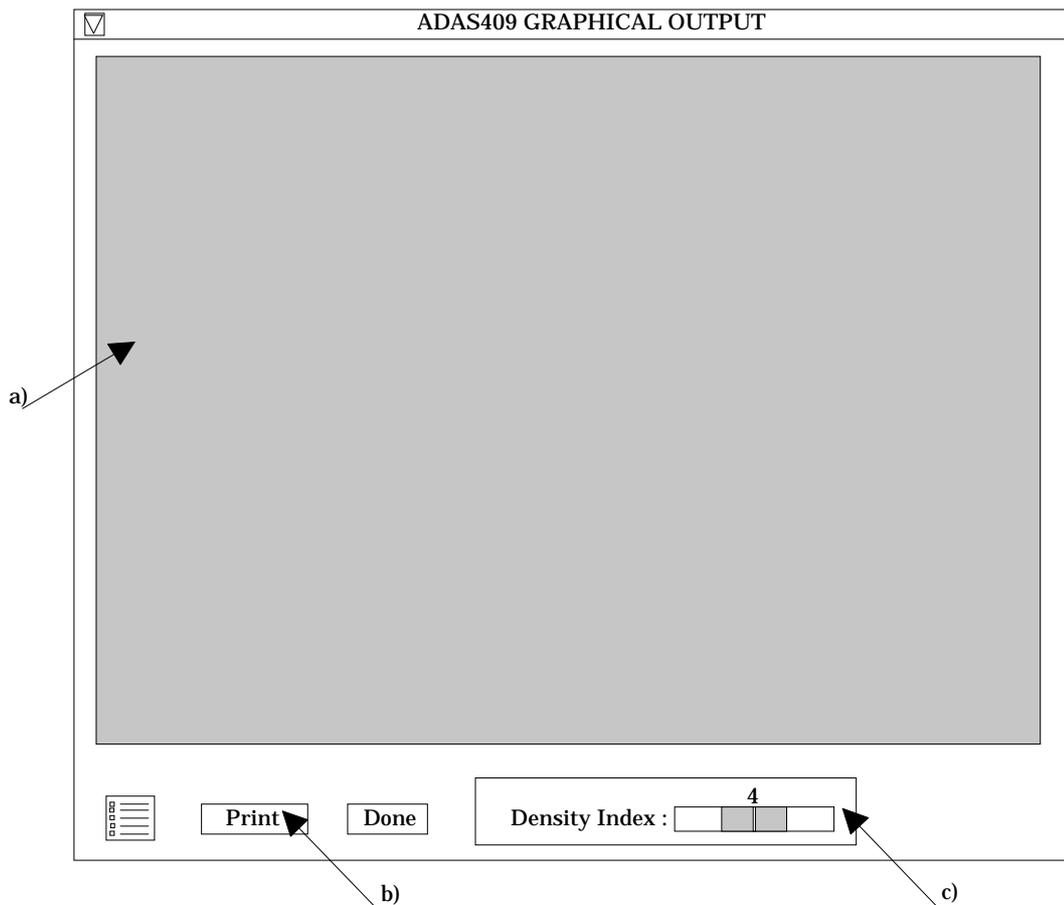
Text Output Replace

File name :
d)

Goft Passing File Append Replace

File name :
e)

