Graphical user interface

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Abstract: The graphical user interfaces *kopragui* and *specplot* are described. *kopragui* allows to edit *kopra* input files, start *kopra* jobs, and plot spectra and input profiles. *specplot* allows to comfortably and flexibly plot spectra.

1 *kopragui* - a useful tool for kopra users

1.1 Description

kopragui is a graphical user interface developed to support and simplify the use of *kopra* (**K**arlsruhe **o**ptimized and **p**recised **r**adiative transfer **a**lgorithm). The program offers the following opportunities:

- **Inspection, creation and modification of *kopra* input files.**

  Parameters of *kopra* input files can be inspected. As there are dependences between some input variables, it can be difficult to edit a *kopra* input file. The modification of a variable possibly implies changes of other variables. Especially, if extensive input files are to be created or modified, it might be difficult to keep an overview on the correctness of all parameters. *kopragui* allows to edit input files in an easy way. The user is lead through windows with all the input variables he has to enter. The values are checked for correctness, and, where possible, for plausibility.

- **Start of kopra**

  kopra can be executed as batch job in the *lsf* cluster. The *lsf* host can be selected automatically by *lsf* or user-defined. The user is informed about the result of the job by email.

- **Plot of spectra**

  spectra as produced by *kopra* and the residual difference of two spectra can be plotted.

- **Plot and manipulation of profiles**

  kopra needs several profiles as input, such as temperature, pressure, or gas vmr profiles. These profiles have an important influence on the creation of spectra by *kopra. kopragui* allows to plot one, or compare several profiles and to print them.
  Pressure, temperature, and vmr profiles can be manipulated sectionwise by arithmetic operations. In this way, profiles can be scaled and/or shifted by an additive offset.

- **Information**

  The *Info* button offers information about the use of *kopragui*, the latest modifications in *kopragui*, the location of a web site with informations about *kopra* and about the author.

1.2 Installation and call

kopragui has been developed in JAVA 1.2 under UNIX (SOLARIS 5.7). The program is delivered as compressed file. You need to have a version of JAVA's JDK 1.2 installed. (see http://java.sun.com/)

1.2.1 Installation

You need 1 MB free disk space to install *kopragui*. Install *kopragui* in the following way:

- Copy *kopragui.tar.gz* (788 361 KB) e.g into your home directory.
- `gunzip` kopragui.tar.gz

- `tar` xvf kopragui.tar
  A directory *kopragui* has been created in your working directory.
- `rm` kopragui.tar
- Insert the path of your kopragui installation directory in the shell script *kopragui*/*kopragui*:
  - `cd` kopragui
  - Load the file *kopragui* in a text editor and insert the installation directory:

    ```
    set kopragui_path= ...
    ```
- Insert the path of your JDK 1.2 directory in the same shell script:

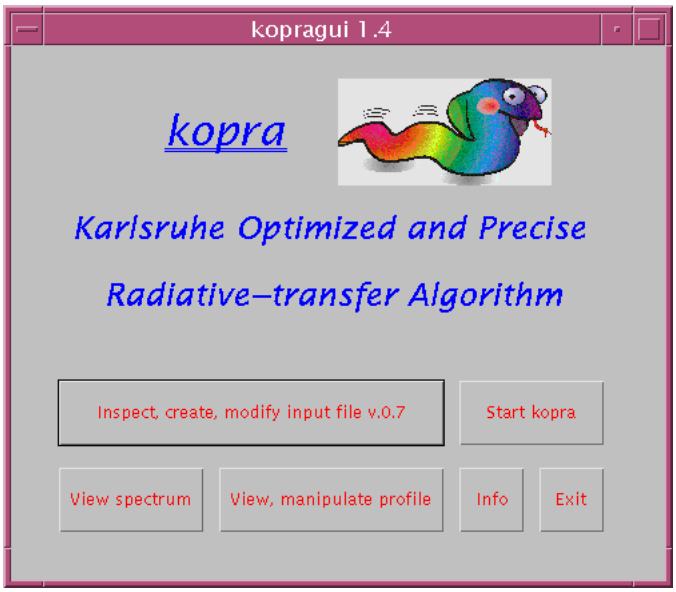
  ```
  set java_path= ...
  ```
- Insert the path of your *kopragui* installation directory in the path variable of your *.cshrc*, if you work with C shell or *.profile*. Alternatively, you can create the following link in your *bin*directory:

  ```
  ln -s <installation-directory>/kopragui/kopragui
                                    <HOME-directory>/bin/kopragui
  ```
- `rehash`

