A quick guide to XSpec at the SEST

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Contents

1 Introduction

1.1 What is XSpec ?

XSpec is a spectral line reduction package for astronomy which has been developed by Per Bergman at Onsala Space Observatory. The package works with *FITS* files and contains some excellent mapping routines. Using XSpec provides a fast and easy way of displaying SEST data.

1.2 How to obtain XSpec

XSpec is available from the following ftp site:
ftp://yggdrasil.oso.chalmers.se/pub/xs

1.3 XSpec License

2 General

2.1 How to start XSpec

XSpec is available on *Puppis* and *Vela*.

To run XSpec on Puppis open a shell and type *xspec*.

XSpec can be started on Vela during observations by clicking the *XSpec* button in the Pegasus tool bar.

It is advised to only use XSpec on Vela for displaying a single spectrum or small maps. If XSpec is used intensively during observing then it may interfere with the telescope communications and interrupt observations. The Vela console should be kept as free as possible so observers don't miss information relating to telescope control and observing.

2.2 How to load a single data file

1. Use *File menu – Open FITS – Open Single*. An *Open single FITS file* window should appear. In this window type in the name of the specific file you wish to look it in the *Selection* box and then click *Open*. Alternatively, double click on the file listed in the *Files* box.

It's a great help that specific types of files (s,S,m,M.fits) can be listed in the *Files* box by using the *Filter* option.

The data should be displayed in the XSpec window. Along the left on this window is information on the current data file. Information on each channel can be obtained by moving the cursor in the display area and reading *Cursor info*.

2.3 How to load multiple data files

1. Use *File menu – Open FITS – Open multiple (map)*. Choose the type of spectra (s,S,m,M.fits) by using the *Filter* option and then click *open*.
2. A list of files will appear in the *Read multiple FITS files* window. In this window select *Set filter* and choose from the filter options. The button next to the filter options must be pressed. Click *apply* and *dismiss*.
3. In the *Read multiple FITS files* window click *Filter/Sort*.
4. To select a sequence of files in the *Read multiple FITS files* window click the left mouse button on the first file and drag it over the desired files. Alternatively, use the *Select all* button.

5. Select *Graph menu – Viewing modes – Multiple spectra* to display the data.

Multiple data at the same position will be displayed on the same axis. For data that is part of a map the spectra will be displayed on a grid.

2.4 How to alter the Display

Use *Graph menu – Change scales* to change the x- and y-axis range.

To display the scan number use *Graph menu – Type of labels* and select *Scan number* from the *Type of top label* options.

To zoom-in on a section of the profile, click the left mouse button and drag it over the desired region. To zoom-out make sure the cursor is in the *XSpec* window and type *u*.

2.5 How to print

XSpec requires *pgplot* libraries for printing. Printing directly to the printer from Vela is disabled. Please use Puppis.

Use *File menu – Print Postscript file* to print directly to the printer.

Use *File menu – Save Postscript file* to create a postscript file.

If the printing command on Puppis is not working or the postscript files have no labels try typing *setenv PGPLOT_FONT /app/pgplot/grfont.dat* before starting XSpec.

2.6 How to save the data

Use *File menu – Save single FITS* to save files as individual *FITS* files.

Use *File menu – Save FITS cube* to create a fits cube from a map.

2.7 Troubleshooting

XSpec is in a development phase and so there are still a number of bugs. If XSpec crashes on Vela or Puppis then do the following;

1. Open a shell and type *ps -el | grep spec.*
2. Note the number listed in the fourth column (PID) and then type *kill -9 number*

If your keyboard doesn't have an *Alt* key try using the Extended Char key.

2.8 How to obtain further help

There is currently no User's Manual for XSpec. Some on-line help is available by selecting *Help* in the XSpec window. The friendly SEST staff may be persuaded to provide help with XSpec in return for chocolate.

3 Single Spectra

3.1 How to fit and remove a Baseline

1. Select a velocity range suitable for baseline fitting by clicking and dragging the middle mouse button over the desired region. The selected region should be indicated by a green line.
2. Select *Baseline menu – Add baseline box.*

A number of velocity ranges can be selected by repeating these two steps.