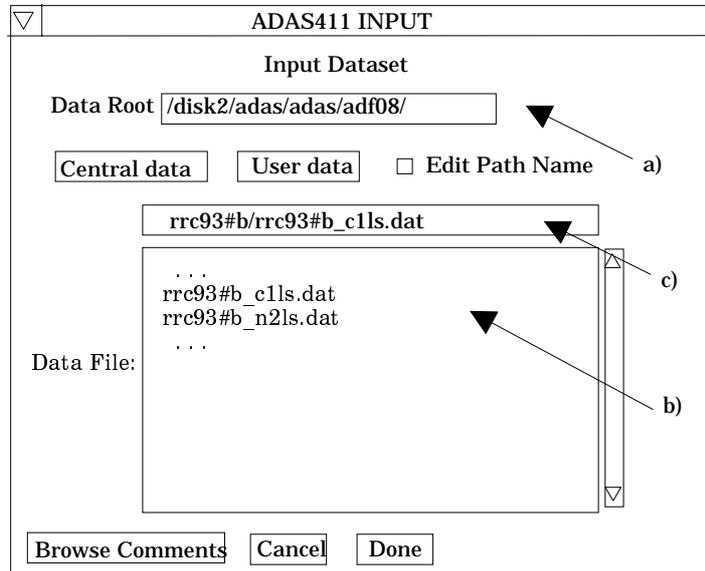
- 9.5. The **graphical output window** is shown below.
- 9.5.1. There is a new facility here. The calculated data are functions of temperature and density but are plotted here as a function of temperature. The slider at c) allows you to scan through the density values. The displayed graphs continually update making the display like a movie. We should be interested in your opinion of this addition.
- 9.5.2. Other options such as the *Print* button remain the same. Note that the current density frame is the one printed.



10. **ADAS410** The dielectronic recombination code has been extended to allow the extraction of the rate coefficient summed over n-shell for selected parents and spin system, that is the 'zero-density' coefficient. A bug, whereby the code crashed when interrogating He-like, 1-2 data has been fixed. The problem was that in this case there are no Auger data. Finally some alterations to the selection logic have been made which make operation more helpful.
11. **ADAS411** The code allows interrogation of state selective radiative recombination data of ADAS data format *adf08*. The ADAS data base now contains large collections of such data spanning all the ions of elements up to neon. *adf08* contains state selective radiative data to resolved lower lying LS-coupled terms. These data can be extracted and displayed by the new code.
- 11.1. The **file selection window** has the appearance shown below
- 11.1.1. Data root a) shows the full pathway to the appropriate data subdirectories of type *adf08*. Click the *Central Data* button to insert the default central ADAS pathway to the correct data type. Click the *User Data* button to insert the pathway to your own data. Note that your data must be held in a similar file structure to central ADAS, but with your identifier replacing the first *adas*, to use this facility.
 - 11.1.2. The Data root can be edited directly. Click the *Edit Path Name* button first to permit editing.
 - 11.1.3. Available sub-directories are shown in the large file display window b). Scroll bars appear if the number of entries exceed the file display window size.
 - 11.1.4. Click on a name to select it. The selected name appears in the smaller selection window c) above the file display window. Then its sub-directories in turn are displayed in the file display window. Ultimately the individual datafiles are presented for selection. Datafiles all have the termination *.dat*. Note the notation used for radiative recombination data file names, that is,

$\langle ion \rangle ls$ with $\langle ion \rangle$ the recombining ion. ls indicates that the radiative recombination data is at LS-resolution.

- 11.1.5. Once a data file is selected, the set of buttons at the bottom of the main window become active.
- 11.1.6. Clicking on the *Browse Comments* button displays any information stored with the selected datafile.



- 11.1.7. Clicking the *Done* button moves you forward to the next window. Clicking the *Cancel* button takes you back to the previous window.

11.2. The **processing options window** has the appearance shown below.

- 11.2.1. An arbitrary title may be given for the case being processed. For information the full pathway to the dataset being interrogated is also shown at b). The button *Browse comments* at a) again allows display of the information field section at the foot of the selected dataset, if it exists.
- 11.2.2. At c), the *Resolved state selective RR* is the only option and is forced. In the case of *Resolved state selective RR*, as illustrated at d), only the initial parent is identified, since the final recombined low levels may not have a clearly distinguished parent. The initial parent is selected at d) by clicking on an entry in the selection window. Then the final term of the recombined ion is selected at e).
- 11.2.3. At f), the electron temperatures at which you wish the radiative recombination data is chosen. Table editor is available to enter this data and default temperatures (equal to those in the *adf08* file) may be chosen by button click as usual.
- 11.2.4. The option of fitting a polynomial to the extracted data is offered just below the temperature selection widget.

