The EIS Planning Tool User's Guide

Introduction

About This Guide

A planning guide will develop here over the coming weeks. As our understanding of the instrument grows, this guide will inevitably — and desirably — develop. This naturally lends itself to a TWiki platform, although a PDF version is planned for each significantly new version.

N.B. This is a work in progress. Please ignore until it is linked from the SolarB WebHome

Software Requirements

In order to run the EIS planning software, you will need:

1. `IDL`; the planning tool is developed under Linux, but works under Windows XP and Mac OS X, too.
2. an up-to-date installation of `SolarSoft`, including the EIS branch of the SSW tree.

Structure of a Study

An EIS *study* is composed of one or more *rasters*, each of which is defined in part by a *line list*. To those with past experience of preparing a *SoHO* CDS study, this nomenclature may well be familiar. However, it is worth explaining both for those who are new to the concept of studies, **and** for those new to EIS.

Line Lists

A line list is simply a list of wavelengths (in *angstroms*) at which the instrument is to observe, along with an identifier (or name) for that wavelength (typically, the ion species which produces it, but this can be customised). No information about the spectral range around

each wavelength is assumed.

For example, the core line list of EIS could be expressed as follows:

Name	Wavelength
Ca XVII	192.82
Fe XII	195.12
He II	256.32

This line list thus consists of three lines, with ion names for each.

Rasters

In EIS nomenclature, the term *raster* covers both possible forms of observation:

- **Scanning rasters**, which are made by building up slit (or slot) images across an area from west to east, thereby achieving spatial coverage in the west-east direction (the slit of EIS is oriented the north-south direction). Such observations can be thought of as having dimensions of *x*, *y* and λ.
- **Sit & stare** observations, which are successive slit/slot exposures at the same nominal position on the Sun. These are observations in *x*, *y* and *t*.

Altogether, the definition of a raster is determined by several parameters:

1. which line list to use
2. which slit/slot to observe through
3. the width of each spectral window
4. what exposure duration(s) should be used
    a. more than one exposure time can be specified: this is useful if, for example, more than one lines is to be observed, but one is much stronger than the rest.
5. whether it is a scanning or sit'n'stare raster
    a. if it is a scanning raster:
        i. how many steps to make in the *x* direction
        ii. how wide these steps should be
    b. if it is a sit'n'stare raster
        i. how many times the exposure(s) should be repeated
6. a unique name, or "acronym", such as `NRL_FLARE_EVAP`.

Studies

A study* can be most simply defined as consisting of one or more rasters grouped together in a particular order for some science objective.

For a study to be completely defined, we must specify

1. the order in which component rasters are to be run
2. how often each raster is to be repeated
3. what instrument triggers will be enabled/acknowledged
4. what compression scheme (if any) is to be used
5. a unique acronym, as is also true for rasters (see above)

(**Note that, to reduce confusion of terminology between "study" and "sequence" within EIS, the term "sequence" refers only to low-level engineering commands.*)

A Quick Word on the Timeline

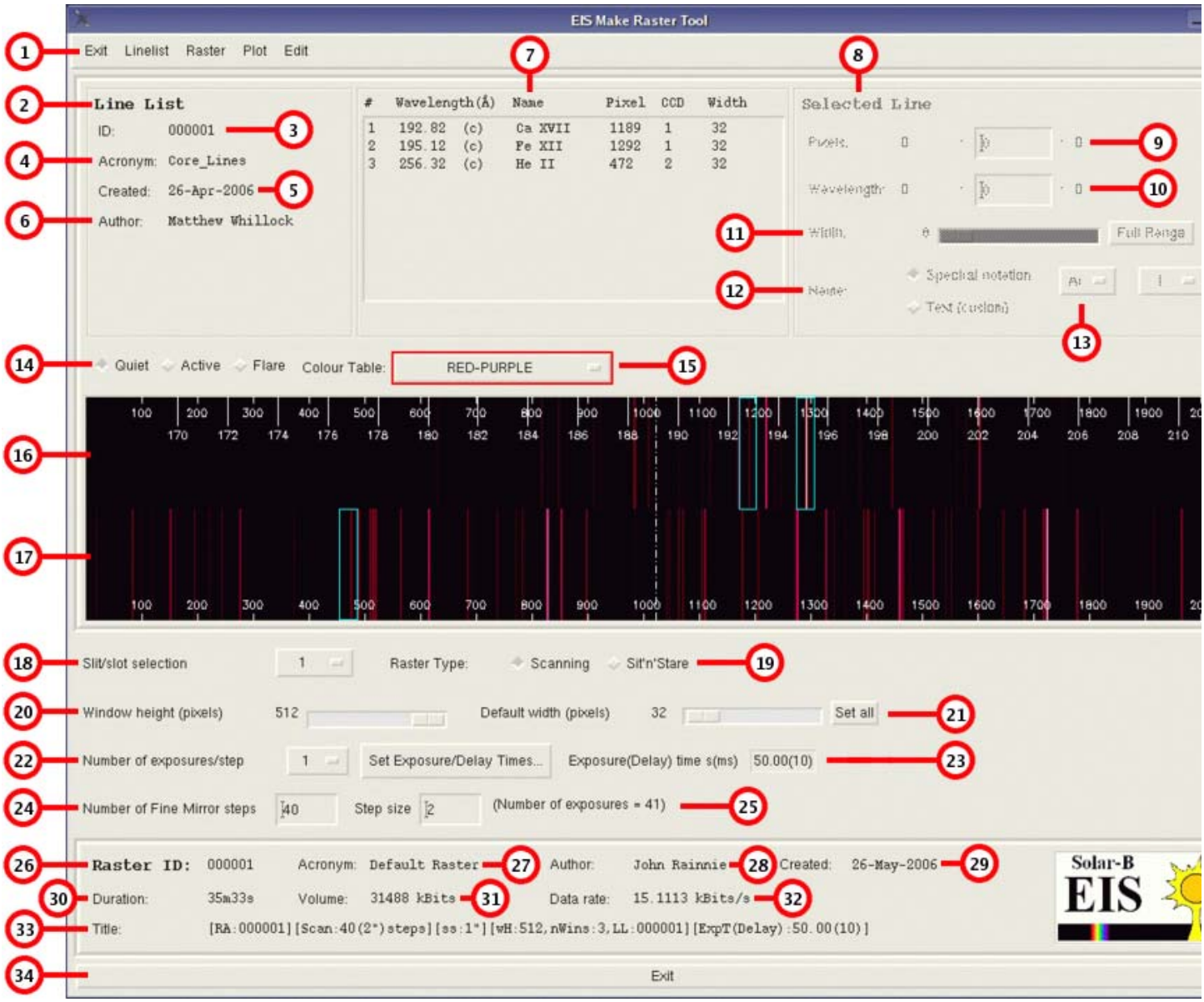
Again, this concept will be familiar to former CDS planners, but it is relatively self-explanatory to others, too.

The **timeline** is the interface which allows the scheduling of studies for a given 24-hour period. However, as this will currently only be used by EIS Chief Observers (COs), we won't go into it in this guide as yet.

