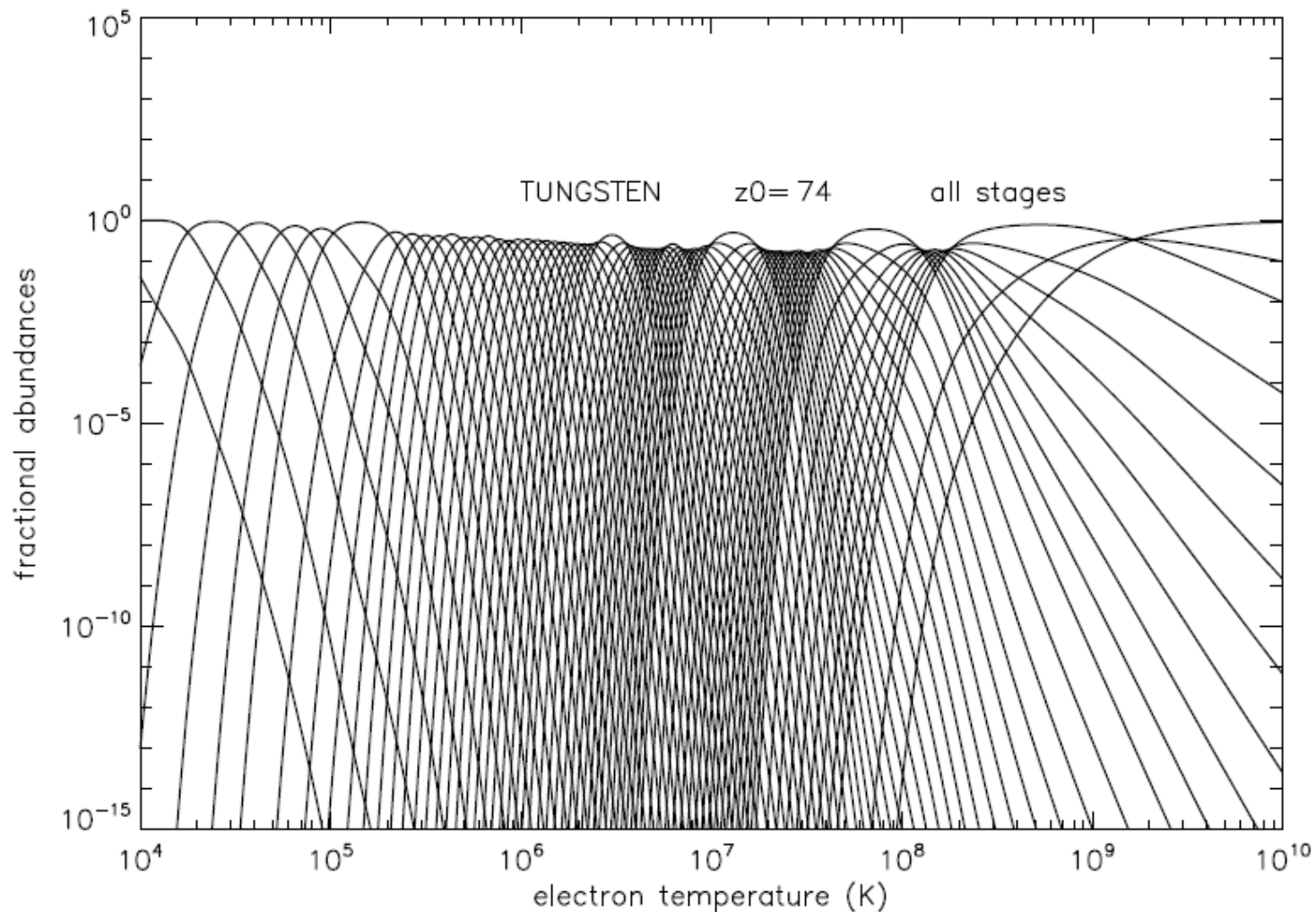


# 3b. The ionisation state of ions in a plasma – part 2

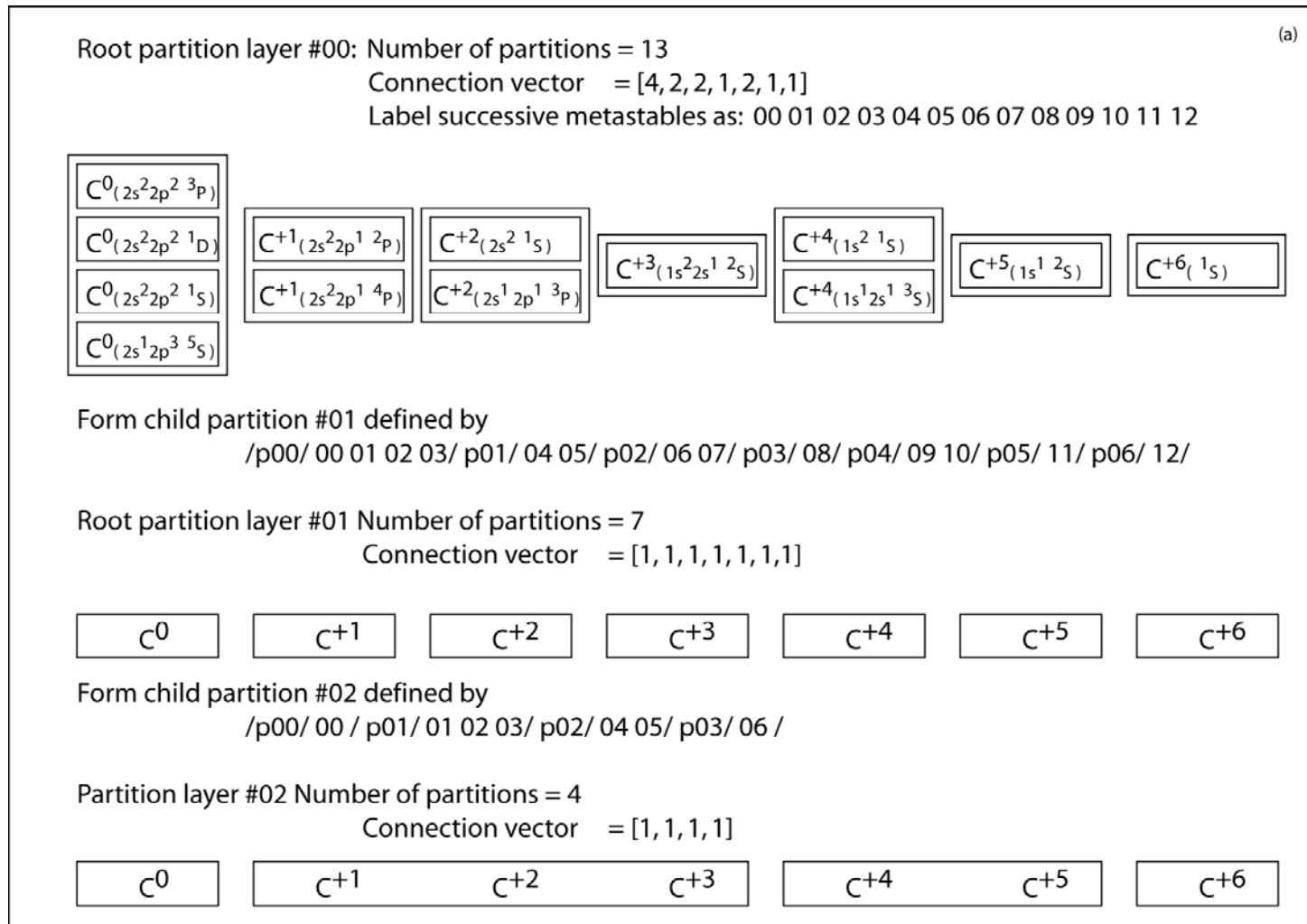
---

- Superstage compression
  - » Extension of the ADF11 data classes
  - » The root partitions and specification of a new partition
  - » ADAS416
- Setting up baseline '89' ADF11 data for an element
  - » Using ADAS407 to obtain atomic parameter sets of format ADF03
  - » Using ADAS408 to produce ADF11 baseline data

