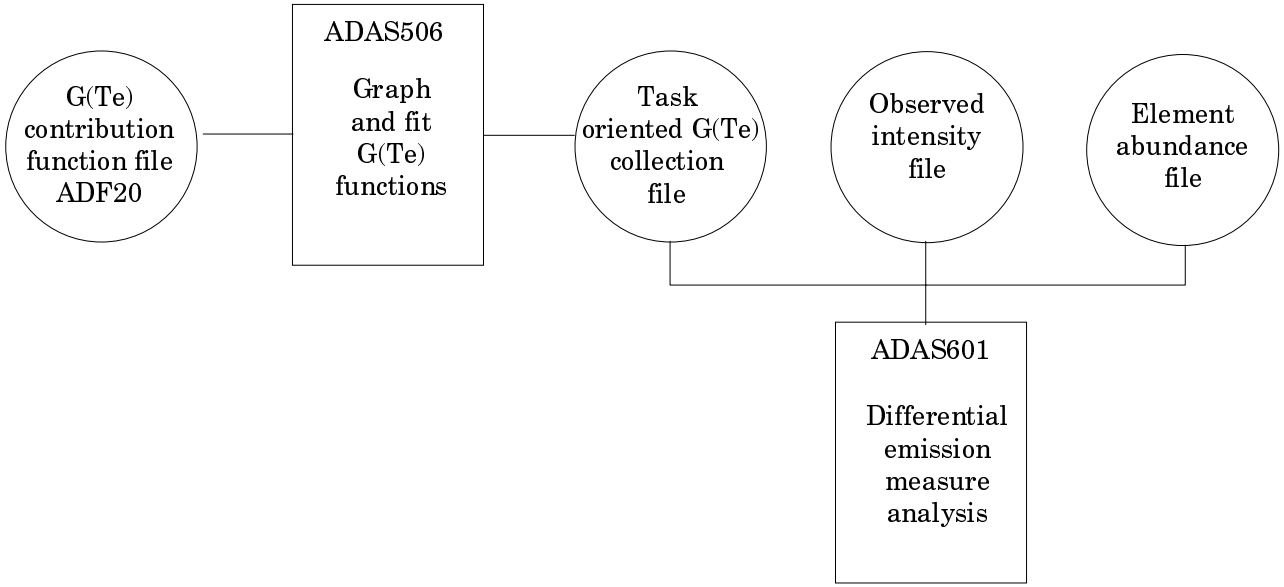
6. Differential emission measure

- Differential emission measure analysis
  - » Setting up a task orientated collection of G(Te) functions
  - » Setting up the experimental line intensity list
  - » Executing a differential emission measure analysis

DEM analysis



$$I_{u\to l} = \frac{1}{4\pi} A(Z) \int_0^\infty G_{u\to l}(T_e)\phi(T_e)\, dT_e$$

G(Te) functions

- The importance of emission functions, that is G(Te) functions, has been stressed for CDS spectral analysis.
- A G(Te) is obtained by combining an emissivity coefficient (from an excited population calculation) with equilibrium ionisation balance fractional abundances

G(Te) functions (contd.)

- Extensive collections of G(Te) functions have been prepared and included in the ADAS data base as class *adf20.*
- Code ADAS506 interrogates adf20 data interactively giving graphical display, tabulation at temperatures of choice and preparation of task orientated compact collections of G(Te) functions.

G(Te) functions (contd.)

- Start ADAS506 as follows
  - » *Move to ADAS series 5*
  - » *Click button for ADAS506*
- ADAS506 has the standard sequential three screen structure, namely *file selection*, *processing options* & *output options* screens