Select *Baseline menu – Remove baseline box* to delete a region.

3. Use *Baseline menu – Set polynomial order* to choose the type of function to use for the baseline fit. Select the desired type of function and polynomial order and then click *dismiss.*
4. Select *Baseline menu – Fit Baseline* to fit the function to the data.

5. Select *Baseline menu – Subtract polynomial fit* to subtract the fit from the data.

The parameters of the baseline fit are listed under *Baseline region* shown at the left of the XSpec window.

3.2 How to fit a Gaussian

1. To provide a guess for the Gaussian fit, firstly move the mouse to the peak of the profile. While clicking the right mouse button, move the mouse to the right or left until the desired width of the guess is achieved. A plot of the guess fit should appear in red.

2. Select *Gauss menu – Add Gaussian.* The parameters of the guess fit should appear in the *XSpec Gaussian Fits* window.

3. Select *Gauss menu – Fit Gaussians* to apply the fit. The values in the *XSpec Gaussian Fits* window will change from the initial guess values to the result of the fit.

Multiple Gaussians may be fitted by repeating Steps 1 to 3.

4. To subtract the fit from the data, select the fit number listed in the *XSpec Gaussian Fits* window and then select *Gauss menu – Subtract selected gaussians.*

Select *Gauss menu – Remove gaussian – All map Gaussian* to remove a Gaussian fit or guess.

Additional parameters of the Gaussian fit are listed under *Gaussian info* shown at the left of the XSpec window.

3.3 How to measure the Integrated Intensity

1. Define the velocity range over which the integrated intensity is to be measured by selecting a region with the middle mouse button. The selected region should be indicated by a red dashed line.

2. Select *Moment menu – Add moment Box.*

The parameters will be listed under *Moment region* at the left of the *XSpec* window.

3.4 How to measure the mean and rms values

1. Define the velocity range over which the mean and rms values are to be measured by selecting a region with the middle mouse button. The select region should be indicated by a green line. The values are printed as *Mean* and *Sigma* and are listed under *Baseline region* at the left of the *XSpec* window.

3.5 How to apply Smoothing

Two options for smoothing are:

1. Use *Reduction menu – Smooth scans.* Choose the type of smoothing function and the desired width in channels and then click *apply* followed by *dismiss.*

2. Use *Reduction menu – Redres scans.* Choose the type of weight function and the desired reduced resolution value.

In both cases the result will automatically be displayed.

4 Mapping and multiple spectra

4.1 How to fit and remove a baseline from multiple spectra

1. To display a single spectrum of a grid or of a multiple plot move the mouse over the desired position and right click. A single spectrum should appear from which a baseline can be removed by using the method described in Section 2.3.

2. To apply the baseline fit to the entire grid view the grid again by selecting *Graph menu – Viewing modes – Multiple spectra* and then type *Alt v*, to fit the baseline, followed by *Alt s*, to subtract the fit.

4.2 How to average a number of spectra at one position

1. Load the data as described in Section 3.1 and select *Graph menu – Viewing modes – Multiple spectra.*

2. Select *Reduction – Average all scans* and choose the type of weighting.

The average of the spectra will be displayed immediately.

4.3 How to produce an Integrated Intensity contour map

1. Load the data on a grid and apply baseline corrections using the methods described in Sections 3.1 and 3.2.

2. Select a single spectra and apply a moment box as described in Section 2.4.

3. Select *Graph menu – Viewing modes – Pos&Pos contour map.*

Use *Graph menu – Contours* to change the contour values, add a grey-scale and apply gridding interpolations.

4.4 How to produce a Postion-Velocity diagram

1. Produce an Integrated Intensity contour map as described in Section 4.3.

2. Mark the desired postion-axis line on the map by clicking with the middle mouse button to mark the start of the line and double clicking to mark the end of a segment or the end of the line. Once the line marking is complete click the left mouse button. The line should be indicated by a red dashed line.