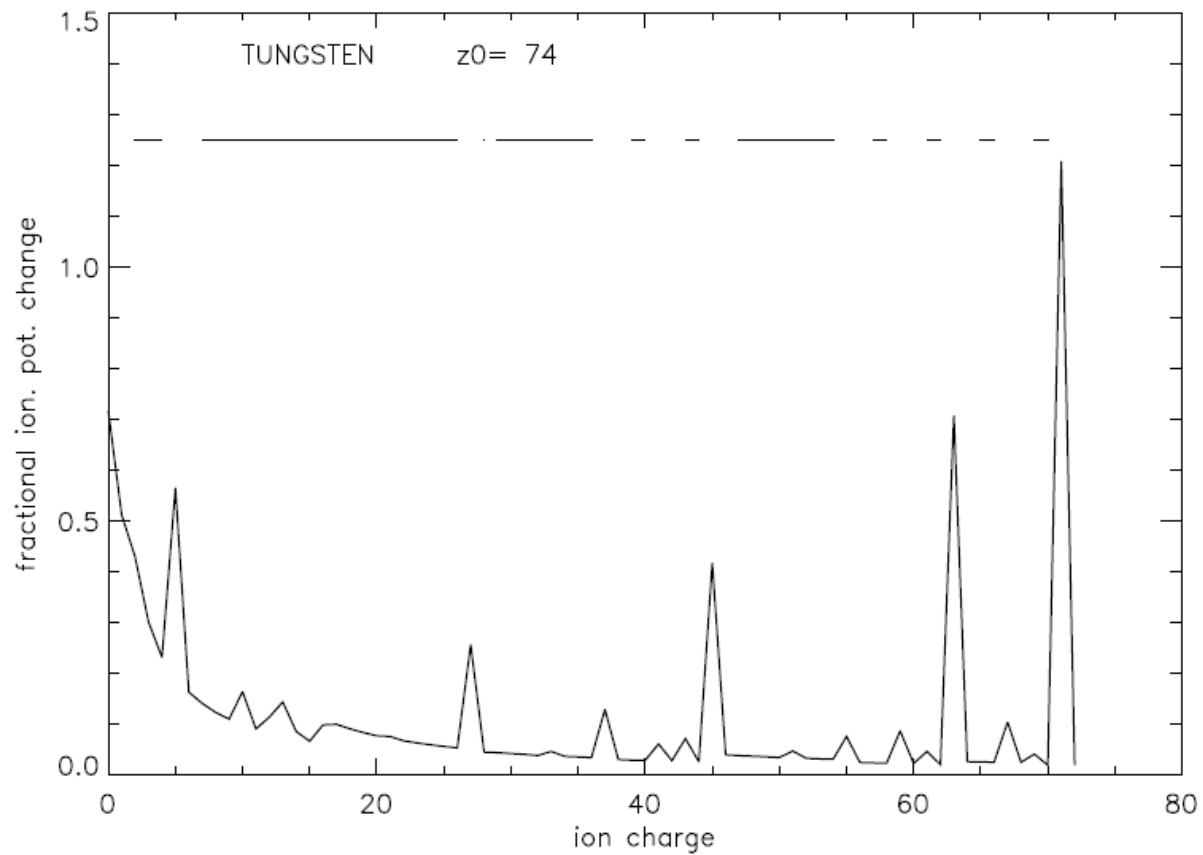
# Stage to stage (unresolved root partition) ionisation balance for tungsten



