

# Interactive ADAS

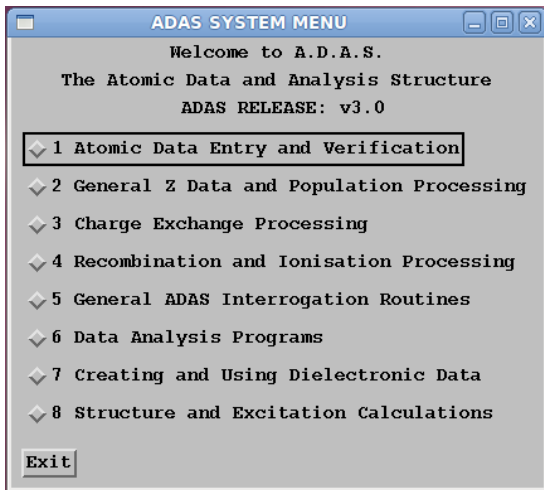
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# Starting interactive ADAS



# ADAS Series

ADAS Series 1 Atomic Data Entry and Verification

ADAS Series 2 General Z Data and Population Processing

ADAS Series 3 Charge Exchange Processing

ADAS Series 4 Recombination and Ionisation Processing

ADAS Series 5 General ADAS Interrogation Routines

ADAS Series 6 Data Analysis Programs

ADAS Series 7 Creating and Using Dielectronic Data

ADAS Series 8 Structure and Excitation Calculations

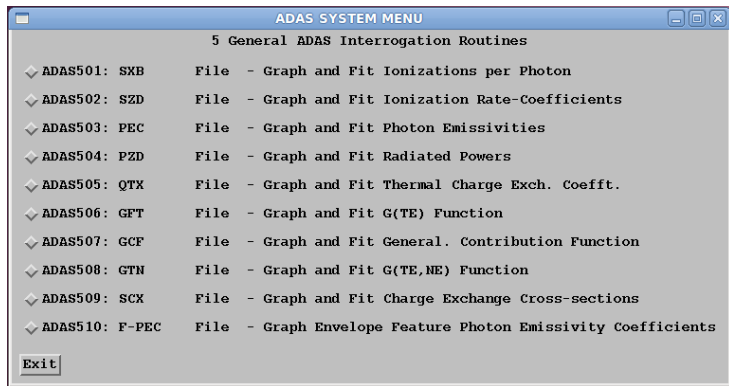
In progress ADAS Series 9 : Molecular ADAS.

## Some ADF data classes

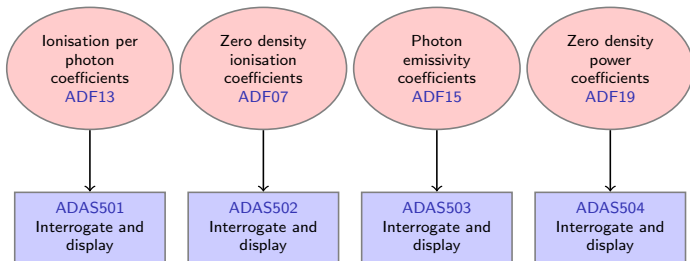
Large data basis, 45 types *adf* files.

- ADF01 Charge exchange cross sections
- ADF04 Resolved specific ion data collections
- ADF07 Electron impact ionisation coefficients
- ADF08 Radiative recombination coefficients
- ADF09 Dielectronic recombination coefficients
- ADF11 Iso-nuclear master files
- ADF12 Charge exchange emission coefficients
- ADF13 Ionisation per photon coefficients
- ADF15 Photon emissivity coefficients
- ADF21 Effective beam stopping coefficients
- ADF22 Effective beam emission coefficients