Preparing a Raster

Starting the Raster Tool

Once you have started your `Solarsoft IDL` session, you can begin creating your raster by typing `eis_mk_raster`. You should now be presented with a graphical user interface (or "widget" in `IDL` speak) that looks something like this:



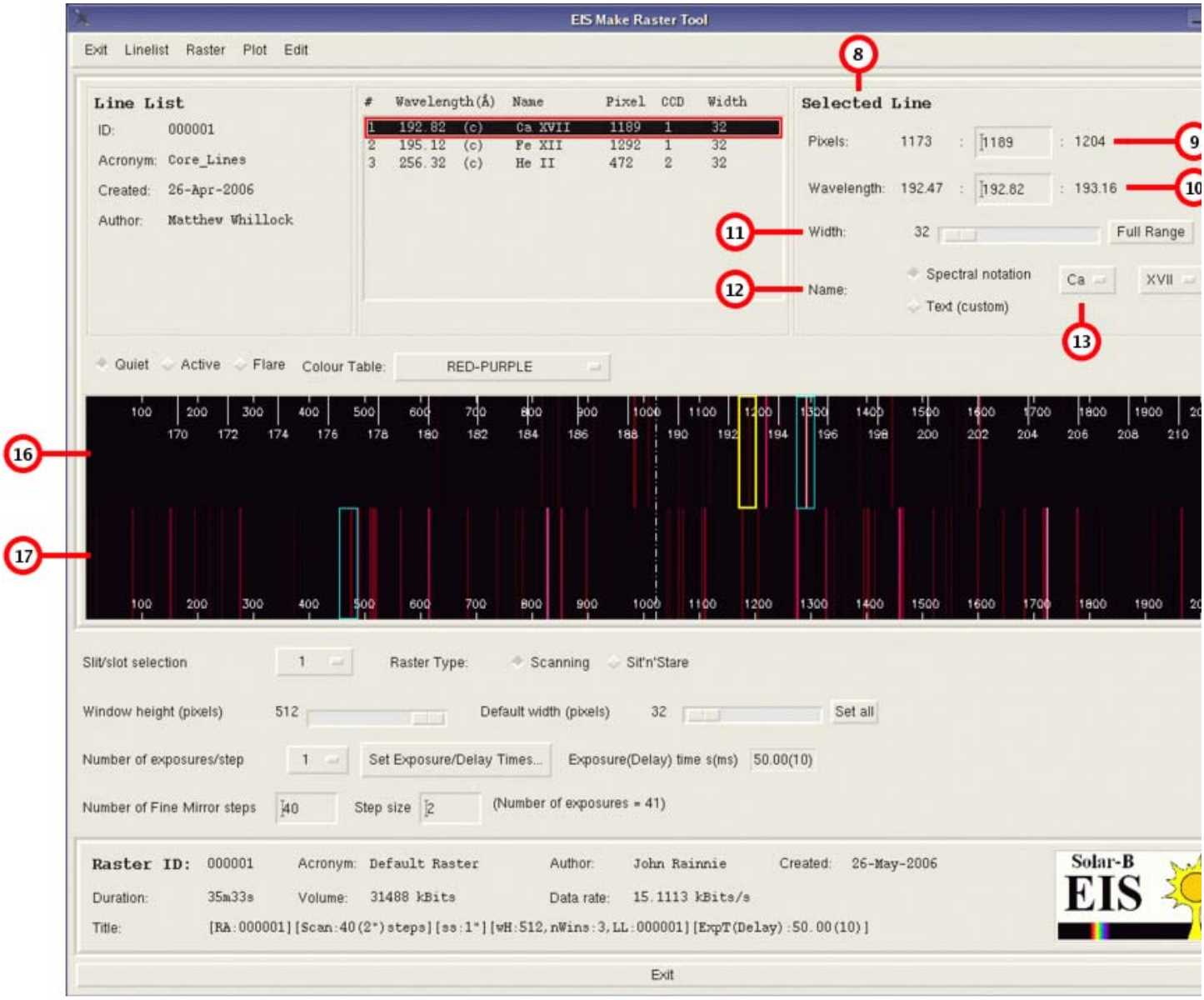
This represents a default raster (Raster ID #000001), which is loaded in when the raster tool is started. You'll see that it contains just the three core lines in its line list (7). On the left is the Line List area (2):

- (3) the **Linelist ID** (#000001)
- (4) the Linelist name, or **acronym** (`Core_Lines`)
- (5) the date the LineList was saved, and
- (6) the person who saved it. In this case, Matt.

The panel to its right (7) contains the most scientifically important information, namely:

- the wavelength of interest (in effect, this is the central wavelength of the spectral range or "window" that you're interested in)
- the name of that window (typically the ion of interest)
- the CCD on which each wavelength falls
  - (16) CCD 1: 170 - 210 Å
  - (17) CCD 2: 230 - 270 Å
- the width (in pixels) of each spectral window

The information on the far right, under **Selected Line** (8) is initially greyed-out because it is line-specific, and no line has yet been selected. Click on the first line in the list (`Ca XVII`), and you should see this area activated. You should also see the corresponding spectral window highlighted in yellow in the synthetic CCD 1 image (16) below.



The **Selected Line** section will now let you set a number of parameters related to the spectral window. The area labelled **Pixels** (9) lets you adjust the position of the centre of the window on the detector. Alternatively you can do this in wavelength (10). In either case, the numbers to the left and right of the field represent the lower and upper limits to the spectral window (in CCD pixel and wavelength units, respectively). Before launch, the translation between pixel co-ordinates and angstroms is done using a simple linear relation. After EIS is commissioned, this will be calibrated using real data, and the wavelength calibration will be regularly monitored and updated.

Also, note that — as with all editable IDL text widget fields, **YOU MUST PRESS ENTER ONCE YOU HAVE TYPED THE VALUE YOU WANT**; otherwise, the widget will simply not process your desired value and your efforts will go unnoticed by the system.

To adjust the spectral width of the window, use the slider (11) to choose a value, measured in units of pixels. For on-board software reasons, you can only choose integer multiples of 8 pixels. The default value is 32 pixels, which is pretty generous: in the middle of CCD 1 (190 Å) this is about ± *400* km s^{-1}; in the middle of CCD 2, around ± *250* km s^{-1}. But you may want to increase or decrease this for science or telemetry reasons.

Another option, although you probably won't often want to do this, is to select half a CCD as your spectral window. This is the biggest possible window, since EIS has two read-out nodes per CCD, located at opposite ends of the CCD: it therefore normally reads only half a CCD from each node.

_If you want to adjust all the spectral windows at once to the same width, read below... _

Finally you have the option of changing the name of the spectral window. If you're dealing with a core line, then you don't need to change this. However if you've added a line, particularly a custom line, you should check that it is appropriately named.

Making a Line List

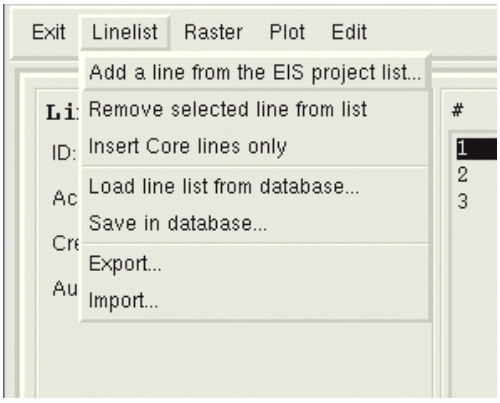
The first step in creating an observation is to decide in which wavelengths — or which wavelength ranges — you want to observe.