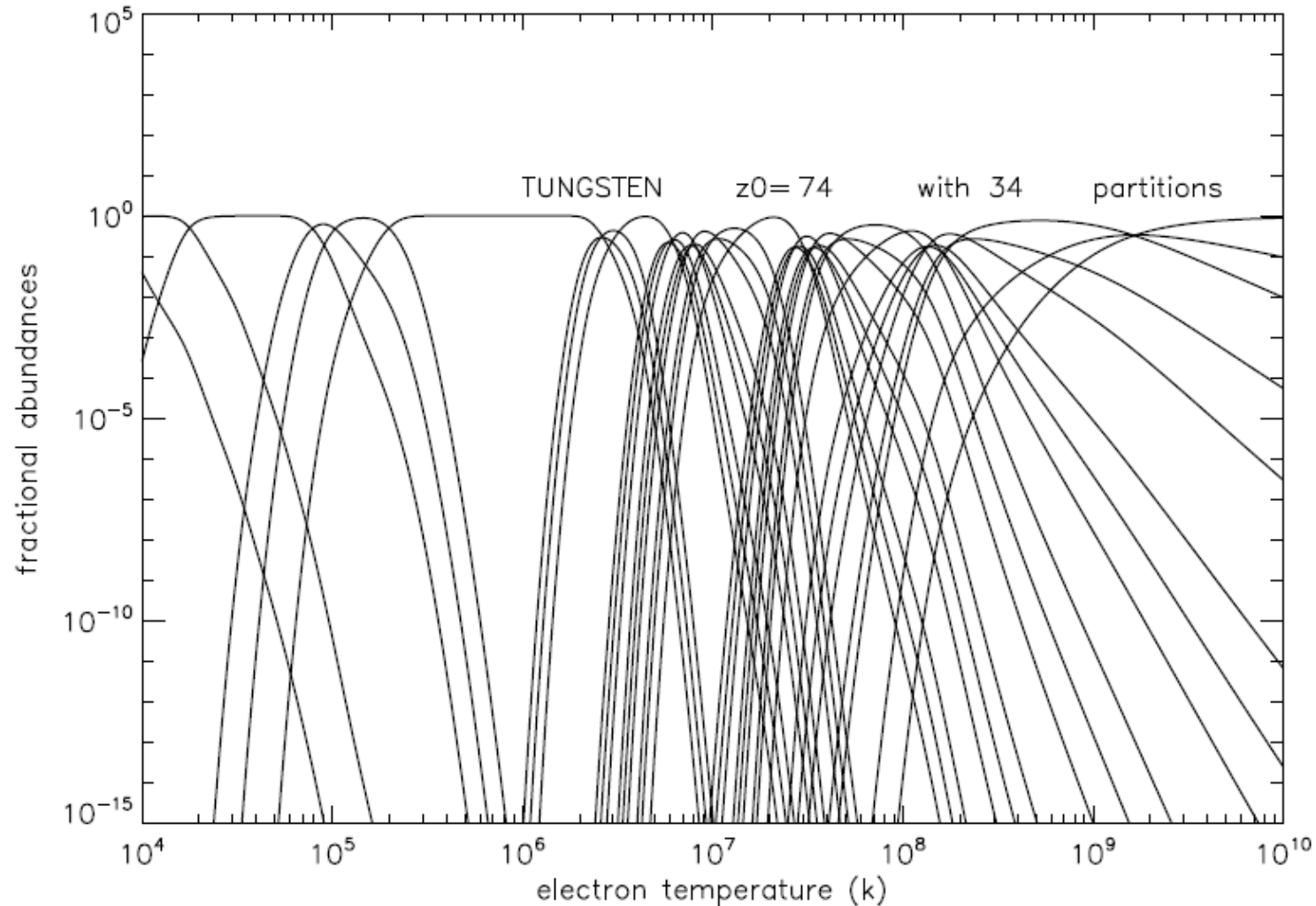
# Main ideas based on carbon as an illustration