After the installation you can call *kopragui* in any directory.

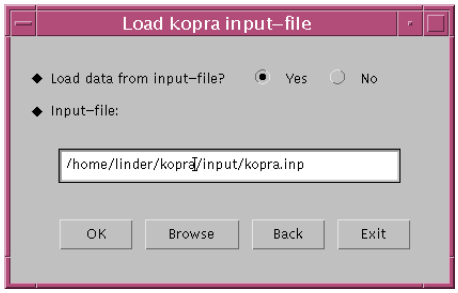
1.2.2 Call

After *kopragui* was called, the following window appears:



1.3 Inspection, creation and modification of *kopra* input files

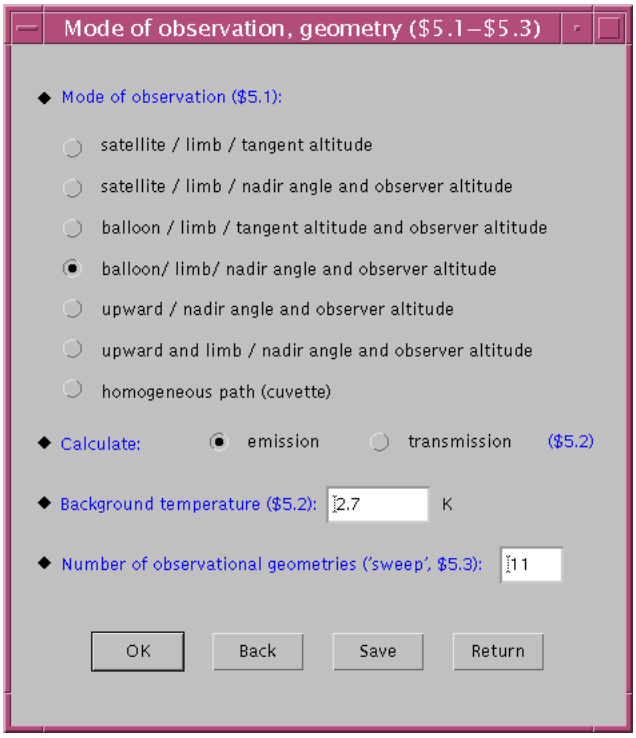
kopragui offers the opportunity to inspect the parameters of an existing *kopra* input file. Moreover a new input file can be created or an existing file can be modified. After pressing the button *Inspect, create, modify input file v.0.7*, the following window asks the user either to create a new *kopra* input file or to modify an existing one:



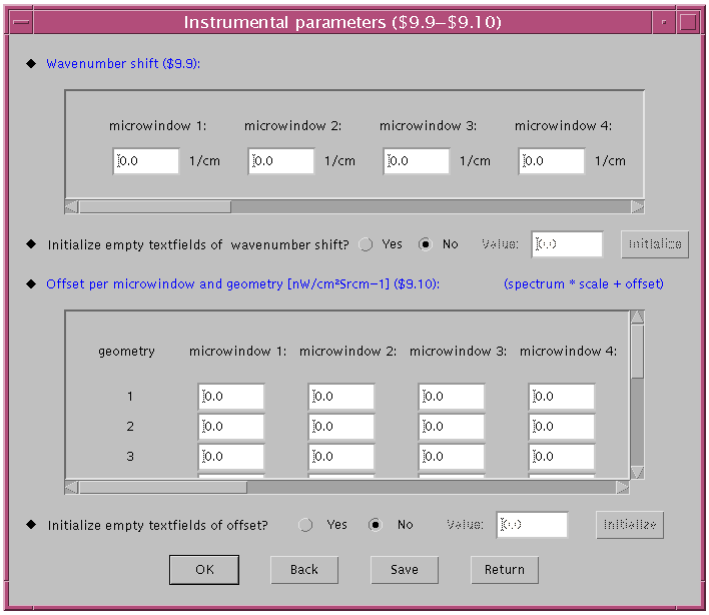
An input file which should be read can be of any version, but a file of version 0.7 is created (see paragraph *$* at the beginning of the file). In case of an error, a message with appropriate hints appears.