Be aware that the core line list above **must** be included in all observations. This is because standard data products (line-intensity, doppler-shift, and line-width maps — known as Level 2 FITS) will be made from all EIS observations in a data pipeline; these products will be used to browse data in the online catalogue. (If you don't include the core lines in your linelist, you'll have it sent back to you by the **Scientific Schedule Co-ordinators (SSCs)**.) These core lines are marked **(c)** in (7).

Adding a Project Line

The EIS mission has certain expected lines from which you can choose to help you put together a line list. To add one of these **project lines** to your line list (which is probably the first thing you'll want to try), go to the main menu (1) and choose *Edit, Add a line from the EIS project list...*

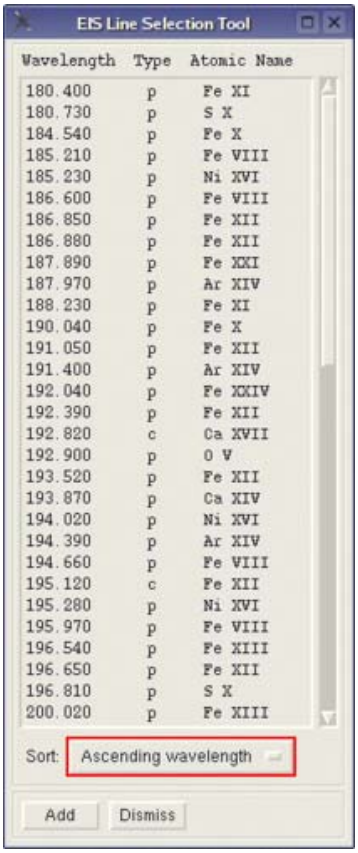
The main linelist menu

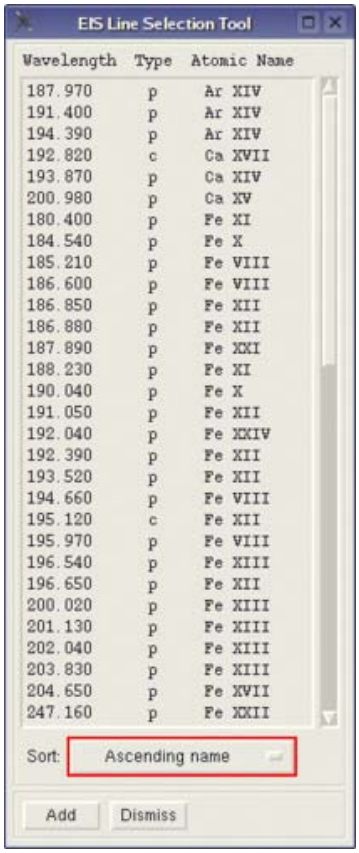


This opens up a new window with a list of wavelengths and the ions which emit them:

By default, these known lines are ordered by wavelength, but you can change that by clicking on **Ascending Wavelength** and changing it to, for example, **Ascending Name**.

This orders the ion species alphabetically (not by atomic number or roman numeral order, but its' enough to let you search for the ion you want):





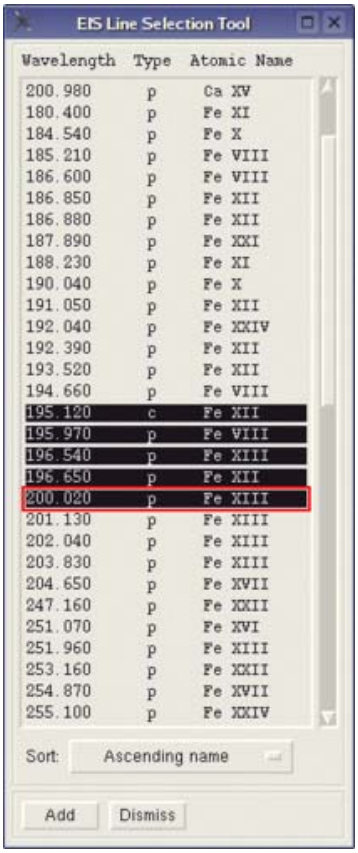
You're not limited to selecting one line at a time, either.

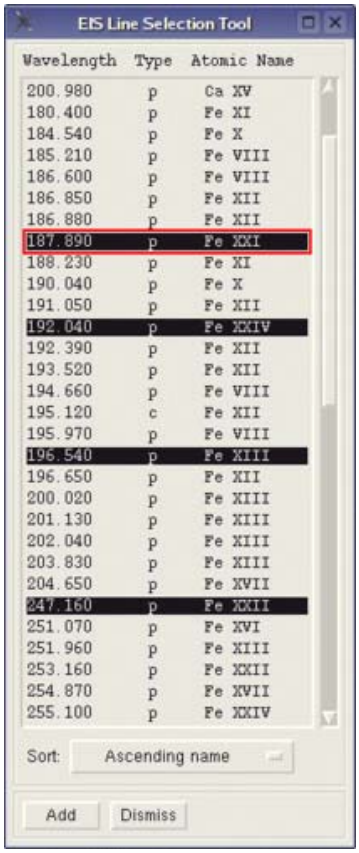
To select multiple lines, click and drag over a range

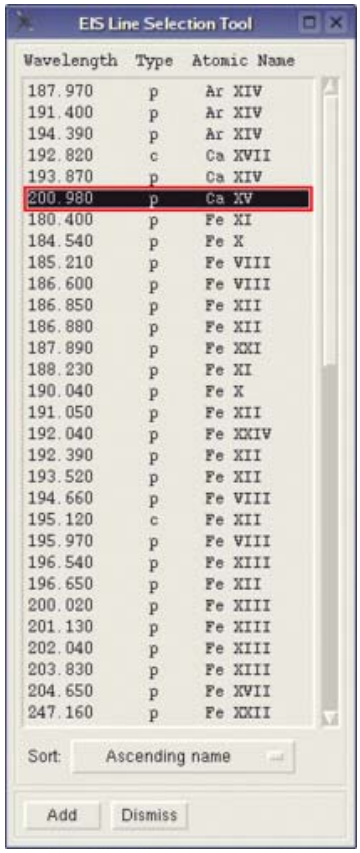
To select non-adjacent lines, hold down the **CTRL** key, and left-click on

But we'll just concentrate on adding a single line of `Ca XV` for now

(you can also add a single line by double-clicking on it).







In all the cases above, you can add the lines you've chosen by hitting **Add**. **Dismiss** will get rid of the window without adding any lines (unless you've double-clicked on a line).