ADAS411 PROCESSING OPTIONS

Title for Run

Data File Name : /disk2/adas/adas/adf08/rrc93#b/rrc93#b_c1ls.dat

Nuclear charge : 6 Recombining ion charge : 1 Recombined ion charge : 0

Resolved state selective RR

Select Initial Parent Select Level

INDEX	Initial Parent Configuration	Term	INDEX	LS Resolved Level Configuration	Term	Valid Data
1	2s2	(1S)	1	2s 2p2	4P	T
1	2s2	(1S)	1	2s 2p2	4P	T
2	2s12p1	(3P)	2	2s 2p2	2D	F
			3	2s2 3s	2S	T

Output Electron Temperatures

INDEX	Output	Input
1		
2		
3		
4		

Temperature Units : Kelvin

Fit Polynomial Value % :

Edit the processing options data and press Done to proceed

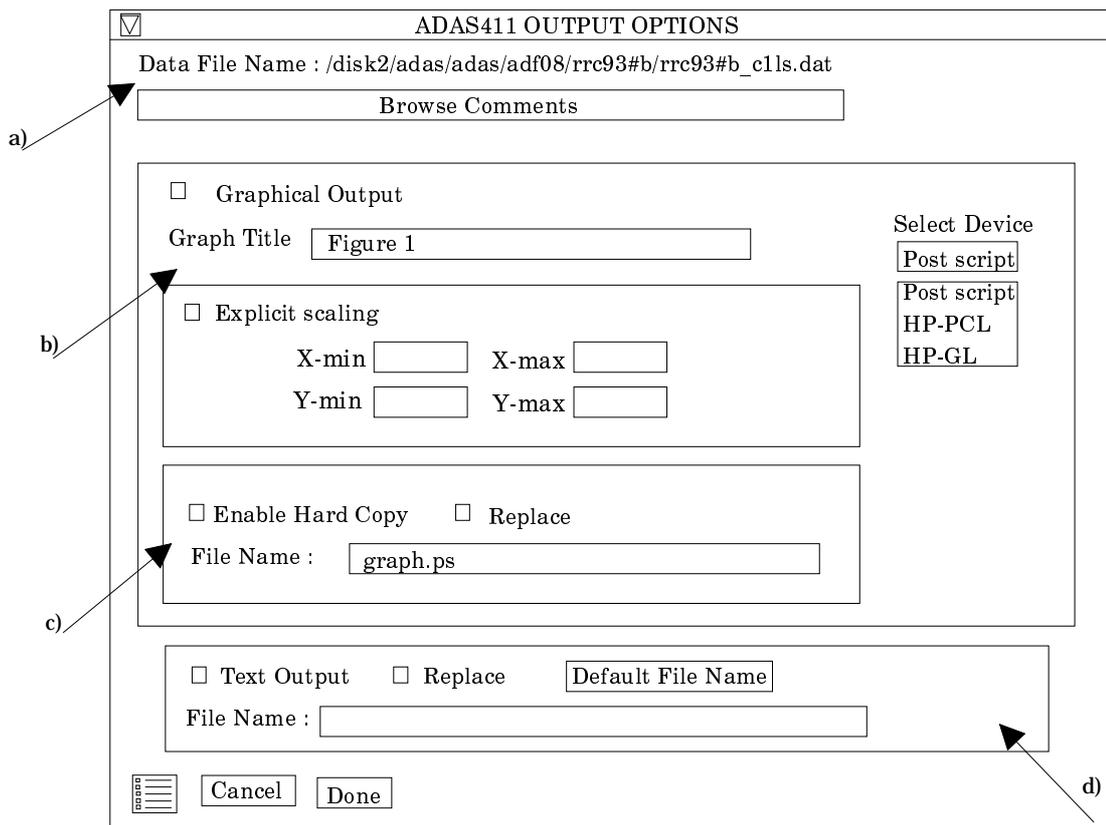
11.2.5. At the base of the window, the icon for *Exit to Menu* is present. This quits the program and returns you to the ADAS series 4 menu. Remember that *Done* takes you forward to the next screen while *Cancel* takes you back to the previous screen.