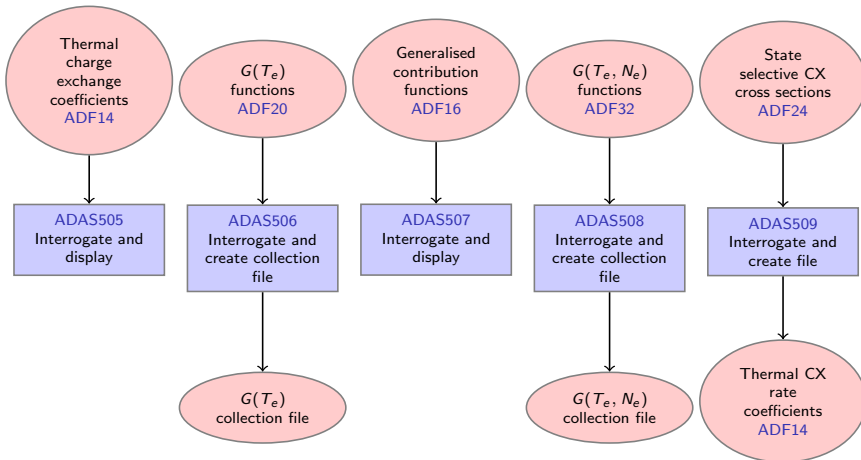
# ADAS Series 5



# ADAS Series 5



# ADAS Series 5



## ADAS501, a typical interrogation code

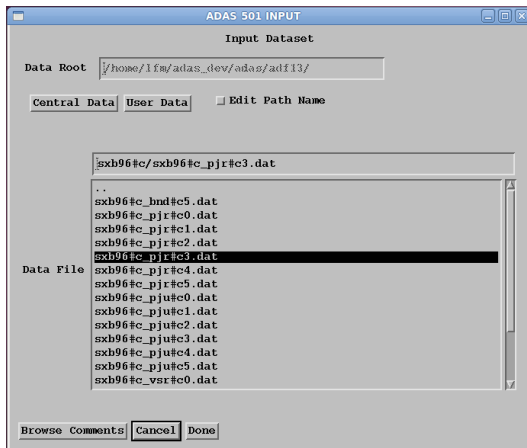
- Datasets of class **ADF13** contain ionisation per photon ratios (SXB data) as a function of  $T_e$  and  $N_e$ .
- The code **ADAS501** interrogates **ADF13** data sets at a temperature or density model of your choice.
- **ADAS501** has a standard sequential three screen structure, namely *file selection*, *processing options* and *output options* screens.



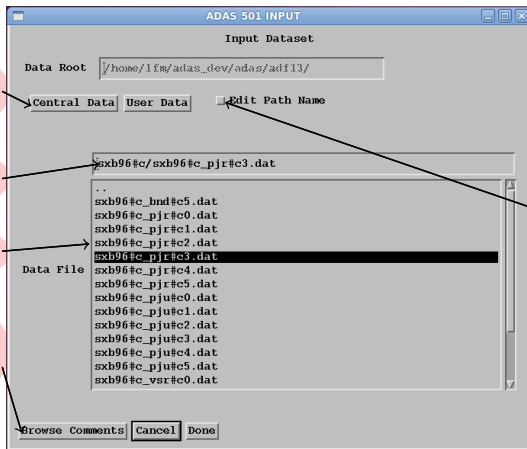
# ADAS501, a typical interrogation code

- File selection
  - The path to central ADAS data of the correct class (**ADF13**) is selected by button press.
  - A display screen shows available files which are selected by clicking on them.
  - Files have the **.dat** extension, otherwise they are directories.
  - **Done** means go to next screen, **Cancel** means return to the previous screen.
  - On many screens there is a small icon button along side **Cancel** allowing **Exit** and **Return to Menu**.

# ADAS501 input screen



# ADAS501 input screen



Click to use central ADAS data

Selected file for processing

ADF13 data file list

Browse comments for selected data set

Click to edit pathway

# ADAS501, a typical interrogation code

- Processing options
  - First select the spectrum line required
  - Then the choice of temperature and density pairs must be entered.
  - The 'Table Editor' widget is activated by button, press to allow this.
  - Using the editor takes a little practice.
  - An advanced graphical method for  $T_e$ ,  $N_e$  pair selection may be used.