Adding a Custom Line

There will be certain cases where you want to add a line which isn't in the EIS project list, for example:

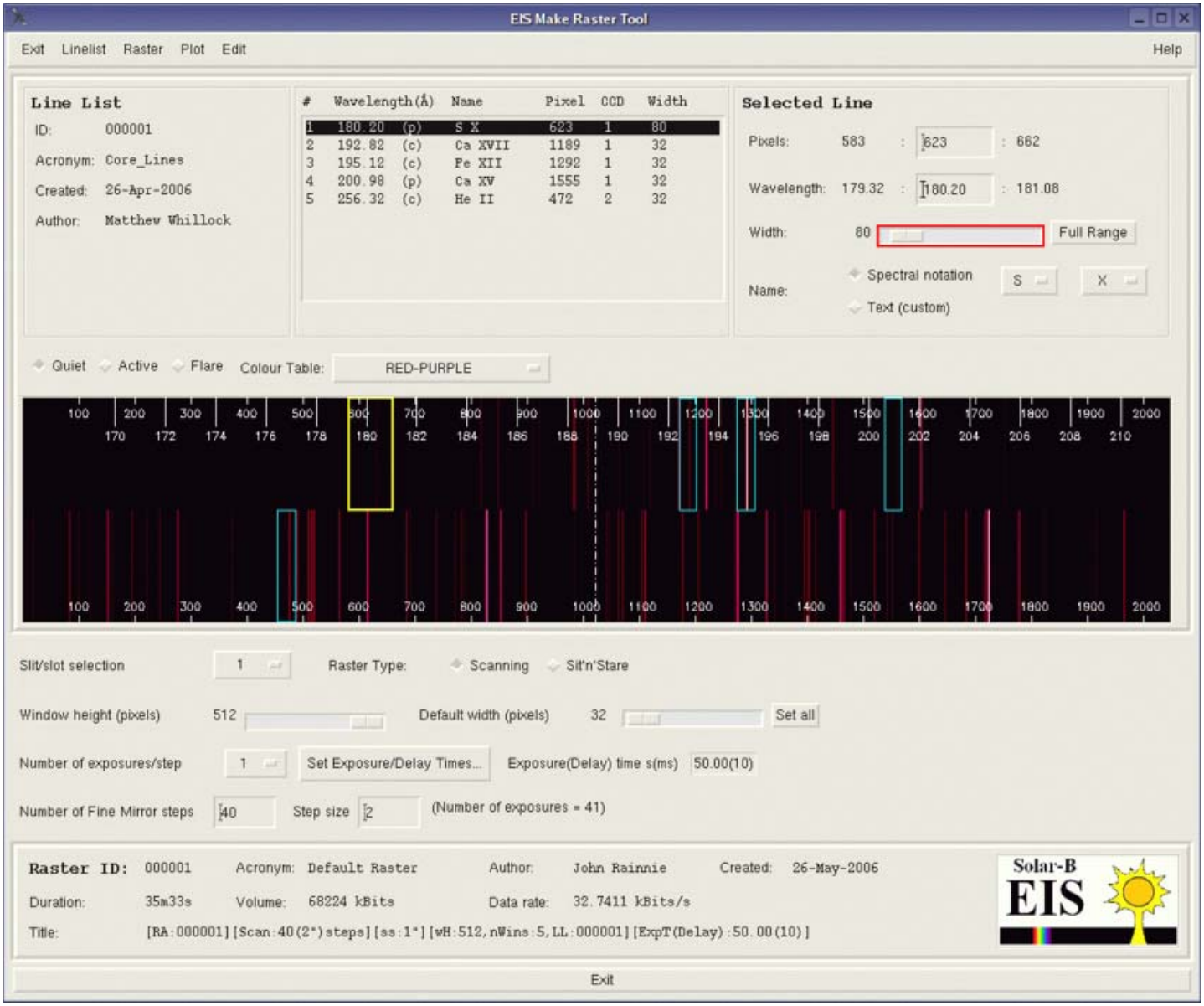
- the line you want isn't there;
- you want to include more than one line, or a piece of continuum, so the notation needs to be a custom one.

In any of these cases, the easiest thing to do is to add a project line and then customise the wavelength accordinlgy. (Remember that *the line list only contains the wavelengths*, not how wide the spectral windows are._)

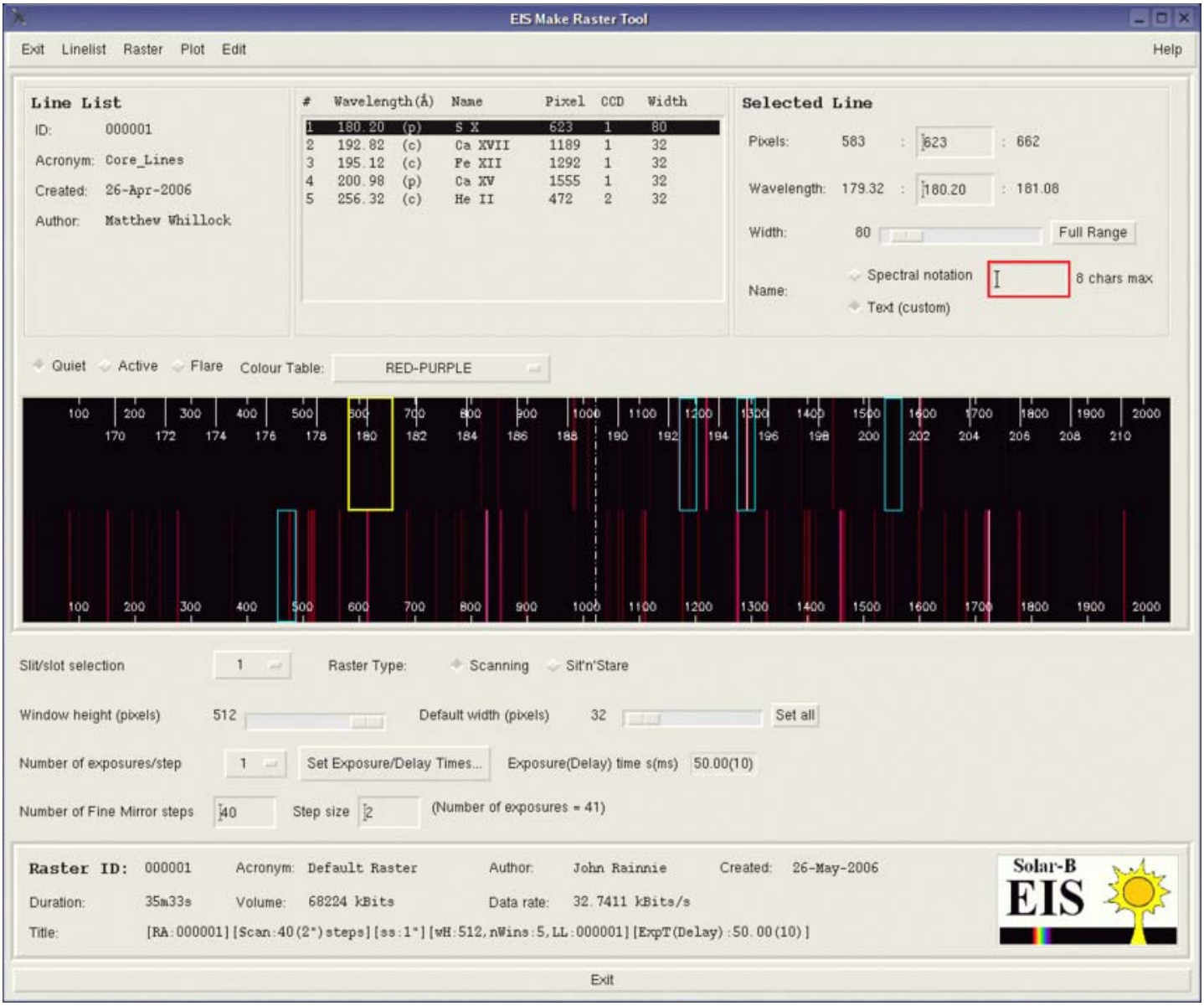
In this example, we'll start by adding the `s x` project line at 180.73 Å, following the steps above.