11.3. The **output options window** appearance is shown below

11.3.1. As in the previous window, the full pathway to the file being analysed is shown for information at a). Also the *Browse comments* button is available.

11.3.2. Graphical display is activated by the *Graphical Output* button at b). This will cause a graph to be displayed following completion of this window. When graphical display is active, an arbitrary title may be entered which appears on the top line of the displayed graph.

11.3.3. By default, graph scaling is adjusted to match the required outputs. Press the *Explicit Scaling* button at b) to allow explicit minima and maxima for the graph axes to be inserted. Activating this button makes the minimum and maximum boxes editable.



- 11.3.4. Hard copy is activated by the *Enable Hard Copy* button at c). The File name box then becomes editable. If the output graphic file already exists and the *Replace* button has not been activated, a 'pop-up' window issues a warning.
- 11.3.5. A choice of output graph plotting devices is given in the Device list window to the right. Clicking on the required device selects it. It appears in the selection window above the Device list window.
- 11.3.6. At d) output of the tabular record of the interrogation may be enabled. This is usually called *paper.txt* and it is created in the directory from which ADAS was launched.
- 11.3.7. The graph is displayed in a following Graphical Output window.
- 11.3.8. At the base of the window, the icon for *Exit to Menu* is present. This quits the program and returns you to the ADAS series 4 menu. Remember that *Done* takes you forward to the next screen while *Cancel* takes you back to the previous screen.

12. **ADAS412** Dimensions have been increased and some minor bugs fixed associated with Hewlett-Packard UNIX.
13. **ADAS505** This code interrogates state selective thermally averaged charge exchange rate coefficients of ADAS data format *adf14* ('tcx files'). The maximum number of temperatures allowed in the *adf14* files has been increased to 24 making it compatible with other data sets and our current usages. The code has also been altered by including the option to select a 'pass' file (*data505.pass* by default) on the Output Options window. The pass file contains the extracted data organised as 'H-lines' for patching into a personal *adf04* file. In fact two blocks of data are provided, namely for a fixed ion temperature and for varying ion temperatures. The latter block would normally match the electron temperature set in the *adf04* file .
14. **ADAS509** Costanza Maggi has been using this code to generate thermally averaged rate coefficients for partially ionised ions from the state selective charge exchange cross-sections. We felt that some improvement was made to the interpolation by taking logarithms and to the

extrapolation by using the options in the ADAS fortran subroutine *xxsple.for*. These changes have been made to the code.

15. **ADF01** The data sets

../adas/adas/adf01/qcx#h0/qcx#h0_en2_kvi#ne10.dat
../adas/adas/adf01/qcx#li0/qcx#li0_kvi#li3.dat
../adas/adas/adf01/qcx#li0/qcx#li0_kvi#b5.dat
../adas/adas/adf01/qcx#li0/qcx#li0_kvi#o8.dat

have been prepared by Ronnie Hoekstra and his students.

16. **ADF03** The data sets

../adas/adas/adf03/atompars/atompars_lh#c.dat

have been prepared by Lorne Horton.

17. **ADF04** The data sets

../adas/adas/adf04/belike/belike_mom97#c2.dat
../adas/adas/adf04/blike/blike_mom97#c1.dat
../adas/adas/adf04/clike/clike_mom97#c0.dat
../adas/adas/adf04/copmm#2/l#he0.dat
../adas/adas/adf04/copmm#2/l#he1.dat
../adas/adas/adf04/copmm#2/l#he2.dat
../adas/adas/adf04/helike/helike_kvi97#he0.dat
../adas/adas/adf04/helike/helike_mom97#c4.dat
../adas/adas/adf04/hlike/hlike_mom97#c5.dat
../adas/adas/adf04/hlike/hlike_mom97#c5n.dat
../adas/adas/adf04/hlike/hlike_mom97#he1n.dat
../adas/adas/adf04/lilike/lilike_mom97#c3.dat

have been prepared by Martin O'Mullane for the '96' helium & carbon production. Martin has also added the xenon data sets

../adas/adas/adf04/copmm#54/l#xe<ion>.dat

where <ion> denotes the ion charge.