# ADAS501 processing

ADAS501 PROCESSING OPTIONS

Title for Run:

Data File Name:

Polynomial Fitting

Fit Polynomial value % :

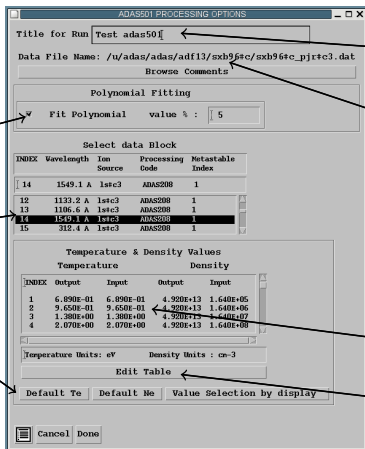
Select data Block

INDEX	Wavelength	Ion Source	Processing Code	Metastable Index
14	1549.1 A	1stc3	ADAS200	1
12	1133.2 A	1stc3	ADAS200	1
13	1106.6 A	1stc3	ADAS200	1
<b>14</b>	<b>1549.1 A</b>	<b>1stc3</b>	<b>ADAS200</b>	<b>1</b>
15	512.4 A	1stc3	ADAS200	1

Temperature & Density Values

INDEX	Temperature		Density	
	Output	Input	Output	Input
1	6.890E-01	6.890E-01	4.920E+13	1.640E+05
2	9.650E-01	9.650E-01	4.920E+13	1.640E+06
3	1.380E+00	1.380E+00	4.920E+13	1.640E+07
4	2.070E+00	2.070E+00	4.920E+13	1.640E+08

# ADAS501 processing



Make polynomial fit to data

Select line for analysis

Set default output values

Your title to appear on graphs and tables

Selected data set

Enter  $T_e$ ,  $N_e$  pairs for output

edit table

# ADAS501 Table editor

ADAS Table Editor

Temperature & Density Values

INDEX	Output	Input	Output	Input
[ 1	6.890E-01	6.890E-01	4.920E+13	1.640E+05
[ 2	9.650E-01	9.650E-01	4.920E+13	1.640E+06
[ 3	1.380E+00	1.380E+00	4.920E+13	1.640E+07
[ 4	2.070E+00	2.070E+00	4.920E+13	1.640E+08
[ 5	2.760E+00	2.760E+00	4.920E+13	1.640E+09
[ 6	4.140E+00	4.140E+00	4.920E+13	1.640E+10
[ 7	6.890E+00	6.890E+00	4.920E+13	4.920E+10
[ 8	9.650E+00	9.650E+00	4.920E+13	1.640E+11
[ 9	1.380E+01	1.380E+01	4.920E+13	4.920E+11
[10	2.070E+01	2.070E+01	4.920E+13	1.640E+12

Default  Delete  Remove  Insert  Copy  Paste

Row\_skip  Column\_skip  Scroll up  Scroll down

Temperature Units

Kelvin  eV  Reduced

Cancel Done

# ADAS501 Table editor

ADAS Table Editor

Temperature & Density Values

INDEX	Output	Input	Output	Input
[ 1	<i>6.890E-01</i>	6.890E-01	4.920E+13	1.640E+05
[ 2	<i>9.650E-01</i>	9.650E-01	4.920E+13	1.640E+06
[ 3	<i>1.380E+00</i>	1.380E+00	4.920E+13	1.640E+07
[ 4	<i>2.070E+00</i>	2.070E+00	4.920E+13	1.640E+08
[ 5	<i>2.760E+00</i>	2.760E+00	4.920E+13	1.640E+09
[ 6	<i>4.140E+00</i>	4.140E+00	4.920E+13	1.640E+10
[ 7	<i>6.890E+00</i>	6.890E+00	4.920E+13	1.640E+10
[ 8	<i>9.650E+00</i>	9.650E+00	4.920E+13	1.640E+11
[ 9	<i>1.380E+01</i>	1.380E+01	4.920E+13	1.640E+11
[10	<i>2.070E+01</i>	2.070E+01	4.920E+13	1.640E+12