kopragui leads the user through a sequence of windows in which all necessary data have to be entered.

The window, shown below, is an example for such an input window. In the first option, the user has to choose the mode of observation, whether the measurement is made from a satellite, balloon, ground, ... This option corresponds to variable *$5.1* of the *kopra* input file. The next two options refer to the background temperature of the experiment (*$5.2*). If *emission* is selected, the background temperature has to be entered. The option *transmission* decides on the sign of *$5.2*. In the last textfield of this window, the user has to enter the number of observational geometries (*$5.3*).



The numerous vectors and matrices are integrated in panels with scrollbars. The following window refers to *instrumental parameters (\$9)*. First the vector *wavenumber shift per microwindow (\$9.9)* and then, the matrix *offset per microwindow and geometry (\$9.10)* has to be defined. Empty textfields can be initialized automatically with a user-defined value.



The data is checked for correctness, and, where it is useful, for plausibility. If an error occurs, a message with information helps the user to correct it. In some cases, *help* windows are available and can be called by pressing the *help* button. In most cases, the windows are self-explaining. The user is asked to enter only relevant data. Textfields for non-relevant data are blocked, and non-relevant windows don't appear.

At the beginning, the user can choose a window to start with. If he has to change a value for example refering to *computational accuracy (\$7)*, he can miss out the preceding windows and directly start editing the value which has to be modified.

The current state of the file can be saved from any window (button *Save*). In this case, the values belonging to the windows, which have not been confirmed by the *OK* button are **not** checked for errors.

The user has the possibility to go back from one window to the previous window by pressing the *Back* button.

It is always possible, to return to this selection window for choice of another input window or to quit (button *Return*).

If file names have to be entered, *kopragui* checks, whether these files exist and are

readable. A file browser supporting the search for files is available.

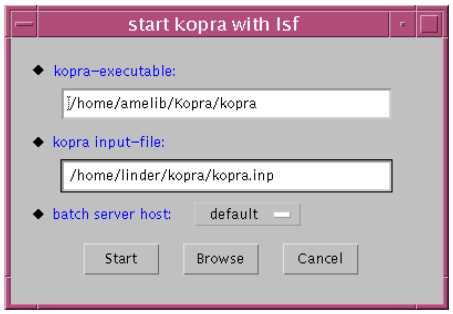
A date in the header for output files *($4.1)* is made actual automatically, if it is written in the correct format (window *Output files and directories*).

The newly created or modified *kopra* input file can be saved under a user-defined name. It has version *0.7*

1.4 Start of *kopra*

kopragui allows the user to start *kopra* with a given input file. If an input file has been edited recently, its file name is inserted automatically, but can also be changed. The *kopra* job is executed in the *lsf* cluster. The batch server can be selected automatically by *lsf* or defined by the user. The user is informed about the result of job by email as soon as the job has finished.