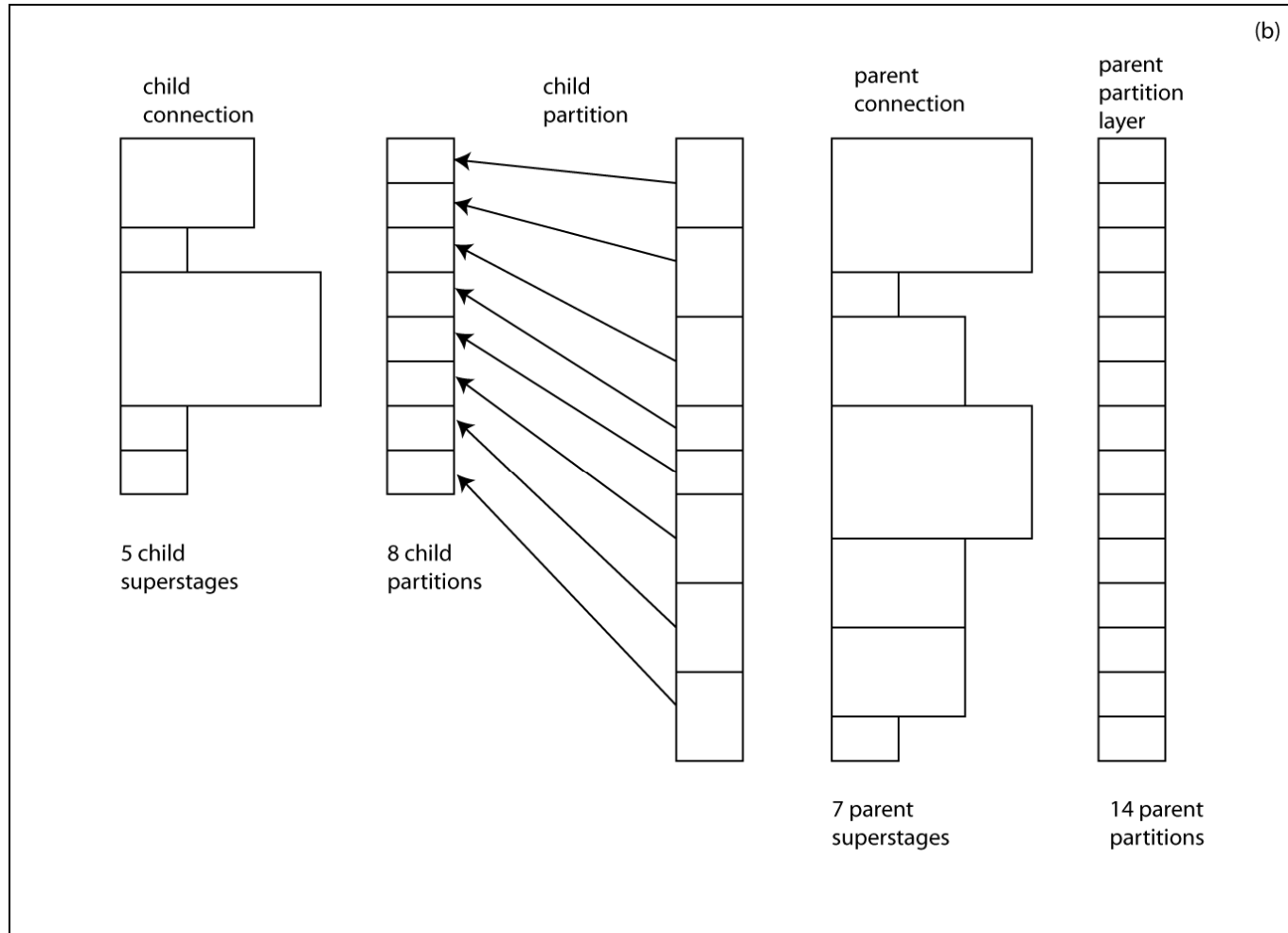
# Superstages and partitions



# Natural partition ionisation balance for tungsten



# Partitioning



# adf11 tungsten acd

## an unresolved - #01 partition level

```
74      8      24      1      6      /TUNGSTEN      /ACD /GCR PROJECT
-----
//#02/p00/ 00 01/
p01/ 02 03 04 05/
p02/ 06 07 08 09 10 11 12/
p03/ 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27/
p04/ 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45/
p05/ 46 47 48 49 50 51 52 53 54 55/
p06/ 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74/
//#01/p00/ 00/p01/ 01/p02/ 02/p03/ 03/p04/ 04/p05/ 05/p06/ 06/p07/ 07/
p08/ 08/p09/ 09/p10/ 10/p11/ 11/p12/ 12/p13/ 13/p14/ 14/p15/ 15/
p16/ 16/p17/ 17/p18/ 18/p19/ 19/p20/ 20/p21/ 21/p22/ 22/p23/ 23/
p24/ 24/p25/ 25/p26/ 26/p27/ 27/p28/ 28/p29/ 29/p30/ 30/p31/ 31/
p32/ 32/p33/ 33/p34/ 34/p35/ 35/p36/ 36/p37/ 37/p38/ 38/p39/ 39/
p40/ 40/p41/ 41/p42/ 42/p43/ 43/p44/ 44/p45/ 45/p46/ 46/p47/ 47/
p48/ 48/p49/ 49/p50/ 50/p51/ 51/p52/ 52/p53/ 53/p54/ 54/p55/ 55/
p56/ 56/p57/ 57/p58/ 58/p59/ 59/p60/ 60/p61/ 61/p62/ 62/p63/ 63/
p64/ 64/p65/ 65/p66/ 66/p67/ 67/p68/ 68/p69/ 69/p70/ 70/p71/ 71/
p72/ 72/p73/ 73/p74/ 74/
-----
10.00000 10.67128 11.34256 12.01384 12.68513 13.35641 14.02769 14.69897
-0.30103 -0.13086 0.03930 0.20947 0.37963 0.54980 0.71996 0.89013
1.06030 1.23046 1.40063 1.57079 1.74096 1.91113 2.08129 2.25146
2.42162 2.59179 2.76195 2.93212 3.10229 3.27245 3.44262 3.61278
-----/ ISPP= 1 / ISPB= 1 /-----/ S1= 1 / DATE= 12:09:05
-11.64510 -11.66588 -11.69610 -11.71692 -11.74369 -11.74369 -12.74277 -12.74277
```