Default  Delete  Remove  Insert  Copy  Paste

Row\_skip  Column\_skip  Scroll up  Scroll down

Temperature Units

Kelvin  eV  Reduced

Cancel Done

Editable values are in italic

Values from source data file

Editor controls

Alter units, it affects inputs



# ADAS501 Output

ADAS501 OUTPUT OPTIONS

Data File Name: /u/adas/adas/adf13/sxb96+c/sxb96+c\_pjr#c3.dat  
Browse Comments

Graphical Output

Graph Title: Test I

Explicit Scaling

X-MIN: [ ] X-MAX: [ ]  
Y-MIN: [ ] Y-MAX: [ ]

Select Device

Post-Script  
HP-PCL  
HP-GL

Enable Hard Copy  Replace

File Name: Test1.ps

Text Output  Replace Default File Name

File Name: paper.txt

Return to Input File Selection Cancel Done

# ADAS501 Output

ADAS501 OUTPUT OPTIONS

Data File Name: /u/adas/adas/adf13/sxb96+c/sxb96+c\_pjr+c3.dat  
Browse Comments

Graphical Output

Graph Title: Test 1

Explicit Scaling

X-min: [ ] X-max: [ ]  
Y-min: [ ] Y-max: [ ]

Select Device

Post-Script  
HP-PCL  
HP-GL

Enable Hard Copy  Replace

File Name: Test1.pdf

Text Output  Replace Default File Name

File Name: paper.txt

Return to Input File Selection Cancel Done

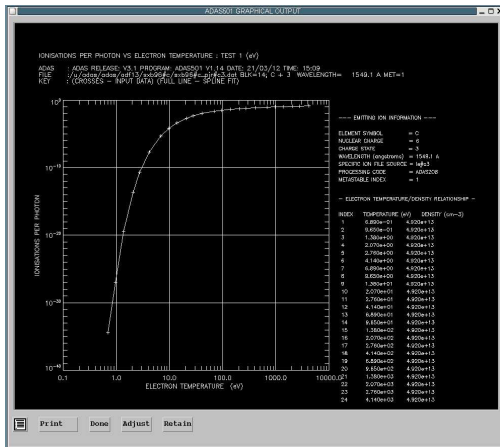
Provide graphical output

Allow graphical hard copy

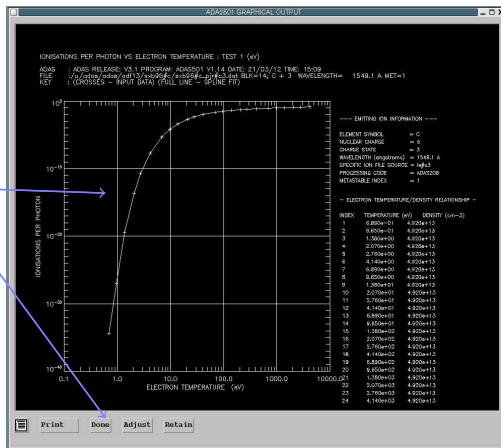
Graphical output file coding

Tabular output results

# ADAS501 Graphic



# ADAS501 Graphic



Graph of results

Advanced options

# The interactive system, working with ADF04 data sets

- ADF04: Resolved specific ion data collection
- Preliminaries
  - Electron impact cross sections and rate coefficients
  - The ADF04 file format
  - Interrogating ADF04 collisional excitation data using ADAS201 and ADAS811

# Electron impact cross sections and rate coefficients

The excitation reaction  $X^{Z+}(E_i) + e(\epsilon_i) \rightarrow X^{Z+}(E_f) + e(\epsilon_f)$  is described by an excitation cross section  $\sigma_{i \rightarrow f}(\epsilon_i)$ .