We'll now move the central wavelength to 180.20 Å:

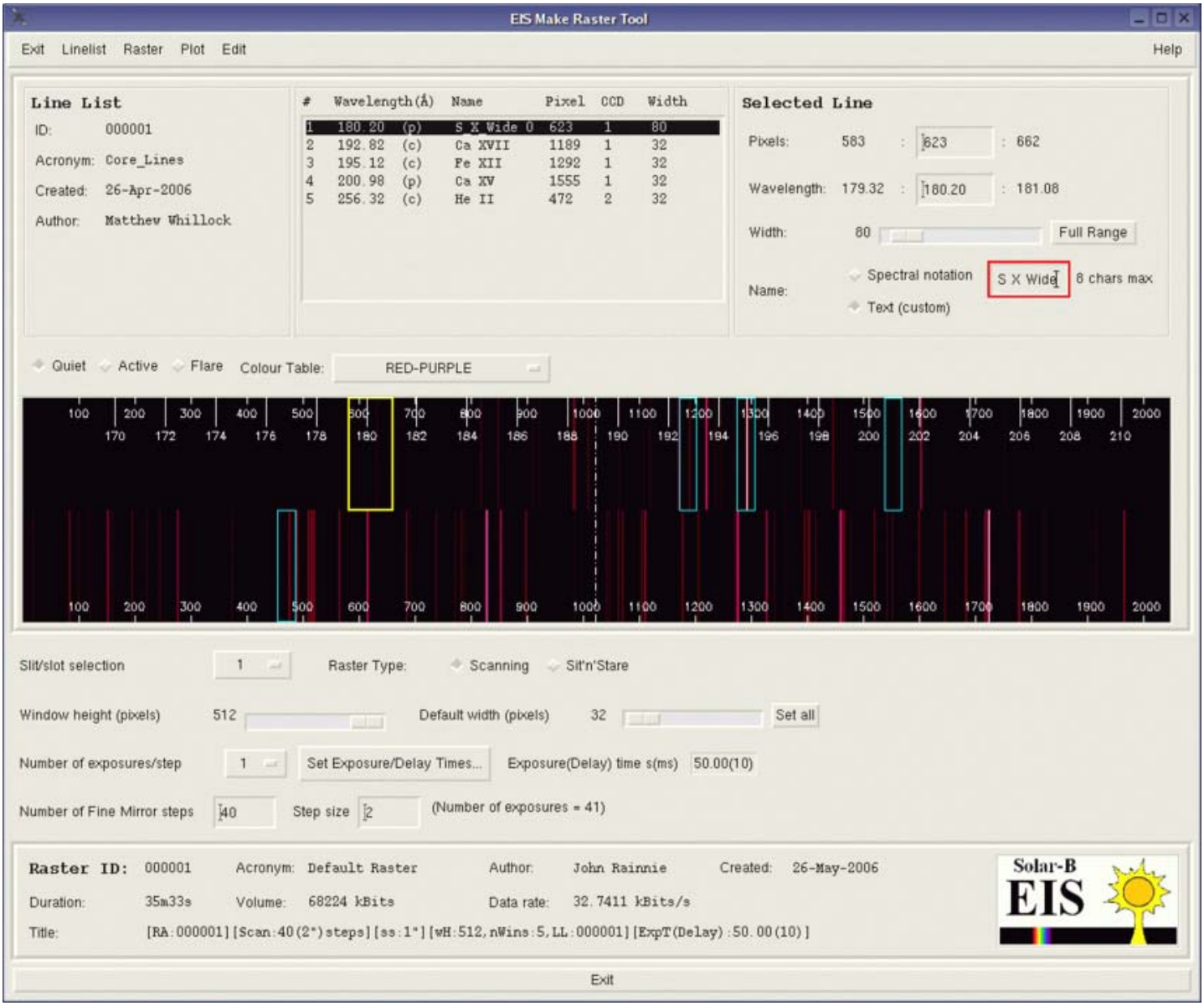
...and adjust the width of the window to 80 pixels, to create a wider spectral window than the four others:



And finally, we rename the window. This is done by going to the window's **Name** field (12) and clicking on **Text (custom)**.



Here, you enter a name for the window, up to 8 characters long (this can include spaces). In this case, I've chosen "S X Wide", as I've just widened the window, but as long as the name is self-explanatory (you mightn't be the only one using this data, remember!), it should be fine.



Removing a Line from the Line List

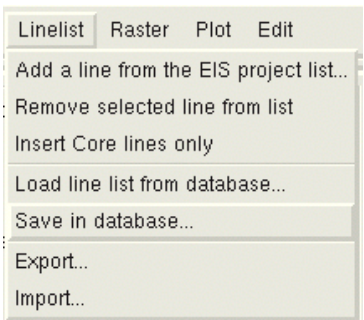
If you want to remove a line, you have two options:

- from the main Linelist menu in (1), choose *Linelist, Remove selected line from list* ; or
- right-click on the line in (7) and choose *Remove line* :

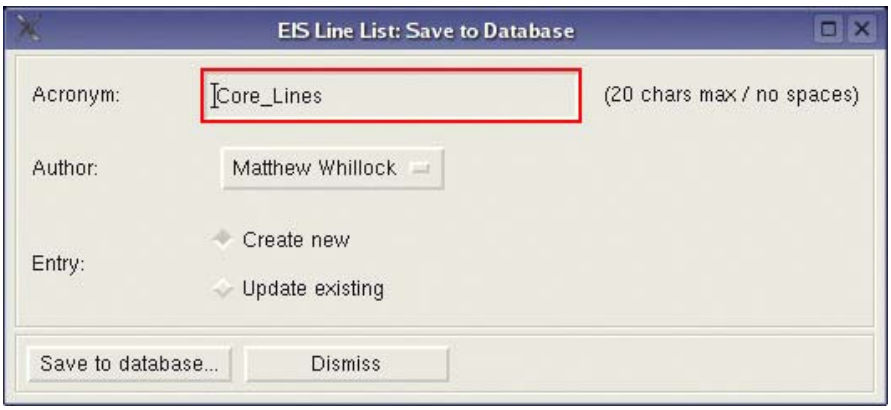
We can now select the custom line we created above, and right-click on it to bring up the *Remove* option. Note that this will only work on the selected (i.e. highlighted) line, not simply on whichever line you right-click on.