partition  
specification



unresolved child  
partition level  
#02

# adf11 format class extensions

---

<u>class index</u>		<u>type</u>	<u>content</u>
1	acd		effective recombination coefficients
2	scd		effective ionisation coefficients
3	ccd		CX recombination coeffts
4	prb		recomb/brems power coeffts
5	prc		CX power coeffts
6*	qcd		base meta. coupl. coeffts
7*	xcd		parent metastable coupling coeffts
8	plt		low level line power coeffts
9	pls		representative line power coefficient
10	zcd		effective charge
11	ycd		effective squared charge
12	ecd		effective ionisation potential

\* Only present with metastable resolved cases (1996 data)



# Useful codes and procedures

---

- *preview\_natural\_partition.pro*
- *xxdata\_11.for*, *xxdata\_11.pro* and *read\_adf11.pro* are all able to read the extended data classes and the partition information in the data sets
- The interactive series 4 code ADAS416 implements superstage compression and outputs a complete set of new (compressed) ADF11 datasets. See also *run\_adas416.pro*

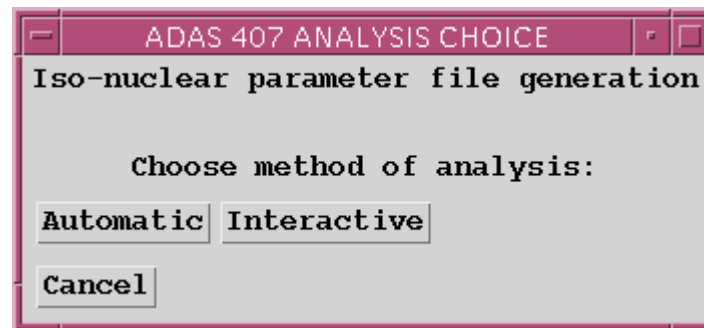
# Preparing baseline ADF11 data

---

- The most basic ADAS calculation of stage to stage ADF11 datasets for an element uses codes ADAS407 and ADAS408.
- ADAS407 processes mass produced ADF04 files for an element, extracting approximate form parameters (ADF03).
- ADAS408 uses ADF03 parameters to generate the ADF11 datasets.

# ADAS407 Analysis Choice

---



# ADAS407 Input

ADAS 407 INPUT

Ionising Ion File Details:-

Data Root: [/packages/adas/adas/adf04/]

Central Data User Data  Edit Path Name

Data File: [copmm#6/ls#c0.dat]

..

ls#c0.dat

ls#c1.dat

ls#c2.dat

ls#c3.dat

Ionised Ion File Details:-

Data Root: [/packages/adas/adas/adf04/]

Central Data User Data  Edit Path Name

Data File: [copmm#6/ls#c1.dat]

..

ls#c0.dat

ls#c1.dat

ls#c2.dat

ls#c3.dat

Edit the processing options data and press Done to proceed

Browse Comments Cancel Done

Choose  
adf04 file  
of ionising  
ion

Choose  
adf04 file  
of ionised  
stage

file name  
set  
automatically  
copss or copmm  
type

# ADAS407 Processing

ADAS407 PROCESSING OPTIONS

Title for Run

**Ionising ion information**  
Nuclear charge: 6 Ion charge: 0  
File: /packages/adas/adas/adf04/copmm#6/ls#c0.dat  
Browse Comments