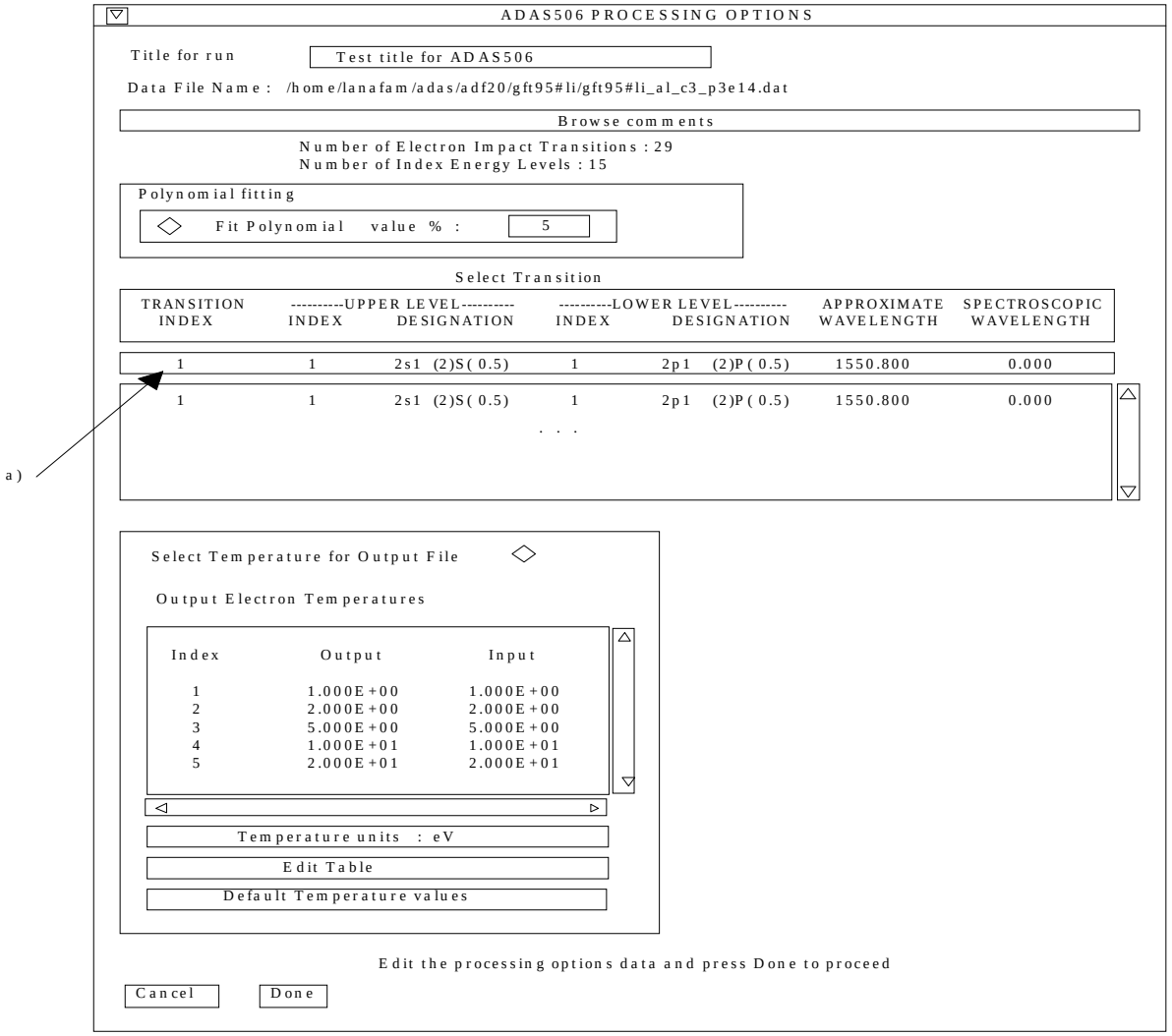
G(Te) functions (contd.)

- File selection
  - » *File selection follows the usual pattern.*
  - » *Data is stored in sub-directories of adf20 according to iso-electronic sequence and year number. (eg. ../adf20/gft95#li/)*
  - » *The individual data sets have additional mnemonics in the name to distinguish the producer, ion and pressure (eg. ../gft#li/gft#li_al_c3_p3e14.dat)*

G(Te) functions (contd.)