Saving a Line List

Once you've settled on a line list, you can save it for future use so that you don't have to keep entering the same parameters over and over every time you want to create a study. To save a line list, once it's been created, go to the main Linelist menu in (1), and choose Save in Database:

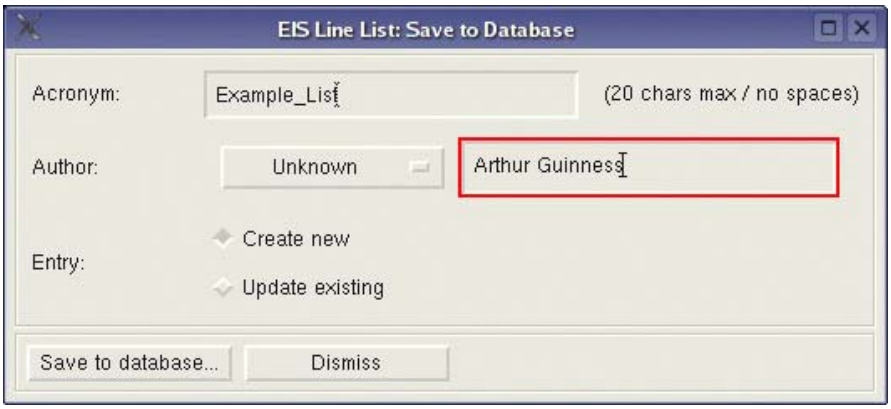


You'll then be presented with a dialogue box to fill in the information, which has some default information — you'll need to replace this, of course:

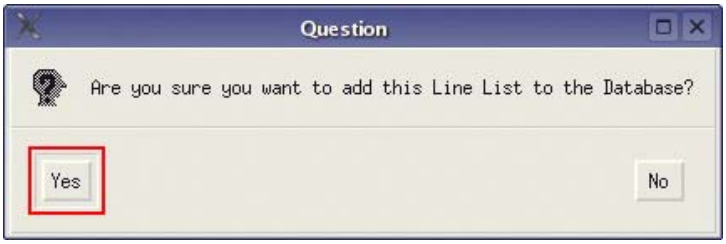


If your name is in the existing list of people associated with making EIS studies, then you can select it from the drop-down menu:

Otherwise, select *Unknown* from the list and enter your own name. Please keep this the same from one time to the next, as we would like the linelist database (and others) to be searchable by the author's name.



Once you've filled in this information, choose *Save* and you'll be asked if you're sure.

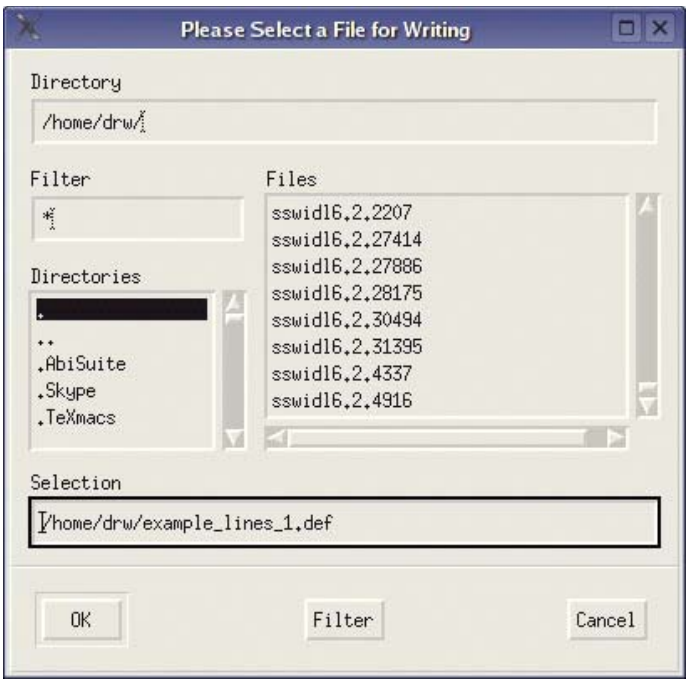


If you *are* sure, then click *Yes*. (The converse, naturally, also applies...)

Exporting a Line List

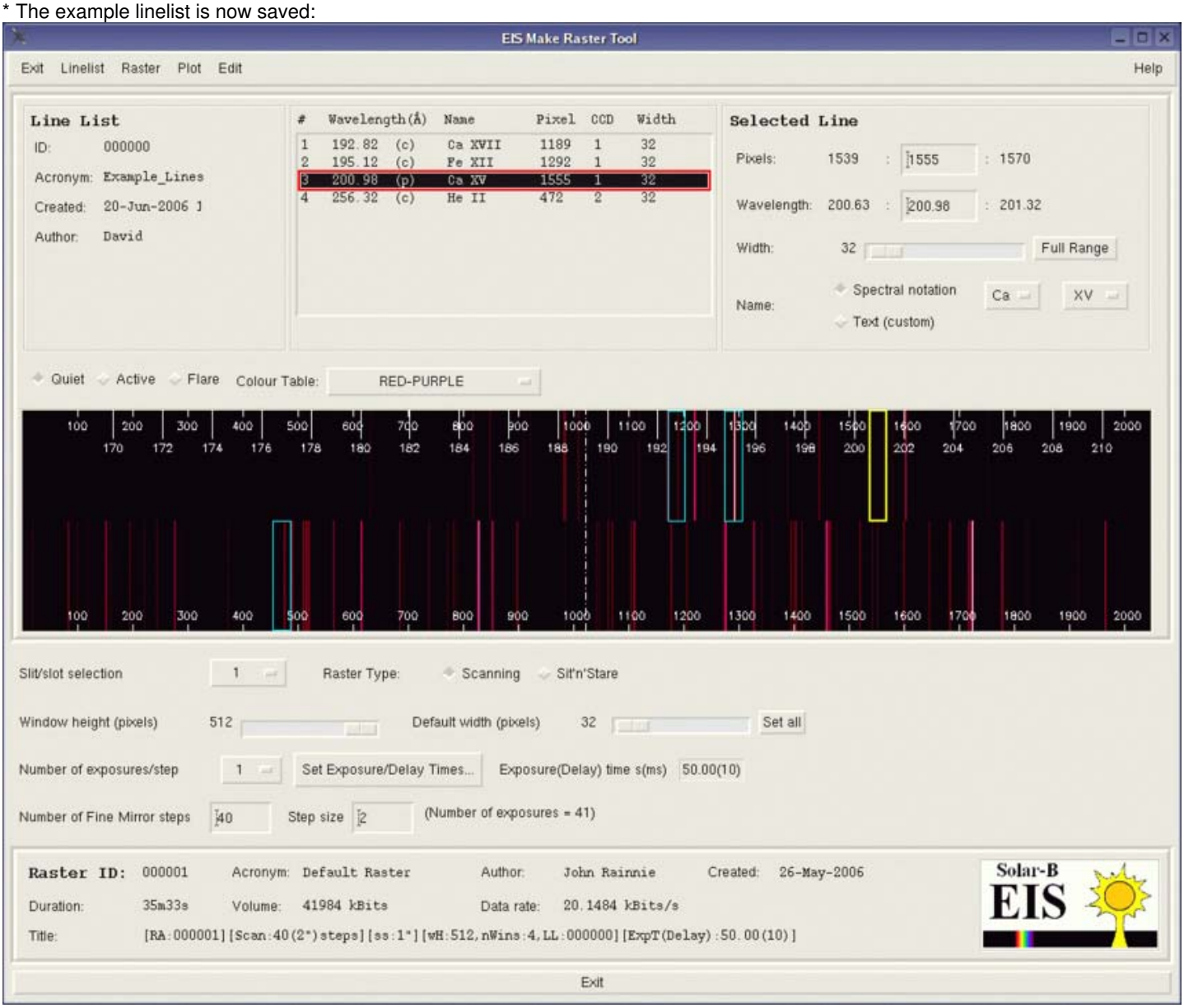
To submit a line list to the SSCs for inclusion in the official database, you need to export your choice of wavelengths to an ASCII text file. This is done by going to the main menu (1) again and choosing *Linelist, Export...* You'll then be presented with a dialogue box asking you for an **Acronym** for the line list, and an author (as for saving a linelist, above).