**Metastable States**

INDEX	LEVEL	DESIGNATION
1	21522523	(3)P( 4.0)

Selections

**Ionised ion information**  
Nuclear charge: 6 Ion charge: 1  
File: /packages/adas/adas/adf04/copmm#6/ls#c1.dat  
Browse Comments

**Parent States**

INDEX	LEVEL	DESIGNATION
1	21522513	(2)P( 2.5)

Selections

**Matching Temperature**  
5.000E+03

1.000E+03
2.000E+03
3.000E+03
<b>5.000E+03</b>
1.000E+04
2.000E+04
3.000E+04
5.000E+04

Units: Kelvin

**Parameter Form**  
A = Van Maanen  
B = Mullane/Summers

Radiative Recombination  B

Dielectric Recombination  B

Collisional Ionisation  B

Total Line Power  B

Specific Line Power  B

**Transition Assignment**  
Metastable Index: 1  
Transition (Key:1-5 = Bundling Group)

INDEX	J	I	FIJ	WLN	Key
1	5	1	0.127	1605.1	1
2	7	1	0.230	1469.6	1
3	14	1	0.160	1284.7	1
4	17	1	0.081	1250.4	1
5	18	1	0.034	1249.6	1
6	22	1	0.062	1242.7	1

Specific line index: 2

Cancel Done

Edit the processing options data and press Done to proceed

Specify metastables of ionising ion (just ground for baseline)

Specify metastables of ionised ion (just ground for baseline)

Select approx. forms

Set matching  $T_e$  for power approx. fitting to exact power

Assign transitions to groups for approx. form fit.

# ADAS407 Output-graphics

ADAS407 OUTPUT OPTIONS

Input files: Parent ion: /packages/adas/adas/adf04/copmm#6/ls#c0.dat [Browse](#) [Comments](#)

Initial ion: /packages/adas/adas/adf04/copmm#6/ls#c1.dat [Browse](#) [Comments](#)

Select output option settings for display:  Graphics  Text

Graph Title

**Total power fit graph :-**

Explicit scaling

X-min:  X-max:

Y-min:  Y-max:

Specific line power fit graph

Explicit scaling

X-min:  X-max:

Y-min:  Y-max:

Enable Hard Copy  Replace

Select Device

File Name :

View graphs

View and reprocess to adjust fit

Finish up

# ADAS407 Output - text

ADAS407 OUTPUT OPTIONS

Input files: Parent ion: /packages/adas/adas/adf04/copmm#6/ls#c0.dat [Browse Comments](#)

Initial ion: /packages/adas/adas/adf04/copmm#6/ls#c1.dat [Browse Comments](#)

Select output option settings for display:  Graphics  Text

MAINBN Passing File  Replace

File Name :

ATOMPARS Passing File  Replace

File Name :

Text Output  Replace

File Name :