3. Move the cursor to the line and type *v*. The postion-velocity diagram should automatically be displayed.

Type *Ctrl x* to remove the red dashed line from the display.

5 Examples

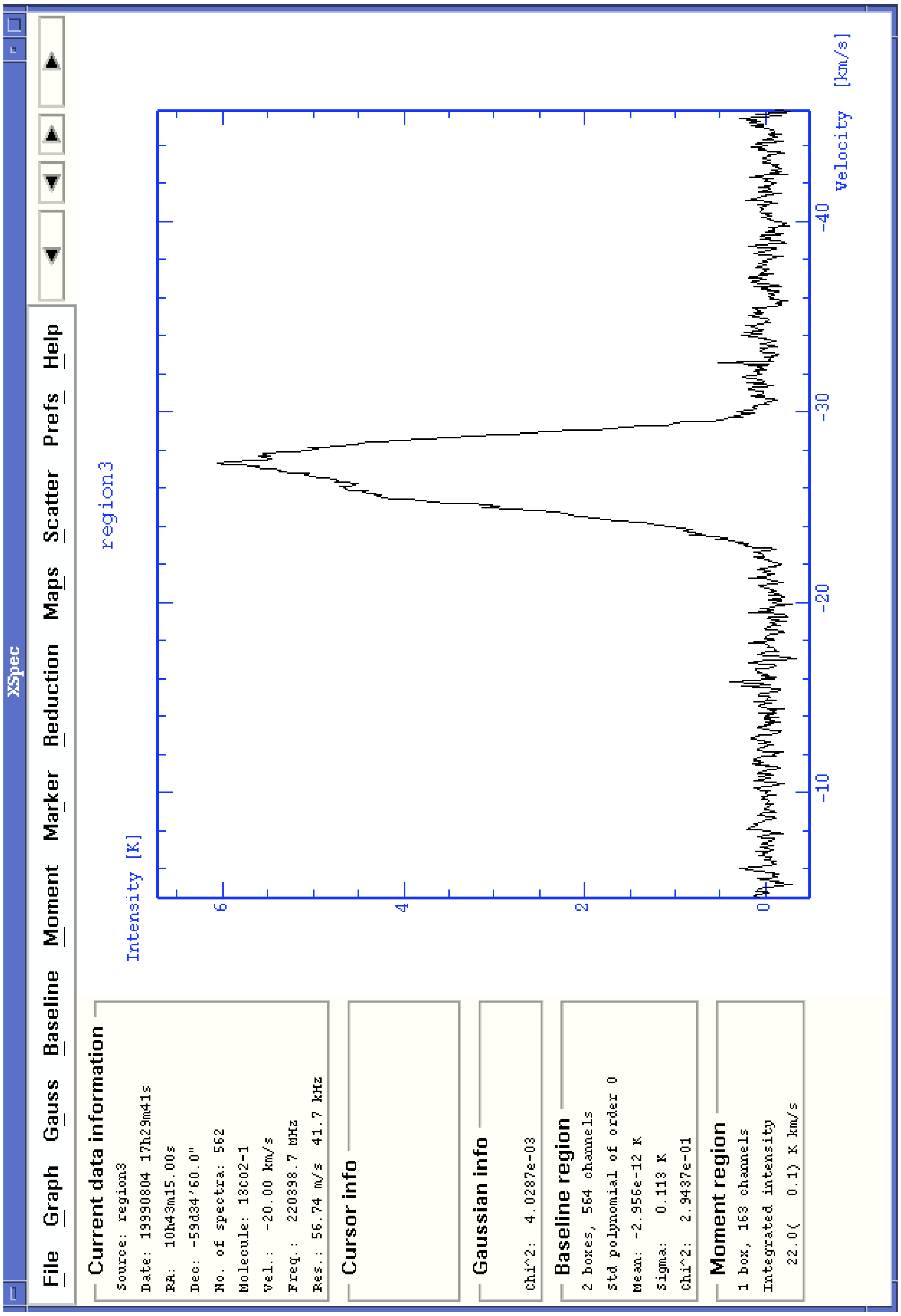

Figure 1: A snap-shot of the Xspec window displaying a single spectrum