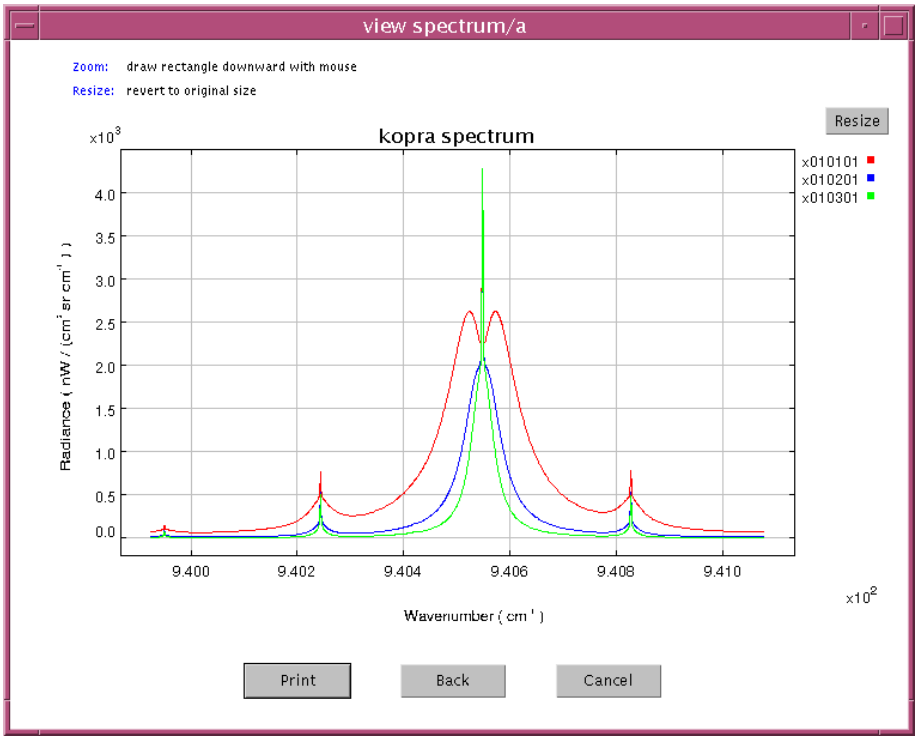
The next figure shows the control window for the execution of *kopra*:



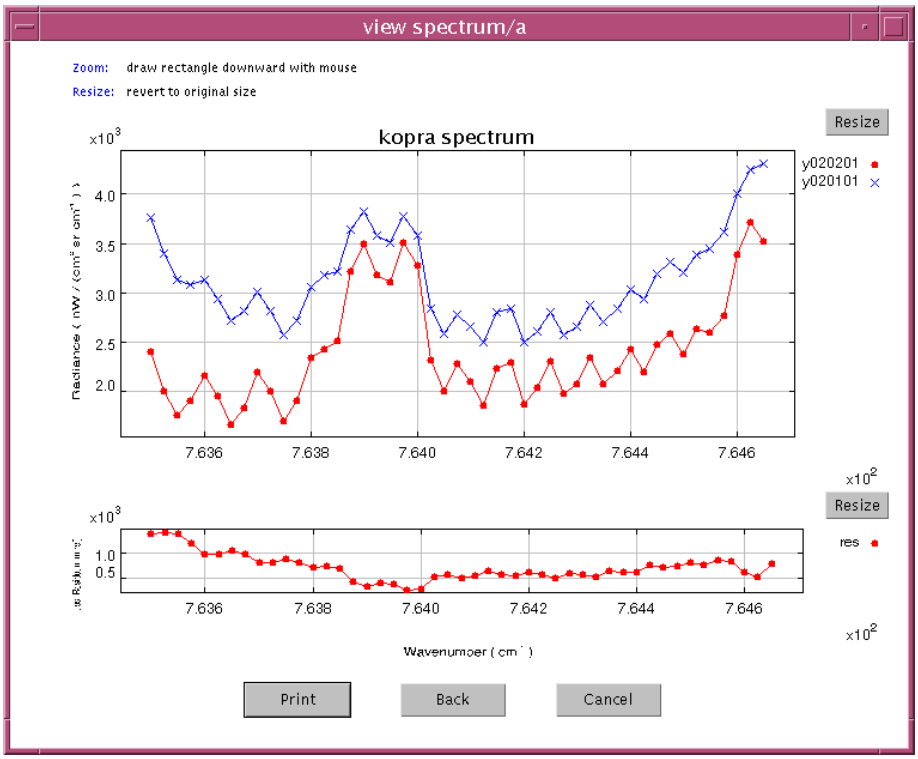
1.5 Plot of spectra

kopra spectra can be plotted and compared in a diagram. The user has the option to add the absolute or relative residual, if he wants to compare two spectra. The header of the plot and the curve labels can be edited. The axis labels can be chosen to be in german or english. The curves can be drawn with or without markers at each grid point. This makes it easier to distinguish several graphs in black and white prints. Parts of the spectrum/a can be zoomed interactively with the mouse.

The following figure shows three spectra in a single plot:



In the next diagram two spectra are compared and the absolute residual is added. The curves are plotted with markers.

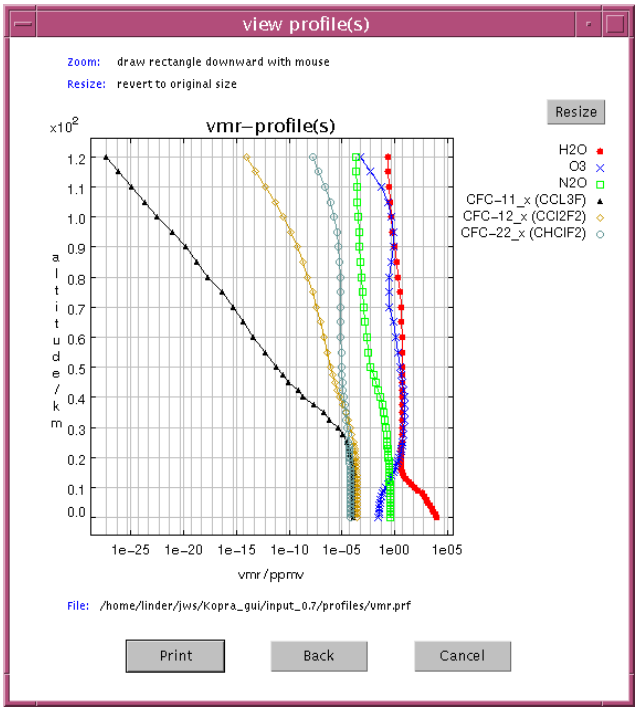


Alternatively, the IDL tool *specplot* can be called to plot *kopra* or *rfm* spectra.

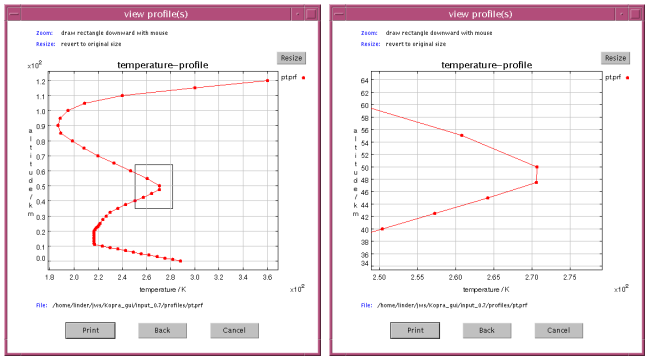
1.6 Plot of profiles

kopragui offers the opportunity to view one or serveral different profiles in a plot or to compare profiles of the same kind in different files.The profiles in a plot are drawn in different colors. Markers can be added at each grid point. Logarithmic axes can be chosen if it is useful.

In the following figure six different vmr gas profiles are plotted with logarithmic x-axis:



It is possible to zoom an area of the diagram by drawing a rectangle with a mouse button, as the next figure shows:



Profile plots can be printed or saved in postscript or encapsulated postscript format.

The following *kopra* profiles can be **plotted**:

- **pressure and temperature profiles**

  Several pressure or temperature profiles can be plotted and compared in a diagram. The pressure axis can be linear or logarithmic.

