

## Tutorial session 4 examples

### 1. ADF01 and ADF12

1. Explore the ADAS database for these formats. Note that the specification is in the ADAS User manual (*appxa-01* and *appxa-12*).

### 2. ADAS301 Test Case

2. Move to your sub-directory `./.../<uid>/adas/pass`. Start ADAS301.
3. Click on *Central Data*, and select `qcx##h0/qcx##h0_old##n7.dat`.
4. Click the *Browse comments* button to see the list of transitions present in the file `qcx##h0/qcx##h0_old##n7.dat`. Move onto ADAS301 Processing window.
5. Select *Fit polynomial* at the 5% level. Click on the  $n=8 - n'=7$  transition in the transition list window. You will need to use the scroll-bar on the right.
6. Click on *Select Velocities/Energies for Output File* button.
7. Now put in default values in the Table. Note the units in use. It is preferred to units of eV/amu. You need to edit the table to change the units.
8. Click on the *Select Quantum Numbers for Processing* button. Select the 7f shell. Note that you can select total and partial cross-sections – see the key to the right.
9. Click on the *Done* button to proceed to the Output options window.
10. Click on the button for *Graphical Output*. Then click *Done* to see the graph.
11. Have a look at the output text file after completion

### 3. ADAS303 Test Case

12. Move to your sub-directory `./.../<uid>/adas/pass`. Start ADAS303.
13. Click on *Central Data*, and select `qef93##h/qef93##h_c6.dat`.
14. Click the *Browse comments* button to see what is in the file `qef93##h_c6.dat`. Move onto ADAS303 Processing window.
15. Select *Fit polynomial* at the 5% level. Click on the  $n=8 - n'=7$  transition in the transition list window. You will need to use the scroll-bar on the right.
16. Click on the *Default Energy/Velocity Values* button. A set of energies appears in the Output energies column. Note the units in use. You need to edit the table to change the units.
17. Click on the *Select supplementary plasma parameters* button. Now type in Output Values for Ion Density, Ion Temperature, Z effective and B Magnetic. Note the reference value and valid ranges for each of these parameters are given. The reference values are good values to start with.
18. Click on the *Done* button to proceed to the Output options window.
19. Click on the button for *Graphical Output*. Then click *Done* to see the graph.
20. Have a look at the output text file after completion

### 4. ADAS 308 Test Case

1. Move to your directory `./.../<uid>/adas/pass`. Start ADAS and move to the ADAS3 series menu. Select ADAS308.
2. Click on *Central Data*, the data root to data class ADF01 should appear in the window alongside. Click on the directory name `qcx##h0` in the file list window. `qcx##h0` appears above in the selection window. Click on `qcx##h0_old##n7.dat`. It appears in the selection window [you may need to scroll down].
3. Click the *Browse comments* button. Information of what is in the file `qcx##h0_old##n7.dat` is displayed. Click *Done* to restore the Input window. Click *Done* and the ADAS308 Processing window appears.
4. The Processing window is complex. Note the information on donor and receiver near the top. To the right enter the Atomic mass of the receiver (14.0). Remember to press `{return}`.
5. Next Input the plasma parameters, for example,  $T_i=5.0e3$ ,  $T_e=5.0e3$ ,  $N_i=2.5e13$ ,  $N_e=5.0e13$ ,  $Z_{\text{eff}}=2.0$ ,  $B=3.0$ .

6. Now Select charge exchange theory. This is a drop down menu. Click *Use input data set*. [Note programs have built in default activation on some buttons. If the button is darkened it is activated]. Now Select emission measure model. This is also a drop down menu. Click *Charge exchange*.
7. Now turn to the Input of beam and spectrum line information and click first on the button for *Beam parameter information*. The appropriate table appears below for editing. Click Edit to bring up Table Editor and enter appropriate values, for example
 

0.85	8.0E4
0.12	4.0E4
0.03	2.7E4

 and then *Done*.
8. Similarly, click the button for Observed spectrum lines and edit it's table. Try
 

9	8	1.00E12
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 and click *Done*.
9. Finally click the button for Required emissivity prediction and edit it's table. Try
 

9	8	1
8	7	2
7	6	2
6	5	

 and click *Done*.
10. All is now ready. Click *Done* to move to the Output options window.
11. Click the button for *Graphical output*. You may also *Enable Hard Copy* and *Text Output*. Finally click *Done* to see the graph.
12. Click *Done* to return to the Output options screen. Click on the *Exit to Menu* icon to finish up. Finally click on the *Exit* button on the sub-menu and main menu windows to exit ADAS.