18. **ADF10** The generalised collisional radiative data sets from ADAS204 calculation include *acd*, *scd*, *xcd* and *prb* types only. The following

../adas/adas/adf10/<class>96/<class>96_b11.dat
../adas/adas/adf10/<class>96/<class>96_b21.dat
../adas/adas/adf10/<class>96/<class>96_b22.dat
../adas/adas/adf10/<class>96/<class>96_be11.dat
../adas/adas/adf10/<class>96/<class>96_be12.dat
../adas/adas/adf10/<class>96/<class>96_c11.dat
../adas/adas/adf10/<class>96/<class>96_c12.dat
../adas/adas/adf10/<class>96/<class>96_c21.dat
../adas/adas/adf10/<class>96/<class>96_c24.dat
../adas/adas/adf10/<class>96/<class>96_h11.dat
../adas/adas/adf10/<class>96/<class>96_he11.dat
../adas/adas/adf10/<class>96/<class>96_he12.dat
../adas/adas/adf10/<class>96/<class>96_li21.dat
../adas/adas/adf10/<class>96/<class>96_li11.dat
../adas/adas/adf10/<class>96/<class>96_li21.dat

with <class> = *acd*, *scd* and *prb* together with

../adas/adas/adf10/xcd96/xcd96_b21.dat
../adas/adas/adf10/xcd96/xcd96_c21.dat
../adas/adas/adf10/xcd96/xcd96_li21.dat

have been prepared by Lorne Horton for the '96' helium & carbon production. Note that final part of the name labels isoelectronic sequence, recombining parent and final recombined spin system. We have used the index of the lowest metastable of the recombined spin system for consistency with the naming of this type of data set when produced in their more complete

form (ie. fully resolved by final recombined state metastable) by ADAS208.

The generalised collisional radiative data sets from ADAS208 calculation include *acd*, *ccd*, *met*, *pls*, *plt*, *prb*, *prc*, *qcd*, *scd* and *xcd*. The following

```
./../adas/adas/adf10/<class>96/pj#<class>96_b11.dat  
./../adas/adas/adf10/<class>96/pj#<class>96_b12.dat  
./../adas/adas/adf10/<class>96/pj#<class>96_b21.dat  
./../adas/adas/adf10/<class>96/pj#<class>96_b22.dat  
./../adas/adas/adf10/<class>96/pj#<class>96_be11.dat  
./../adas/adas/adf10/<class>96/pj#<class>96_be12.dat  
./../adas/adas/adf10/<class>96/pj#<class>96_c11.dat  
./../adas/adas/adf10/<class>96/pj#<class>96_c12.dat  
./../adas/adas/adf10/<class>96/pj#<class>96_c13.dat  
./../adas/adas/adf10/<class>96/pj#<class>96_c14.dat  
./../adas/adas/adf10/<class>96/pj#<class>96_c21.dat  
./../adas/adas/adf10/<class>96/pj#<class>96_c22.dat  
./../adas/adas/adf10/<class>96/pj#<class>96_c23.dat  
./../adas/adas/adf10/<class>96/pj#<class>96_c24.dat  
./../adas/adas/adf10/<class>96/pj#<class>96_h11.dat  
./../adas/adas/adf10/<class>96/pj#<class>96_he11.dat  
./../adas/adas/adf10/<class>96/pj#<class>96_he12.dat  
./../adas/adas/adf10/<class>96/pj#<class>96_li21.dat  
./../adas/adas/adf10/<class>96/pj#<class>96_li11.dat  
./../adas/adas/adf10/<class>96/pj#<class>96_li21.dat
```