More useful for tabulation is the collision strength  $\Omega_{if}$  with independent variable  $X = \frac{\epsilon_i}{\Delta_{if}}$ , with  $X \in [1, \infty]$ .

$$\Omega_{if} = \omega_i \left( \frac{E_i}{I_H} \right) \left( \frac{\sigma_{i \rightarrow f}(\epsilon_i)}{\pi a_0^2} \right) = \omega_f \left( \frac{E_f}{I_H} \right) \left( \frac{\sigma_{f \rightarrow i}(\epsilon_f)}{\pi a_0^2} \right)$$

ADAS principally deals with Maxwell averaged rate coefficients  $q_{i \rightarrow f}(T_e)$ ,  $Y_{if}(T_e)$ .

$$Y_{if}(T_e) = \int_0^\infty \frac{d\epsilon}{kT_e} \Omega_{if}(\epsilon) e^{-\frac{\epsilon}{kT_e}}$$



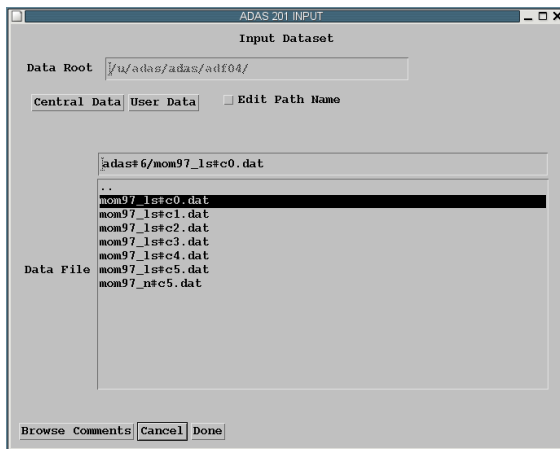




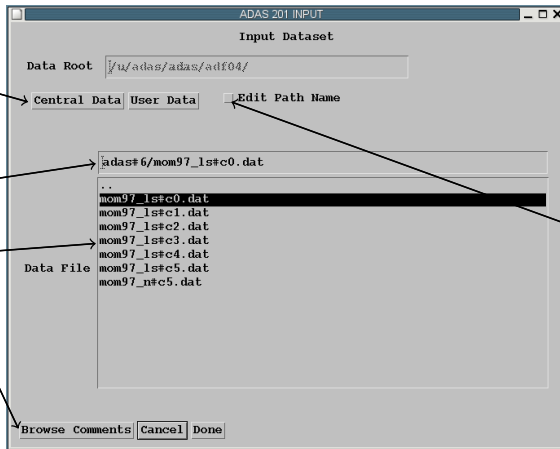
# Configuration specification

1s - 1	3d - 6	5s - 11,B	6s - 16,G	6h - 21,L
2s - 2	4s - 7	5p - 12,C	6p - 17,H	7s - 22,M
2p - 3	4p - 8	5d - 13,D	6d - 18,I	7p - 23,N
3s - 4	4d - 9	5f - 14,E	6f - 19,J	7d - 24,O
3p - 5	4f - 10,A	5g - 15,F	6g - 20,K	... - ...