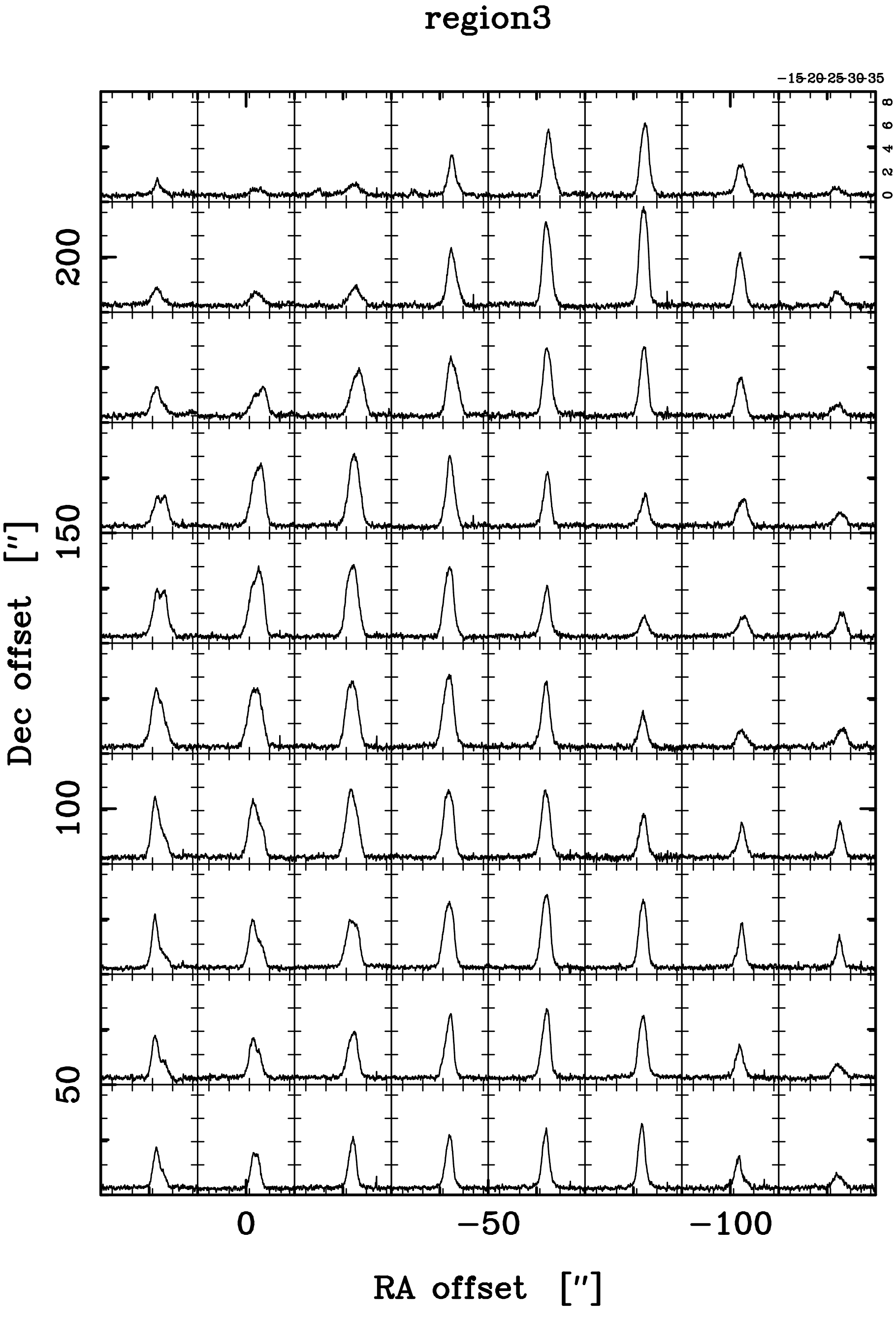

Figure 2: Multiple spectra at positions on a grid

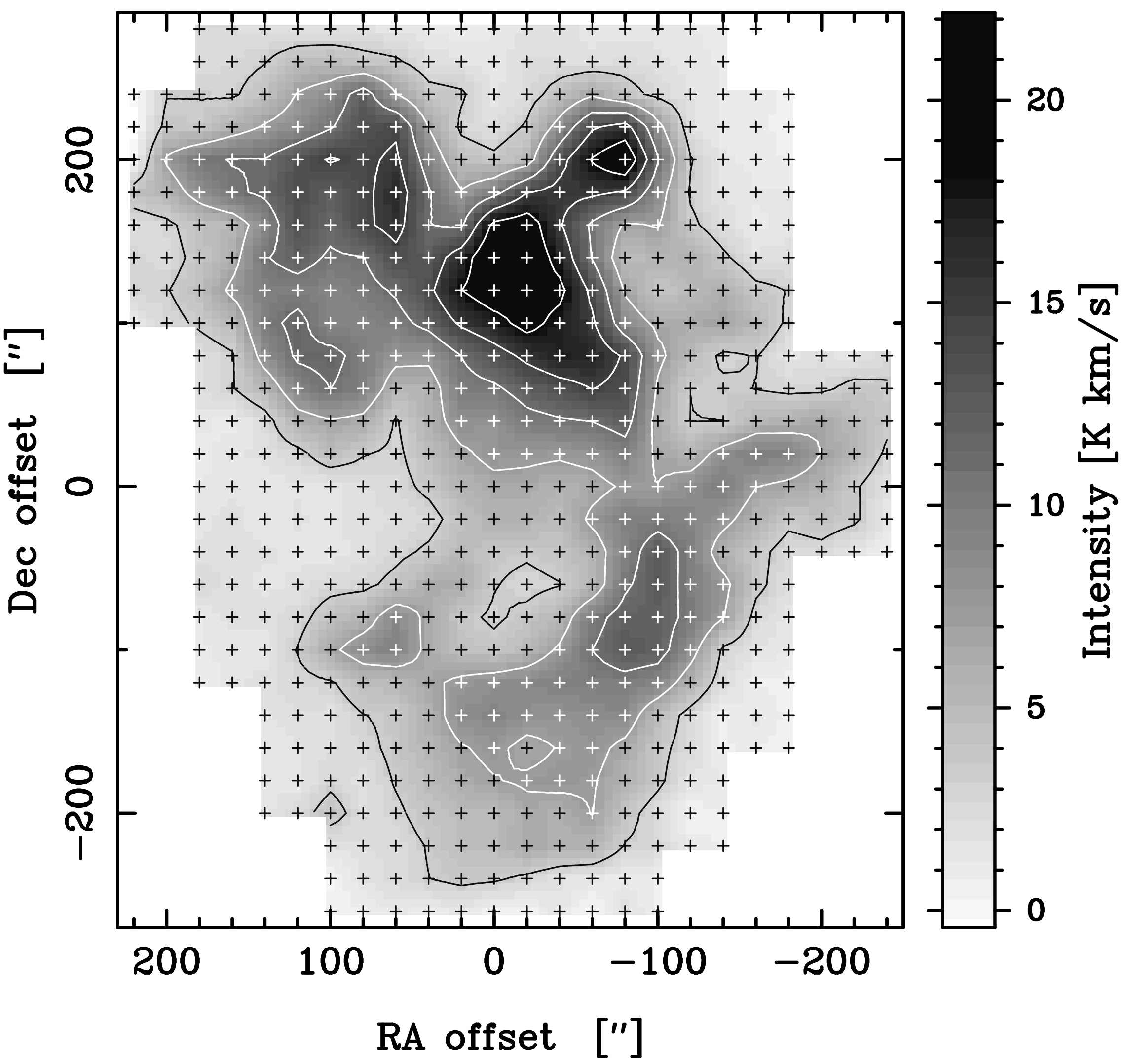