## 5. ADAS 304 Test Case

21. Move to your directory `./.../adas/pass`. Start ADAS and move to the ADAS3 series menu. Select ADAS304.
22. The Input window is different from the usual. Click on *Central Data*, the data root to the data class ADF21 should appear in the window above. Now enter the Group name for input files. This is the directory of the look-up tables of stopping data for a particular beam species. Type `bms93#h`. Remember the `{return}`.
23. Now you must decide on the mixture of impurity nuclei (and hydrogen nuclei) which cause the total stopping. Click the button *Select Ion List*. The button incidentally becomes *Reselect Ion List* on later passes through. A button table pops up. Click on the buttons for the nuclei you wish to include, for example, Be4, C6, H1 and click *Done*. Note the Stopping Ion List. Click *Done* to advance to the Processing Options window.
24. Click on the *Fit polynomial* button, then type 5 in the adjacent active editable box
25. Now move to the Stopping ion fractions. Click on the *Edit Table* button to activate Table Editor. Enter 0.1,0.1,0.8 for Be, C, H respectively and click *Done*.
26. Now Select the co-ordinate type for the output graph. Click the *Energy* button for the first try.
27. Click on the *Default Output Values* button. You may find a warning widget pops up. If so, click the *Confirm* button.
28. Click the button for *Graphical output*. Finally click *Done* to see the graph.
29. Click *Done* to return to the Output options screen. You may *Exit to menu* using the icon in this program.

## 6. ADAS 310 Test Case

13. Move to your directory `./.../adas/pass`. Start ADAS and move to the ADAS3 series menu. Select ADAS310.
14. The Input window is considerably different from the usual. Enter beam species details (H for hydrogen and its isotopes) and the atomic charge of the beam species.
15. There are two files to be selected, the expansion file and the charge exchange file. To select the expansion file, click on the *Central Data* button, the *Data root* to the data class ADF18 should appear in the window above. Now select the data file `bndlen_exp#h0.dat`.

To select the charge exchange file, click on *Central Data*, the *Data root* to data class ADF01 should appear in the window. Select *qcx#h0*. Now select the data file *qcx#h0\_e2p#h1.dat*. Click on the *Done* button to advance to the Processing options window.

16. The control parameters of the collisional-radiative calculation are organised into three groups, selected in turn by the buttons *general*, *switches (I)* and *switches (II)*.  
 General button: Click on the *general* button to view the general parameter settings. The default values are reasonable.  
 Switches (I) button: Click on the *switches (I)* button to view the settings associated with electron collisions. Working down the list set the parameters to the following: 2, 3, NO, YES.  
 Switches (II) button: Click on the *switches (II)* button to view the settings associated with the ion collisions. Working down the list set the parameters to the following: YES, 0, YES, YES.
17. Now you must decide what range of principal quantum numbers that you want to include in the calculation. Click on the *Representative N-shells* button. Enter 1 and 110 as the minimum and maximum n-shells. Now click on the *Edit Table* button and enter the following values into the editor: 1,2,3,4,5,6,7,8,9,10,12,15,20,30,40,50,60,70,80,90,100. Click on *Done* to return to the processing widget.
18. Now you need to decide the impurity content of the target plasma. Click on the *Impurity information* button. Now click on the *Selection mode* button and choose *Multiple impurities*. Click on the *Edit Table* button and enter the following information into the editor

H	1.0	0.9
C	12.0	0.05
Be	11.0	0.05

Click on the *Done* button to return to the processing window.

19. Click on the *electron/proton density scan* button to choose the range of plasma densities. In the usual manner enter the following values into the table editor.

1.0e13	1.0
2.0e13	2.0
3.0e13	3.0
4.0e13	4.0
5.0e13	5.0

Click Done to return to the processing window. Enter the value 3 as the *Index for the reference density*.

20. Now click on the *electron/proton temperature* button and enter the following values into the text editor

1.0e3
2.0e3
3.0e3
4.0e3
5.0e3

Click on the *Done* button to return to the processing widget. Enter the value 3 as the *Index for the reference temperature*.

21. Click on the *beam energy scan* button and enter the following values into the table editor

2.0e4
3.0e4
4.0e4
5.0e4
6.0e4

Click on the *Done* button to return to the processing widget. Enter the value 3 for the *Index for the reference beam energy* and 1.0e8 as the *Beam density*.

Now click on *Done* to advance to the Output window.

22. There are several possible outputs but our interest is in the contents of the first passing file. The first passing file is of type ADF26 and contains the tabulated population structure and effective stopping coefficients as a function of plasma parameters. It should be noted that the fourth passing file contains the stopping coefficients assembled

according to format ADF21. The preferred route to obtaining the stopping coefficients is via ADAS312.

23. Click on the *First passing file* button and enter a filename. Now click on *Run now*. An Information widget appears. After the calculation, click on the *Exit to Menu* button to return to the ADAS3 series menu.