- Processing options
  - » *A line is selected by button click on it in the line list window*
  - » *Spectroscopic quality wavelengths are given when they have been entered into the souce data sets by hand.*
  - » *Temperatures of choice are entered in the drop down table editor.*

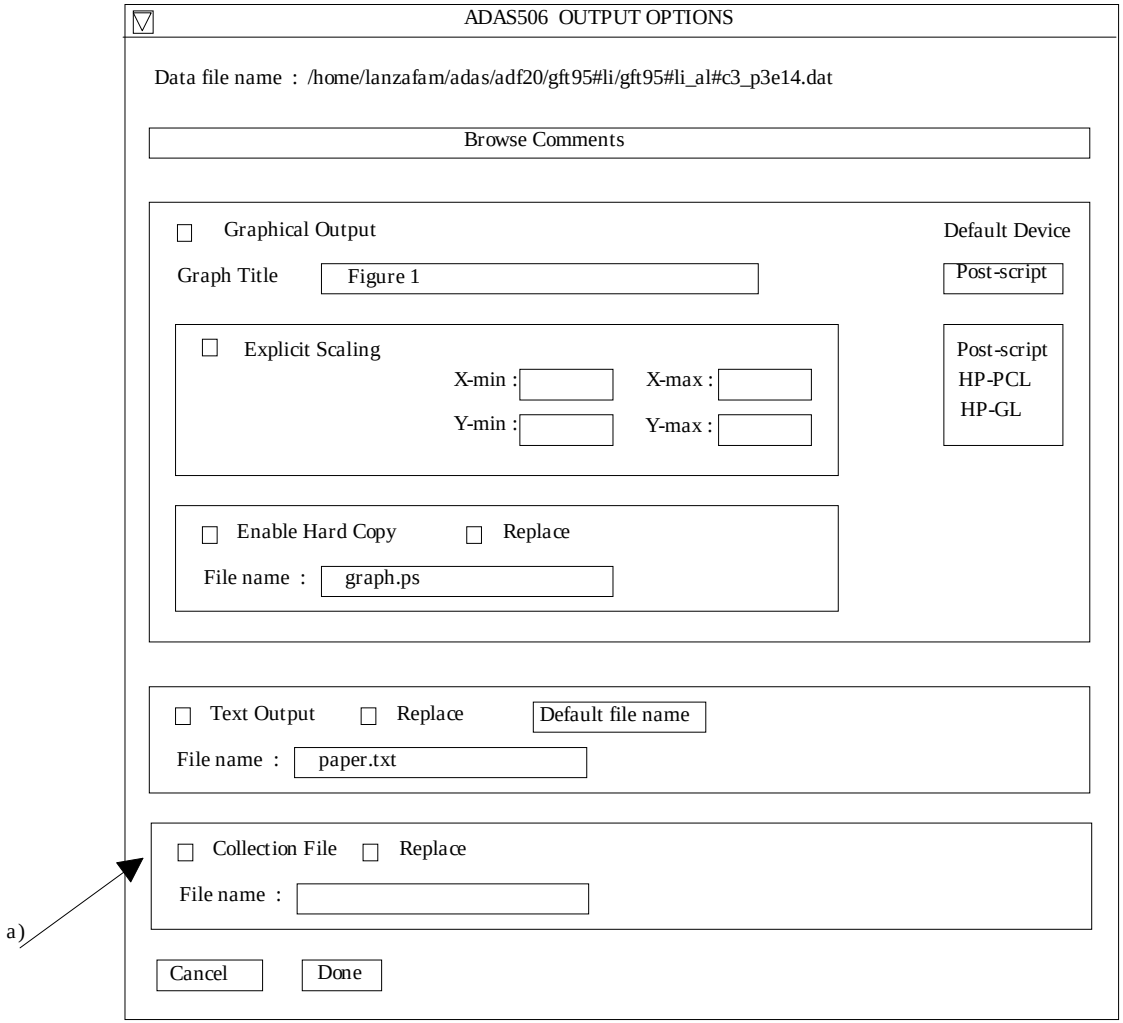
ADAS506 Processing



G(Te) funtions (contd.)