with *<class>* = *acd*, *ccd*, *scd*, *qcd*, *prb* and *xcd* have been added. Note that the *qcd*, *prb* and *xcd* sets do not span as many cases as *acd*, *ccd* and *scd*. This is correct physically. Then there are the differently structured *<class>* = *met*, *plt* and *pls*

```
./../adas/adas/adf10/<class>96/pj#<class>96_b##.dat  
./../adas/adas/adf10/<class>96/pj#<class>96_be##.dat  
./../adas/adas/adf10/<class>96/pj#<class>96_c##.dat  
./../adas/adas/adf10/<class>96/pj#<class>96_h##.dat  
./../adas/adas/adf10/<class>96/pj#<class>96_he##.dat  
./../adas/adas/adf10/<class>96/pj#<class>96_li##.dat
```

All these have been prepared by Lorne Horton for the '96' helium & carbon production. Note that final part of the name labels isoelectronic sequence, recombining parent and final recombined metastable.

19. **ADF11** The iso-nuclear generalised collisional data sets from mapping and collecting the *pj#* *adf10* files using ADAS404 and combining metastables into ionisation stages

```
./../adas/adas/adf11/<class>96/<class>96_c.dat  
./../adas/adas/adf11/<class>96/<class>96_he.dat
```

have been prepared by Lorne Horton for the '96' helium & carbon production. Note that the class code *<class>* = *acd*, *ccd*, *pls*, *plt*, *prb*, *prc* and *scd*.

20. **ADF13** The photon efficiency data sets from ADAS208 calculation

```
./../adas/adas/adf13/sxb96#c/sxb96#c_pjr#c0.dat  
./../adas/adas/adf13/sxb96#c/sxb96#c_pjr#c1.dat  
./../adas/adas/adf13/sxb96#c/sxb96#c_pjr#c2.dat  
./../adas/adas/adf13/sxb96#c/sxb96#c_pjr#c3.dat  
./../adas/adas/adf13/sxb96#c/sxb96#c_pjr#c4.dat  
./../adas/adas/adf13/sxb96#c/sxb96#c_pjr#c5.dat  
./../adas/adas/adf13/sxb96#c/sxb96#c_pju#c0.dat  
./../adas/adas/adf13/sxb96#c/sxb96#c_pju#c1.dat  
./../adas/adas/adf13/sxb96#c/sxb96#c_pju#c2.dat  
./../adas/adas/adf13/sxb96#c/sxb96#c_pju#c3.dat  
./../adas/adas/adf13/sxb96#c/sxb96#c_pju#c4.dat  
./../adas/adas/adf13/sxb96#c/sxb96#c_pju#c5.dat  
./../adas/adas/adf13/sxb96#c/sxb96#c_vsu#c1.dat  
./../adas/adas/adf13/sxb96#c/sxb96#c_vsu#c1.dat
```

../adas/adas/adf13/sxb96#c/sxb96#he_pjr#he0.dat
../adas/adas/adf13/sxb96#c/sxb96#he_pjr#he1.dat
../adas/adas/adf13/sxb96#c/sxb96#he_pju#he0.dat
../adas/adas/adf13/sxb96#c/sxb96#he_pju#he1.dat

have been prepared by Lorne Horton for the '96' helium & carbon production. Note that the code 'pj' indicates that projection matrices were included in the calculation. The code 'r' indicates metastable resolved data and 'u' indicates combined for ionisation stages. The code 'vs' indicates that only data in the visible spectrometer range has been included.

21. **ADF14** The state selective thermally averaged charge exchange rate coefficient data for partially stripped carbon ions with ground state neutral hydrogen donor

../adas/adas/adf14/tcx#h0/tcx#c1.dat
../adas/adas/adf14/tcx#h0/tcx#c2.dat
../adas/adas/adf14/tcx#h0/tcx#c3.dat
../adas/adas/adf14/tcx#h0/tcx#c4.dat
../adas/adas/adf14/tcx#h0/tcx#c5.dat
../adas/adas/adf14/tcx#h0/tcx#c6.dat

have been prepared by Costanza Maggi for the '96' helium & carbon production.