- **gas profiles**

  All gas profiles of a file can be plotted. Alternatively, gas profiles which are common to different files can be compared. The vmr axis can be linear or logarithmic.

- **vibrational temperature profiles**

  All vibrational temperatures of a file can be plotted in a diagramm. A kinetic temperature profile can be added to the plot.

- **aerosol absorption and scattering coefficient profiles**

  The aerosol absorption and scattering coefficients can be plotted for each microwindow and all altitude levels. Alternatively the profiles can be plotted for all microwindows and a specified altitude level. In this case, the corresponding wavenumbers are read from a *kopra* input file, which has to be specified.

- **isotope (relative) abundance profiles**

  The (relative) abundances of isotopes of a "line data" gas given in a file can be drawn in a plot, dependent on the altitude level. There is an option to extrapolate the graphs to given altitude borders. This may be useful if the abundances are given for one or only few altitude levels. The axis for the abundances can be linear or logarithmic.

- **pressure and temperature gradient profiles**

  The pressure and temperature latitude and longitude gradients can be plotted in a diagram. The pressure axis can be linear or logarithmic.

- **gas gradient profiles**

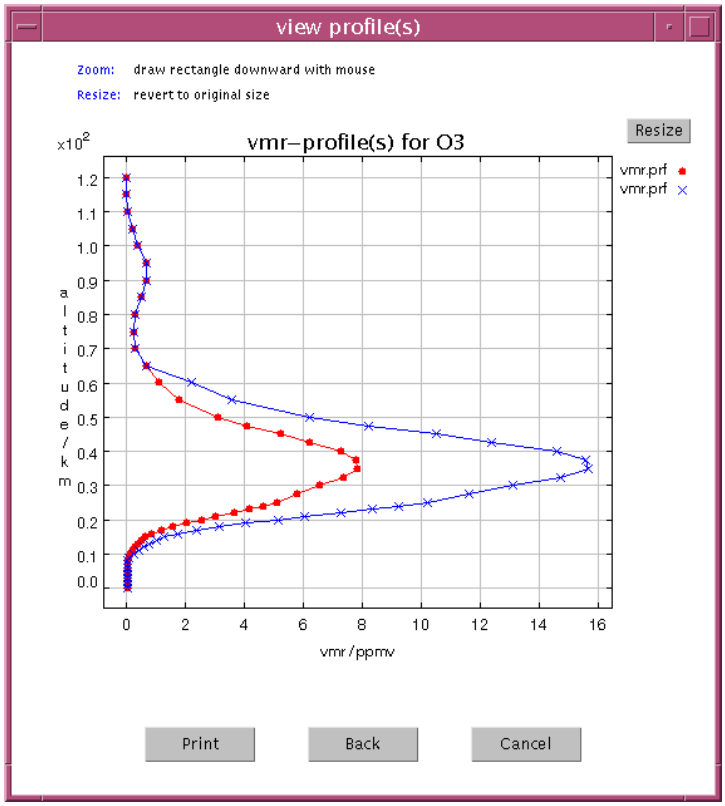
  The latitude and longitude gradients of a gas can be plotted.

- **vibrational temperature gradient profiles**

  The latitude and longitude vibrational temperature gradients of a state can be plotted.

It is possible to **manipulate** pressure, temperature and vmr profiles sectionwise with arithmetic operations +,-,*,/. Using this option, profiles can be scaled and/or shifted by an additive offset. The manipulated profiles can be saved.