- Output options
  - » *The usual outputs are available but there is the addition of a 'collection file'*
  - » *Collection files are personal and usually linked to a particular observational task.*
  - » *A collection file contains the G(Te) function of a particular line only once.*
  - » *The collection file is correctly formatted for direct entry to D.E.M. analysis*

ADAS506 Output



a)

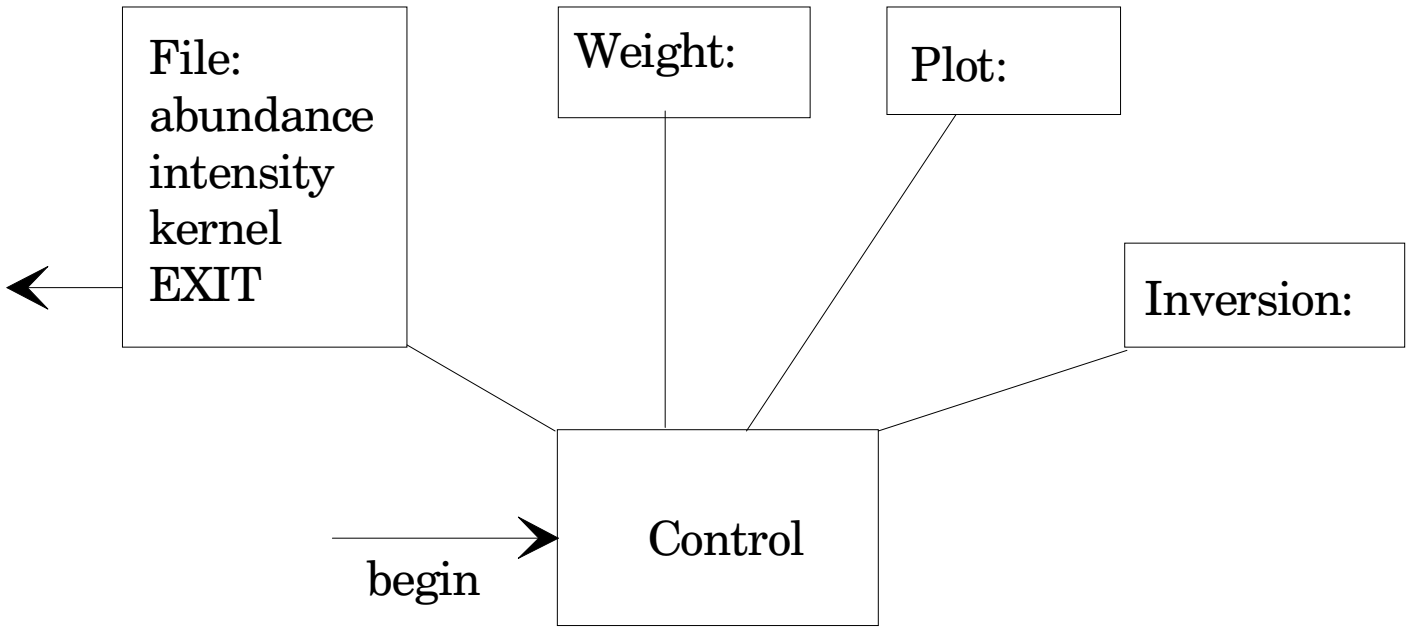
DEM analysis (contd.)

- Different organisational approach
- Uses a control window
  - » Not strictly sequential; actions include
    - – input of data sets
    - – changing of options
    - – evaluating DEM with current inputs and options
    - – examining input collection of G(Te)
    - – display and print out DEM
    - – prediction of unidentified line intensities

DEM analysis (contd.)

- Need input files of intensities and abundances and a kernel file.
  - » The name ‘kernel file’ is used in DEM for the G(Te) collection file
  - » The intensity file structure was decided with the CDS team. It is very flexible, taking account of blends etc.

DEM analysis (contd.)



DEM analysis (contd.)

PROGRAM : DEM V2.0

File Weight Plot Run

Abundance file :

/disk2/adas/adas/arch601/abundance/abund.alan

Intensity file :

/disk2/adas/adas/arch601/intensity/A.dat

Kernel file :

/disk2/adas/adas/arch601/kernel/goft.pmwa

Weight: from intensity data file

Status: ready

DEM analysis (contd.)