# ADAS201 File selection



# ADAS201 File selection



Click to use central ADAS data

Selected file for processing

ADF04 data file list

Browse comments from selected data set

Click to edit pathway

# ADAS201 processing

ADAS201 PROCESSING OPTIONS

Title for Run: Test

Data File Name: /u/adaz/adaz/adf04/adaz6/mom97\_1stc0.dat

Browse Comments

Number of Electron Impact Transitions : 992  
Number of Index Energy levels : 64

Polynomial Fitting

Fit Polynomial value % : 5

Select Specific Electron Impact Transition

TRANSITION INDEX	LOWER LEVEL INDEX DESIGNATION	UPPER LEVEL INDEX DESIGNATION
541	1 2S2 2P2 (3)P( 4.0)	17 2S2 2P1 3S1 (3)D( 7.0)
538	1 2S2 2P2 (3)P( 4.0)	6 2S2 2P1 3S1 (1)P( 1.0)
539	1 2S2 2P2 (3)P( 4.0)	7 2S1 2P3 (3)D( 7.0)
540	1 2S2 2P2 (3)P( 4.0)	14 2S1 2P3 (3)P( 4.0)
541	1 2S2 2P2 (3)P( 4.0)	17 2S2 2P1 3D1 (3)D( 7.0)
542	1 2S2 2P2 (3)P( 4.0)	18 2S2 2P1 4S1 (3)P( 4.0)

Select Temperatures for output file w

Output Electron Temperatures

INDEX	Output	Input
1	1.000E+04	1.000E+04
2	1.250E+04	1.250E+04
3	2.500E+04	2.500E+04
4	3.750E+04	3.750E+04

Temperature Units: Kelvin

Edit Table

Default Temperature Values

Cancel Done

# ADAS201 processing

The screenshot shows the 'ADAS201 PROCESSING OPTIONS' dialog box. It contains several sections: 'Title for Run' (Test), 'Data File Name', 'Browse Comments', 'Number of Electron Impact Transitions' (992), 'Number of Index Energy Levels' (64), 'Polynomial Fitting' (Fit Polynomial value %: 5), 'Select Specific Electron Impact Transition' (a table with columns for Transition Index, Lower Level Index Designation, and Upper Level Index Designation), 'Select Temperatures for output file w', 'Output Electron Temperatures' (a table with columns for Index, Output, and Input), 'Temperature Units: Kelvin', 'Edit Table', and 'Default Temperature Values'. At the bottom are 'Cancel' and 'Done' buttons.

TRANSITION INDEX	LOWER LEVEL INDEX DESIGNATION	UPPER LEVEL INDEX DESIGNATION
541	1 2S2 2P2 (3)P( 4.0)	17 2S2 2P1 3S1 (3)D( 7.0)
538	1 2S2 2P2 (3)P( 4.0)	6 2S2 2P1 3S1 (1)P( 1.0)
539	1 2S2 2P2 (3)P( 4.0)	7 2S1 2P3 (3)D( 7.0)
540	1 2S2 2P2 (3)P( 4.0)	14 2S1 2P3 (3)P( 4.0)
541	1 2S2 2P2 (3)P( 4.0)	17 2S2 2P1 3D1 (3)D( 7.0)
542	1 2S2 2P2 (3)P( 4.0)	18 2S2 2P1 4S1 (3)P( 4.0)

INDEX	Output	Input
1	1.000E+04	1.000E+04
2	1.250E+04	1.250E+04
3	2.500E+04	2.500E+04
4	3.750E+04	3.750E+04

Make polynomial fit to data

Select transition for analysis

Set default output values

Your title to appear on graphs and tables

Number of transitions and levels

Select and enter  $T_e$  values for output

edit table

# ADAS201 Output

ADAS201 OUTPUT OPTIONS

Data File Name: /u/adas/adas/adf04/adas#6/mom97\_1stc0.dat  
Browse Comments

Graphical Output

Graph Title: Example

Explicit Scaling

X-AXIS: [ ] X-REAX: [ ]  
Y-AXIS: [ ] Y-REAX: [ ]

Select Device  
Post-Script  
**Post-Script**  
HP-PCL  
HP-GL

Enable Hard Copy  Replace

File Name: adas201\_example.ps

Text Output  Replace Default File Name

File Name: adas201\_paper.txt

Cancel Done

# ADAS201 Output

ADAS201 OUTPUT OPTIONS

Data File Name: /u/adas/adas/adf04/adas+6/mom97\_1stc0.dat

Browse Comments

Graphical Output

Graph Title: Example

Explicit Scaling

X-min: X-max: Y-min: Y-max:

Select Device

Post-Script

HP-PCL

HP-GL

Enable Hard Copy  Replace

File Name: adas201\_example.ps

Text Output  Replace Default File Name

File Name: adas201\_paper1.txt

Cancel Done

Provide graphical output

Allow graphical hard copy

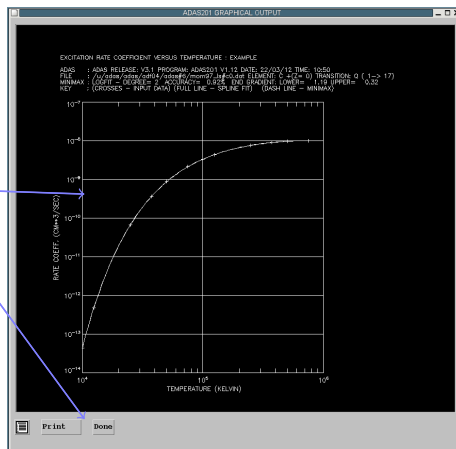
Graphical output file coding

Tabular output results





# ADAS201 Graphic



Graph of results

Advanced options

# ADAS811 File selection

ADAS811 INPUT

adf04 file 01:

Data Root

Edit Path Name

Data File

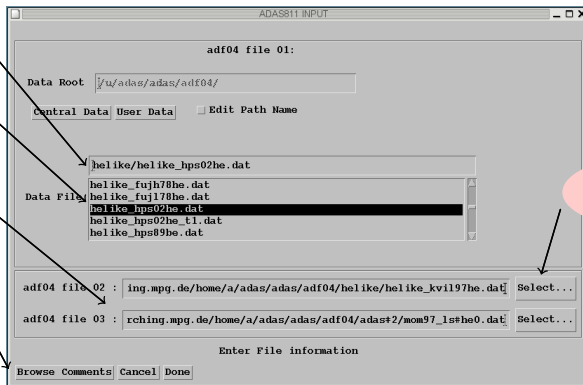
- helike\_fujh78he.dat
- helike\_fujl78he.dat
- helike\_hps02he.dat**
- helike\_hps02he\_t1.dat
- helike\_hps89he.dat

adf04 file 02 :

adf04 file 03 :

Enter File information

# ADAS811 File selection



Select first file

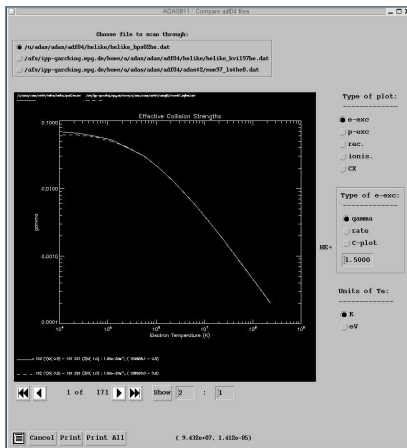
ADF04 data file list

Select second and third file to compare

Browse comments from selected data set

Click to show chooser pop-up

# ADAS811 Graphic

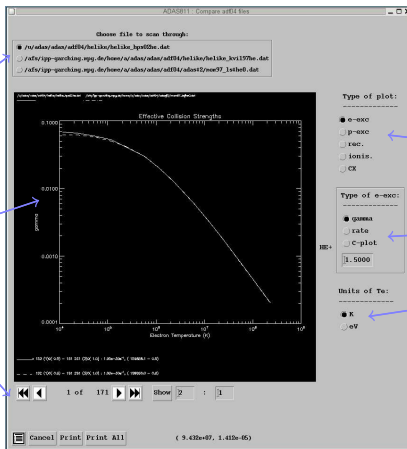


# ADAS811 Graphic

Select file to cycle through

Comparative graph for matched transitions

Tape recorder keys



Select type process

Select type of display

Select  $T_e$  units

Thank you for your attention.