Figure 3: An example of an Integrated Intensity contour map

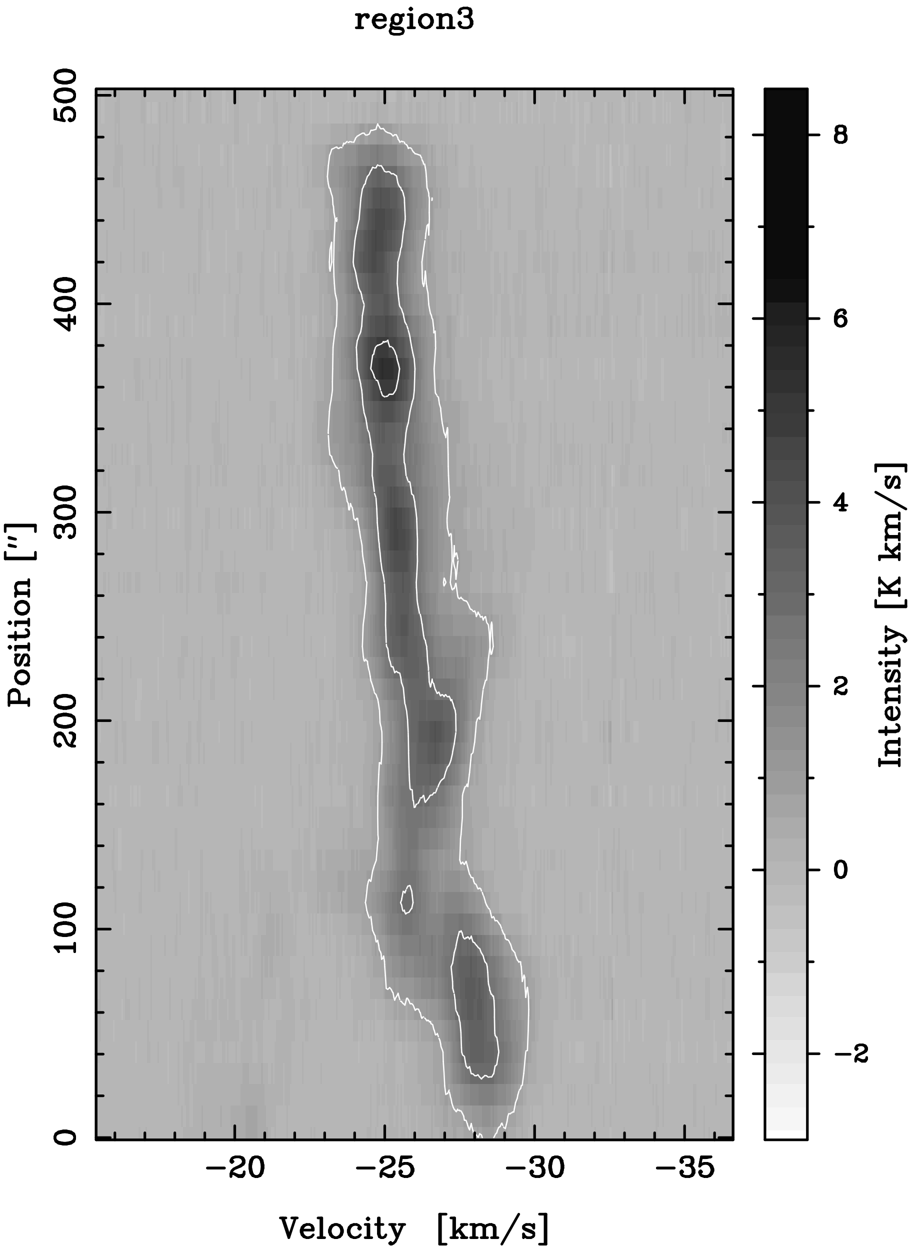

Figure 4: An example of a position-velocity diagram