File

- read abundance file
- read intensity file
- read kernel file
- EXIT
- Quit

Weight

- use intensity
- use square root of the intensity
- get weight from data file

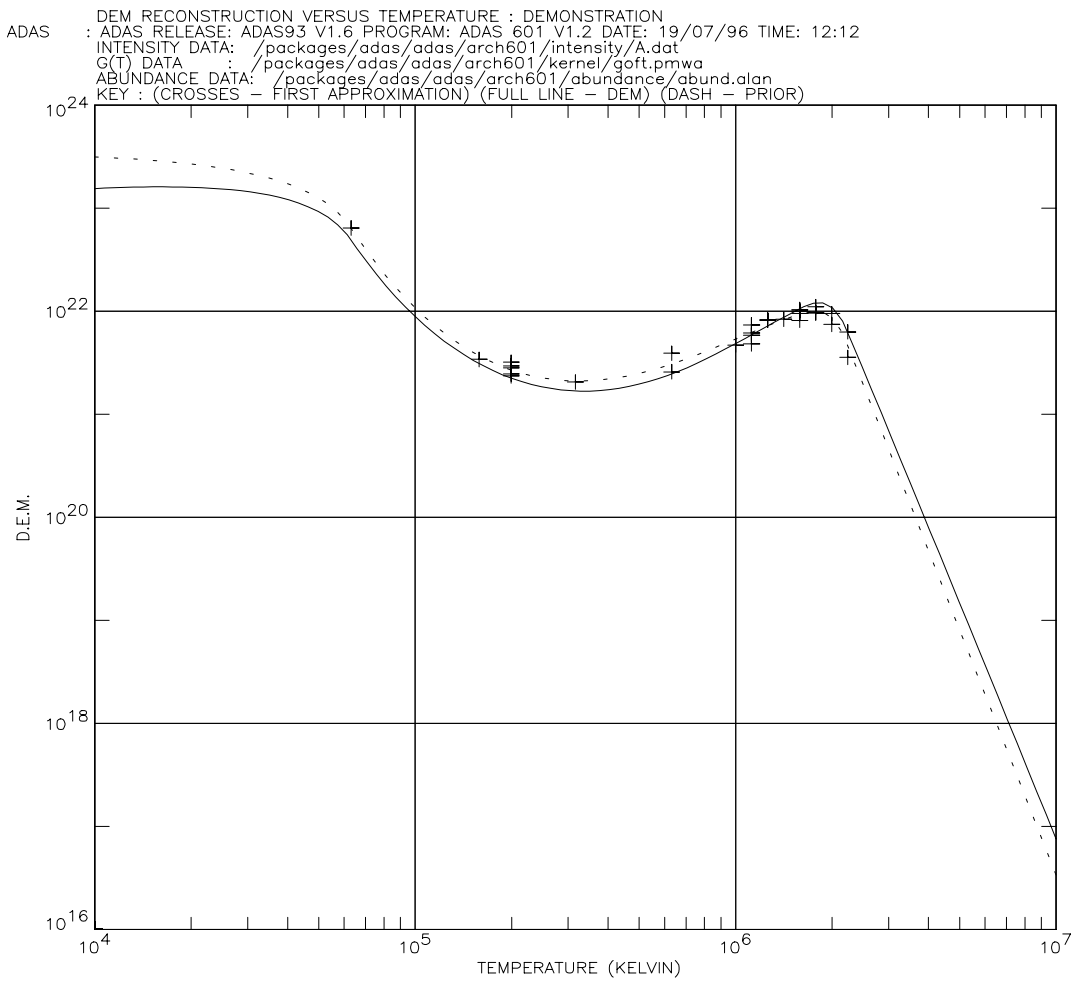
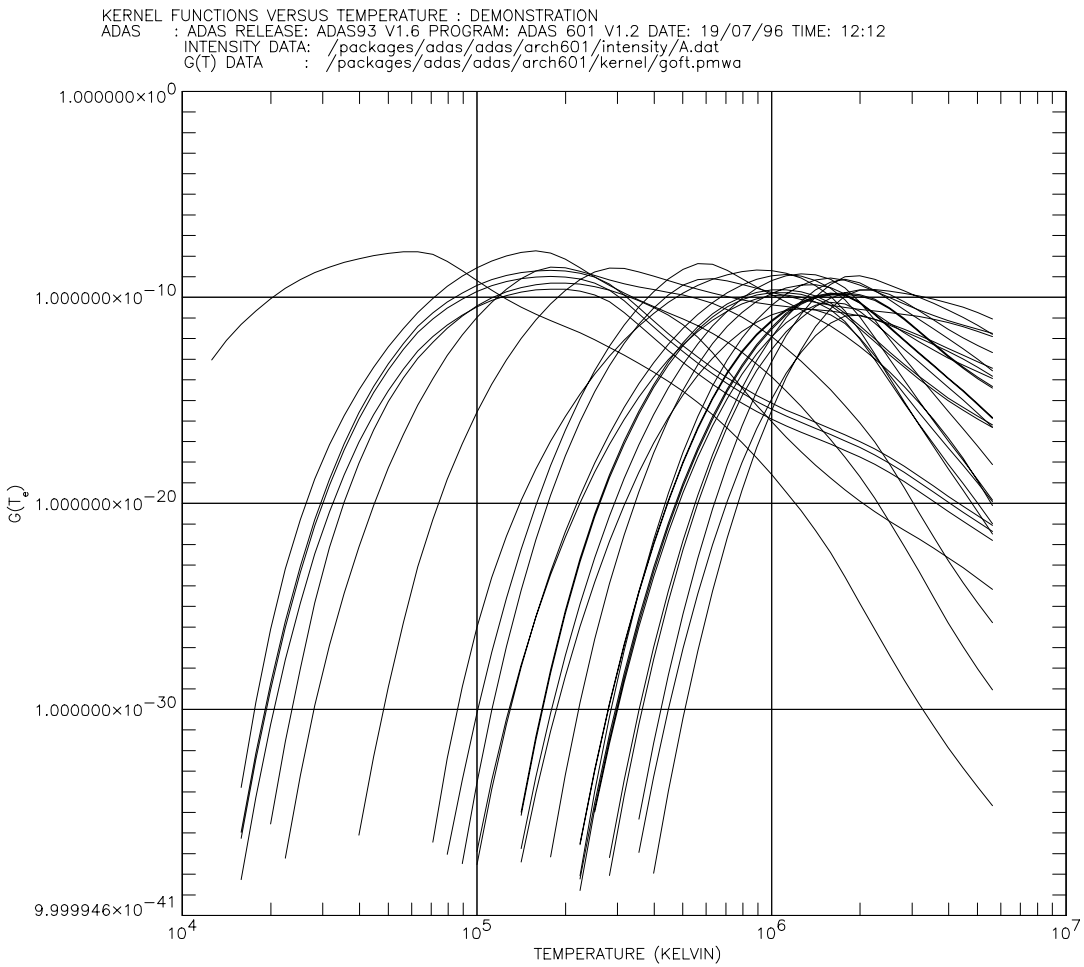
Plot

- graphical selection
- plot kernel
- plot DEM

Run

- execute integral inversion

DEM graph


DEM RECONSTRUCTION VERSUS TEMPERATURE : DEMONSTRATION
ADAS : ADAS RELEASE: ADAS93 V1.6 PROGRAM: ADAS 601 V1.2 DATE: 19/07/96 TIME: 12:12
INTENSITY DATA: /packages/adas/adas/arch601/intensity/A.dat
G(T) DATA : /packages/adas/adas/arch601/kernel/goft.pmwa
ABUNDANCE DATA: /packages/adas/adas/arch601/abundance/abund.alan
KEY : (CROSSES – FIRST APPROXIMATION) (FULL LINE – DEM) (DASH – PRIOR)
D.E.M.
10^{24}
10^{22}
10^{20}
10^{18}
10^{16}
10^{4}
10^{5}
10^{6}
10^{7}
TEMPERATURE (KELVIN)

Kernel graph