22. **ADF15** The photon emissivity data sets from ADAS208 calculation

../adas/adas/adf15/pec96#c/pec96#c_pjr#c0.dat
../adas/adas/adf15/pec96#c/pec96#c_pjr#c1.dat
../adas/adas/adf15/pec96#c/pec96#c_pjr#c2.dat
../adas/adas/adf15/pec96#c/pec96#c_pjr#c3.dat
../adas/adas/adf15/pec96#c/pec96#c_pjr#c4.dat
../adas/adas/adf15/pec96#c/pec96#c_pjr#c5.dat
../adas/adas/adf15/pec96#c/pec96#c_pju#c0.dat
../adas/adas/adf15/pec96#c/pec96#c_pju#c1.dat
../adas/adas/adf15/pec96#c/pec96#c_pju#c2.dat
../adas/adas/adf15/pec96#c/pec96#c_pju#c3.dat
../adas/adas/adf15/pec96#c/pec96#c_pju#c4.dat
../adas/adas/adf15/pec96#c/pec96#c_pju#c5.dat
../adas/adas/adf15/pec96#c/pec96#c_vsu#c1.dat
../adas/adas/adf15/pec96#c/pec96#c_vsu#c1.dat
../adas/adas/adf15/pec96#c/pec96#he_pjr#he0.dat
../adas/adas/adf15/pec96#c/pec96#he_pjr#he1.dat
../adas/adas/adf15/pec96#c/pec96#he_pju#he0.dat
../adas/adas/adf15/pec96#c/pec96#he_pju#he1.dat

have been prepared by Lorne Horton for the '96' helium & carbon production. Note that the code 'pj' indicates that projection matrices were included in the calculation. The code 'r' indicates metastable resolved data and 'u' indicates combined for ionisation stages. The code 'vs' indicates that only data in the visible spectrometer range has been included.

23. **ADF17** The projection matrix data sets from ADAS204 calculation

../adas/adas/adf17/cbnm96#b/cbnm96#b_c1ls.dat
../adas/adas/adf17/cbnm96#be/cbnm96#be_c2ls.dat
../adas/adas/adf17/cbnm96#c/cbnm96#c_c0ls.dat
../adas/adas/adf17/cbnm96#h/cbnm96#h_c5ls.dat
../adas/adas/adf17/cbnm96#h/cbnm96#h_he1ls.dat
../adas/adas/adf17/cbnm96#he/cbnm96#he_c4ls.dat
../adas/adas/adf17/cbnm96#he/cbnm96#he_c3ls.dat
../adas/adas/adf17/cbnm96#li/cbnm96#li_c3ls.dat

have been prepared by Martin O'Mullane for the '96' helium & carbon production.

24. **ADF18/a09_a04** The cross-reference mapping datasets from adf09 dielectronic data sets to adf04 specific ion datasets

../adas/adas/adf18/a09_a04/mom96#b/mom96#b_c1ls.dat
../adas/adas/adf18/a09_a04/mom96#be/mom96#be_c2ls.dat
../adas/adas/adf18/a09_a04/mom96#c/mom96#c_c0ls.dat

../adas/adas/adf18/a09_a04/mom96#he/mom96#he_c4ls.dat
../adas/adas/adf18/a09_a04/mom96#he/mom96#he_he0ls.dat
../adas/adas/adf18/a09_a04/mom96#li/mom96#li_c3ls.dat

have been prepared by Martin O'Mullane for the '96' helium & carbon production.