The next figure, shows an O_3 profile which has been multiplied by 3 between 10 and 60 km and the original O_3 profile in a plot:



1.7 Information

kopragui offers information about the following items:

- use of *kopragui*
- latest modifications of *kopragui*
- a web site with informations about *kopra*
- the author

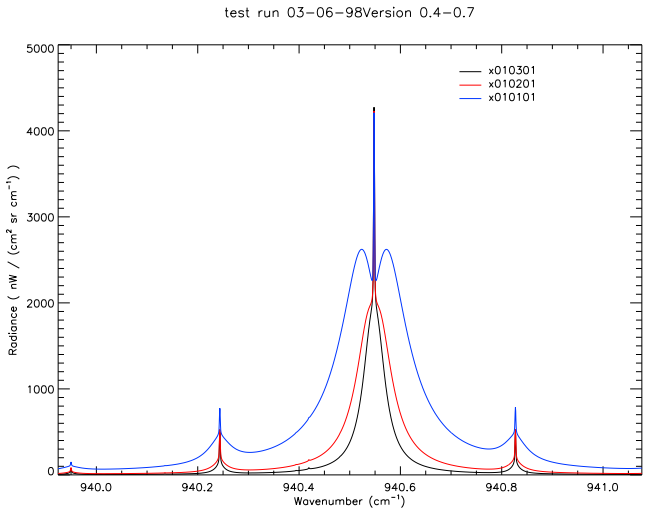
2 *specplot*

specplot is an interactive plot tool for *kopra* and/or *rfm* spectra:
specplot offers the following opportunities:

- **plot of *kopra* and/or *rfm*spectra**

  Up to 15 spectra can be plotted in one diagramm. The file selection box allows to select several spectra at a time. The maximum data range is set automatically.

  The figure below shows three spectra in a plot:



- **selectable curve attributes: colors, linestyles, markers,...**

  The curve attributes are initialized, but can be set individually by the user. The curves can be distinguished either by color or by linestyle. They can be plotted with up to 15 different *colors*.

  The following *linestyles* are available:

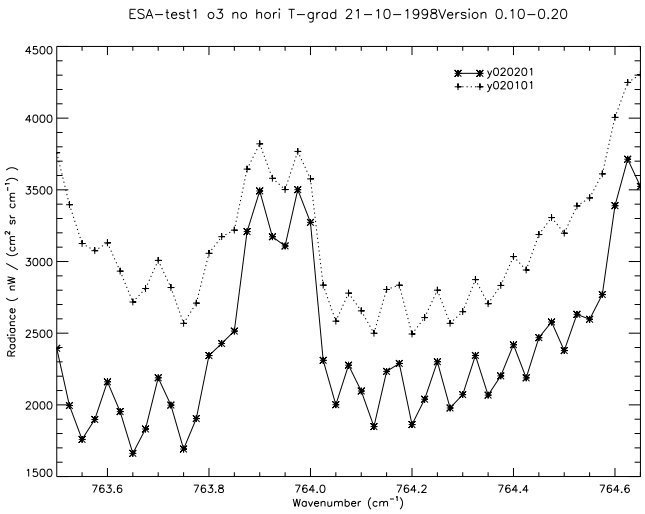
  solid (—), dotted (.....), dashed (_ _ _ _), dash dot (_._._._), dash dot dot dot (_.._.._..), long dashes (– –)

  Markers can be set at each gridpoint. The following markers are available:

  plus sign (+), asterisk (*), period (.), diamond, triangle, square, x, circle (o).

  The next figure shows two spectra with different linestyles and markers at each grid point:

- **plot of absolute or relative residual**



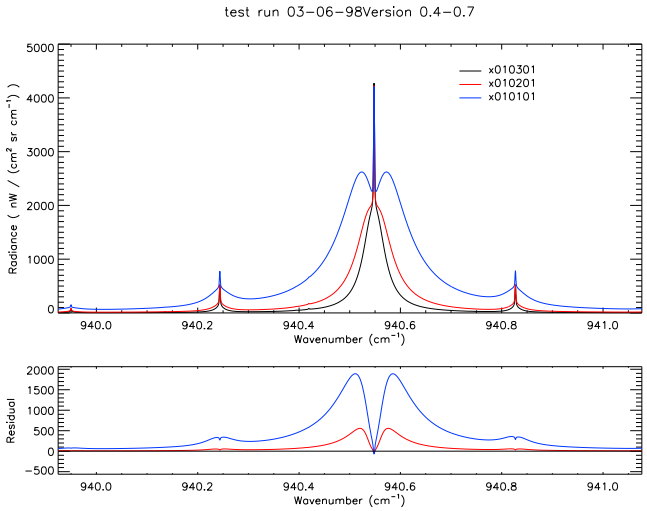
The residual is calculated and added to the plot. The user has the choice to plot the absolute or relative residual. Alternatively, the plot of residuals can be switched off. The first spectrum is reference spectrum. The residuals are calculated according to the rule:

absolute residuals: $(n - ref)$
relative residuals: $(n - ref)/ref$

where ref is the first spectrum and n is the nth spectrum.

If the compared spectra have different gridpoints, specplot uses linear interpolation to calculate the residual. A zero line can be added to the residual.

The figure below shows three spectra with their absolute residuals:



- **zoom**

  Parts of the plot can be zoomed with the mouse according to the following rule:

  - A rectangle is drawn with the *left* mouse button, indicating the area, which should be zoomed.
  - The position of the rectangle can be changed with the *middle* mouse button.
  - The zoom command is send with the *right* mouse button.

  The zoom is enabled by default, but can be disabled by clicking the corresponding option in the menu *zoom*.

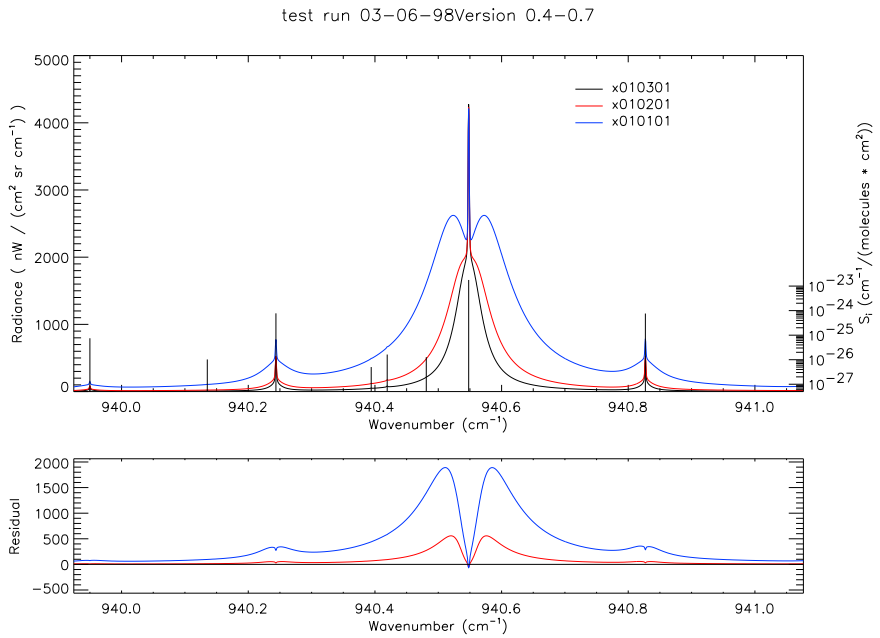
- **changeable legend parameters**

  The legend entries correspond to the file names of the spectra, but can be modified. The positions of the legend entries can be set individually.

- **plot of line intensities**

  Lines of gases (HITRAN line data gases, non-HITRAN line data gases, pseudo line data gases) can be added to the plot. The line intensities are drawn according to a seperate logarithmic y-axis on the lower right side of the diagram. The number of lines can be reduced by setting a threshold intensity, so that only lines with greater intensities will be plotted. The data is read from a database.

The figure below shows three spectra with CO_2 lines in the given wavenumber range:



- **hard copy**

  The plot can be saved in one of the following formats:

  postscript (ps), encapsulated postscript (eps) or encapsulated postscript interchange format (epsi).

- **print**

  The plot can be printed on paper or transparency in black+white or color.