Advanced option

Parameter set output file

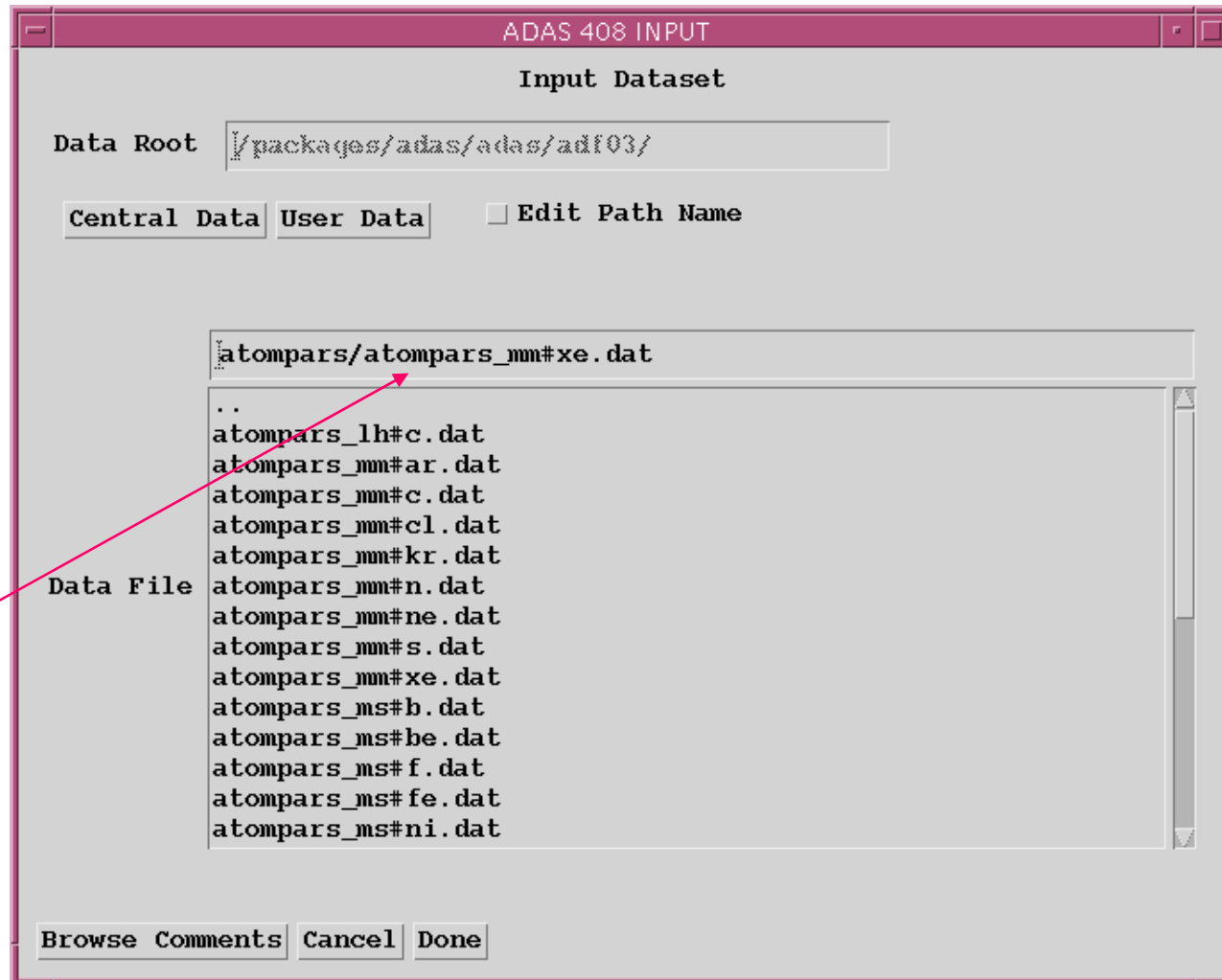
# ADAS407 Graph

Matching point





# ADAS408 Input



Select  
parameter  
file

# ADAS408 Processing

ADAS408 PROCESSING OPTIONS

Title for Run:

Data File Name:

Please input mass information:-

Impurity element symbol :

Impurity element isotopic mass:

Neutral hydrogen isotopic mass:

Please input soft X-ray filter information:-

Use a simple cut-off energy?

Energy of cut-off (eV) :

Current filter name :

Please enter electron temperature and density limits for scans

Electron Temperature (eV)	Temperature units:	Electron Density (cm <sup>-3</sup> )
Lower limit : <input type="text" value="1.0e0"/>	<input type="radio"/> Kelvin	Lower limit : <input type="text" value="1.00e+10"/>
Upper limit : <input type="text" value="1.00e+04"/>	<input checked="" type="radio"/> eV	Upper limit : <input type="text" value="1.00e+18"/>
No. of temps. : <input type="text" value="30"/>		No. of dens. : <input type="text" value="20"/>

(Note: equal logarithmic scaling of temperatures and densities is used)

Element ion range

Specify power filter

Temperature range

Density range

# ADAS408 Output

ADAS408 OUTPUT OPTIONS

Data File Name: /packages/adas/adas/adf03/atompars/atompars\_mm#xe.dat

Browse Comments

Please enter the year number for master passing files (two-digits): 3

Passing file template : /home/summers/adas/pass/XXX03#Xe.ev2000.pass

Text Output  Replace Default File Name

File Name : adas408\_paper.txt

Output written to file.

Set year

Automatic GCR file naming