25. **ADF18/a09_p204** The cross-reference mapping datasets from adf09 dielectronic data sets to ADAS204 calculation

../adas/adas/adf18/a09_p204/nrb96#b/nrb96#b_c1n.dat
../adas/adas/adf18/a09_p204/nrb96#be/nrb96#be_c2n.dat
../adas/adas/adf18/a09_p204/nrb96#c/nrb96#c_c0n.dat
../adas/adas/adf18/a09_p204/nrb96#h/nrb96#h_c5n.dat
../adas/adas/adf18/a09_p204/nrb96#h/nrb96#h_he1n.dat
../adas/adas/adf18/a09_p204/nrb96#he/nrb96#he_c4n.dat
../adas/adas/adf18/a09_p204/nrb96#he/nrb96#he_he0n.dat
../adas/adas/adf18/a09_p204/nrb96#li/nrb96#li_c3n.dat

have been prepared by Martin O'Mullane for the '96' helium & carbon production.

26. **ADF18/a19_p208** The cross-reference expansion/mapping datasets from adf17 projection matrix data sets to ADAS208 calculation

../adas/adas/adf18/a17_p208/exp96#b/exp96#b_c1n.dat
../adas/adas/adf18/a17_p208/exp96#be/exp96#be_c2n.dat
../adas/adas/adf18/a17_p208/exp96#c/exp96#c_c0n.dat
../adas/adas/adf18/a17_p208/exp96#h/exp96#h_c5n.dat
../adas/adas/adf18/a17_p208/exp96#h/exp96#h_he1n.dat
../adas/adas/adf18/a17_p208/exp96#he/exp96#he_c4n.dat
../adas/adas/adf18/a17_p208/exp96#he/exp96#he_he0n.dat
../adas/adas/adf18/a17_p208/exp96#li/exp96#li_c3n.dat

have been prepared by Martin O'Mullane for the '96' helium & carbon production.

27. **ADF24** The state selective charge exchange cross-section data for partially stripped carbon ions with ground state neutral hydrogen donor

../adas/adas/adf24/scx#h0/scx#h0_cfm#c1.dat
../adas/adas/adf24/scx#h0/scx#h0_cfm#c2.dat
../adas/adas/adf24/scx#h0/scx#h0_cfm#c3.dat
../adas/adas/adf24/scx#h0/scx#h0_cfm#c4.dat
../adas/adas/adf24/scx#h0/scx#h0_cfm#c5.dat
../adas/adas/adf24/scx#h0/scx#h0_cfm#c6.dat

have been prepared by Costanza Maggi for the '96' helium & carbon production. Note that the datasets of this type issued at the last release were corrupted in format. The present data replace them.

28. **ADF25** The ADAS204 driver data sets

../adas/adas/adf25/bns96#b/bns96#b_c1.dat
../adas/adas/adf25/bns96#be/bns96#be_c2.dat
../adas/adas/adf25/bns96#c/bns96#c_c0.dat
../adas/adas/adf25/bns96#h/bns96#h_c5.dat
../adas/adas/adf25/bns96#h/bns96#h_he1.dat
../adas/adas/adf25/bns96#he/bns96#he_c4.dat
../adas/adas/adf25/bns96#he/bns96#he_he0.dat
../adas/adas/adf25/bns96#li/bns96#li_c3.dat

have been prepared by Martin O'Mullane for the '96' helium & carbon production.

29. **ADF11** Data for xenon has been prepared by Martin O'Mullane and added as

../adas/adas/adf11/<code89>/<code89>_xe.dat

30. Note that the state of the database in broad terms is described and updated in

../adas/docs/datastatus/adf_stat

31. **Plans for ADAS213, ADAS205 and ADAS207.**

- 31.1. It was indicated that these routines would be ready for this release. In fact the codes are operational but we have deferred their release until next time. Stuart is also extending ADAS213 beyond its original concept following discussion with Kurt Behringer. Incidentally, ADAS213 (for calculating escape factors) will probably be called ADAS214 at release as we intend to slot in a state selective ionisation rate coefficient code as ADAS213 to sit along side ADAS211 and ADAS212.

H. P. Summers
4 March 1998