When you select *Export...*, you'll be asked where to save the linelist file (which, by default, is given a `.def` extension). The Raster Tool will come up with a filename based on your acronym, but you can change this to whatever you want.



Finally, click *OK* to save your list to the specified file.

* The example linelist is now saved:



Importing a Line List

This is just the inverse of exporting a linelist, and is useful if you want to see a linelist that someone else has created, but that isn't necessarily in the official database. *It's pretty straight-forward, but I'll fill in the details on this later.*

Changing the CCD image

Before launch, only synthetic CCD (i.e. full-spectrum) images are available, and this is what this guide will feature until the post-commissioning phase.

(Insert a bit more chat about this)

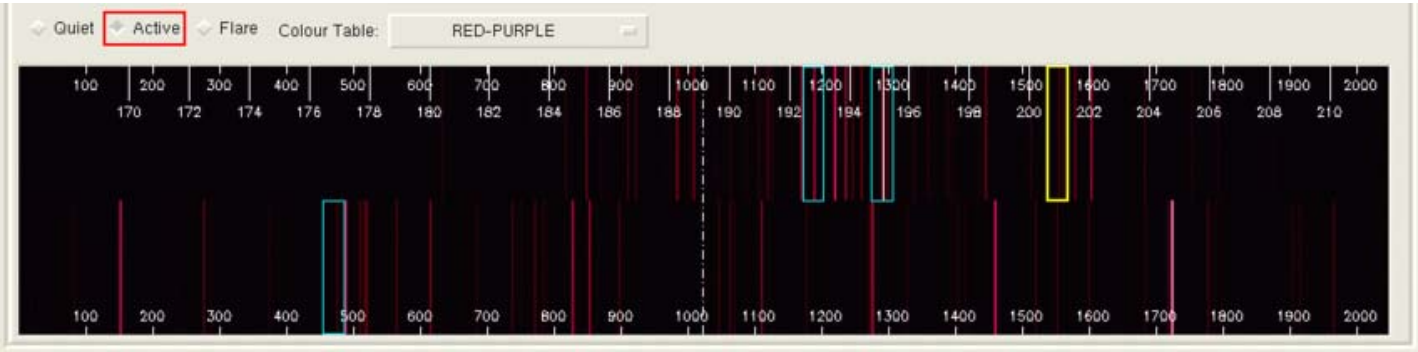
- Active Region & Flare spectra
- SERTS already-observed spectra?
- EIS commissioning spectra (spectral atlas)

Note that when you change colour tables, the spectrum silently defaults back to the Quiet Sun image -- you need to change this manually to make sure you're looking at the right kind of spectrum.

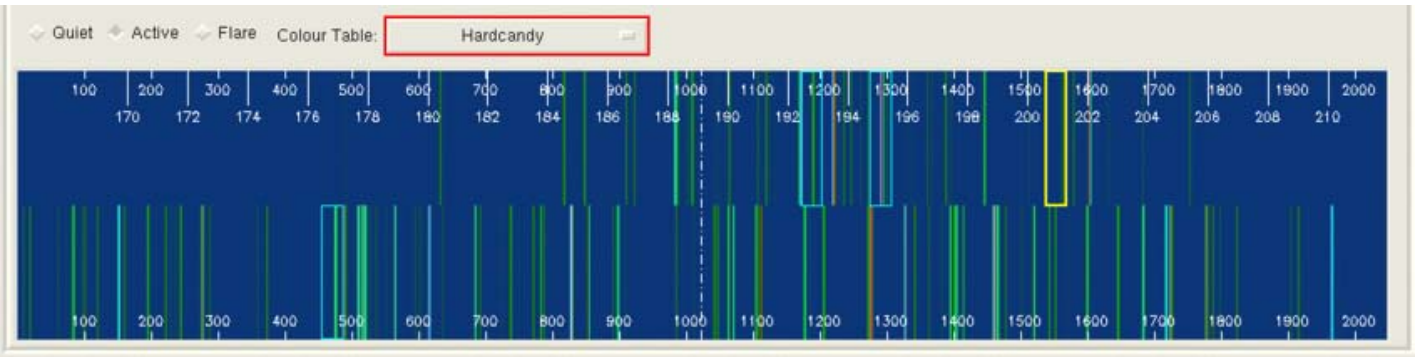
The spectra which are currently available are CHIANTI-derived synthetic spectra, and there are three types from which to choose:

1. Quiet (Quiet Sun)
2. Active (Active Region)
3. Flare

For now, try changing the type from *Quiet* to *Active*.



You can also change the colour table in order to see fainter (or brighter) lines more clearly. For example, the *Hardcandy* table:



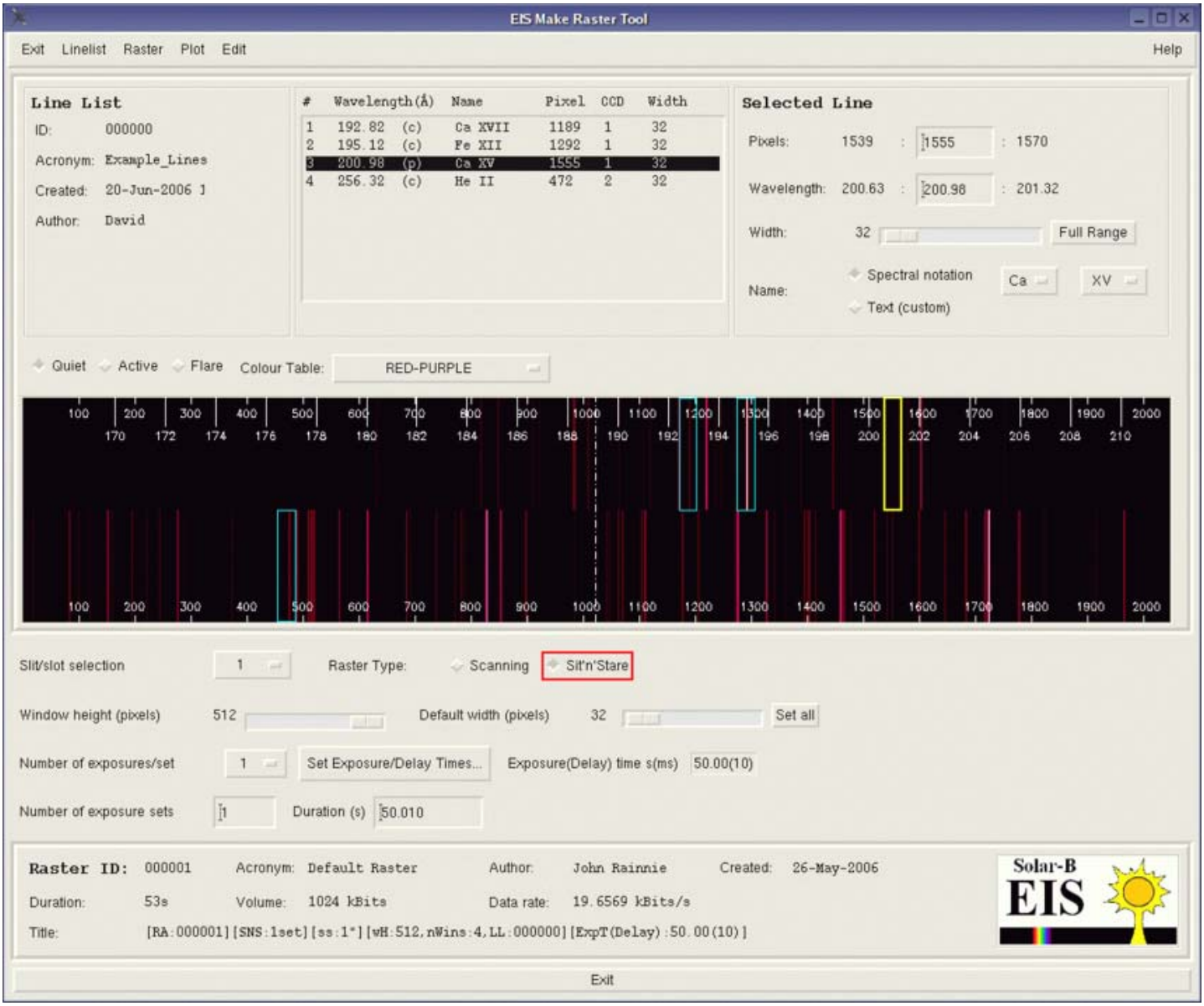
Making a Raster

Changing the type of raster

This is easy enough to do, but it has a knock-on effect. For the purposes of this example we'll work with a Sit'n'Stare raster. To do this, go to the *Raster Type* section (19) and choose *Sit'n'Stare*. You'll notice that some of the fields below change, namely:

Scanning Raster	Sit'n'Stare Raster
Number of exposures/step	Number of exposures/set
Number of Fine Mirror steps	Number of sets

Change the type of raster to Sit'n'Stare:



This is simply logical, and we'll explain the terminology as we go on.

Making a Study

Notes

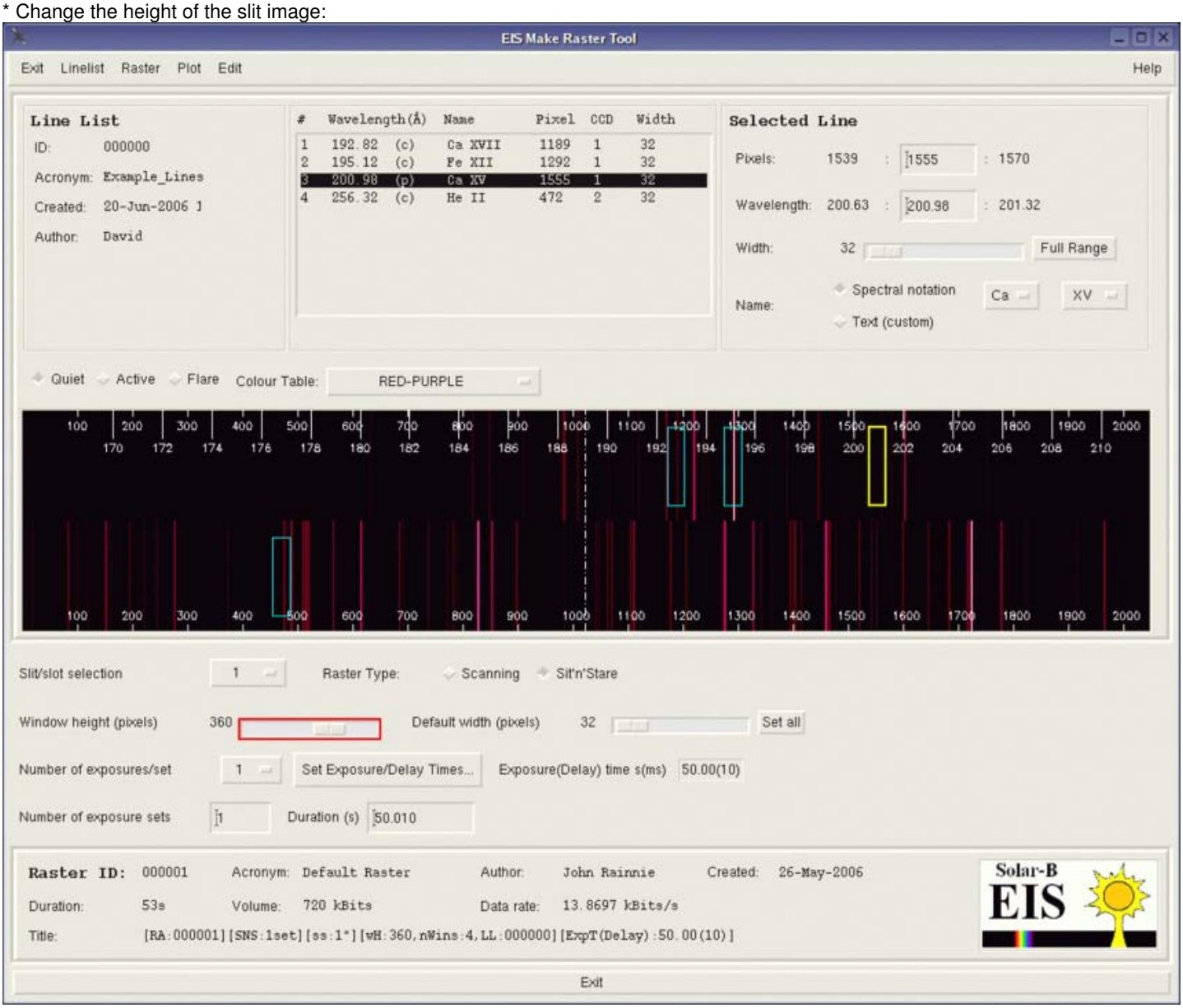
Just to keep track of things, I've appended some notes below.

- Only one response study possible per trigger type, between real-time (*i.e.* commanding) contacts
  - *E.g.* , If two studies in the timeline are sensitive to the EIS flare trigger, they must both respond with the same response study. There is only room for one set of EIS Flare Trigger response properties in the EIS ICU.

The same goes for the XRT flare trigger, EIS event trigger and the Automatic Exposure Control.

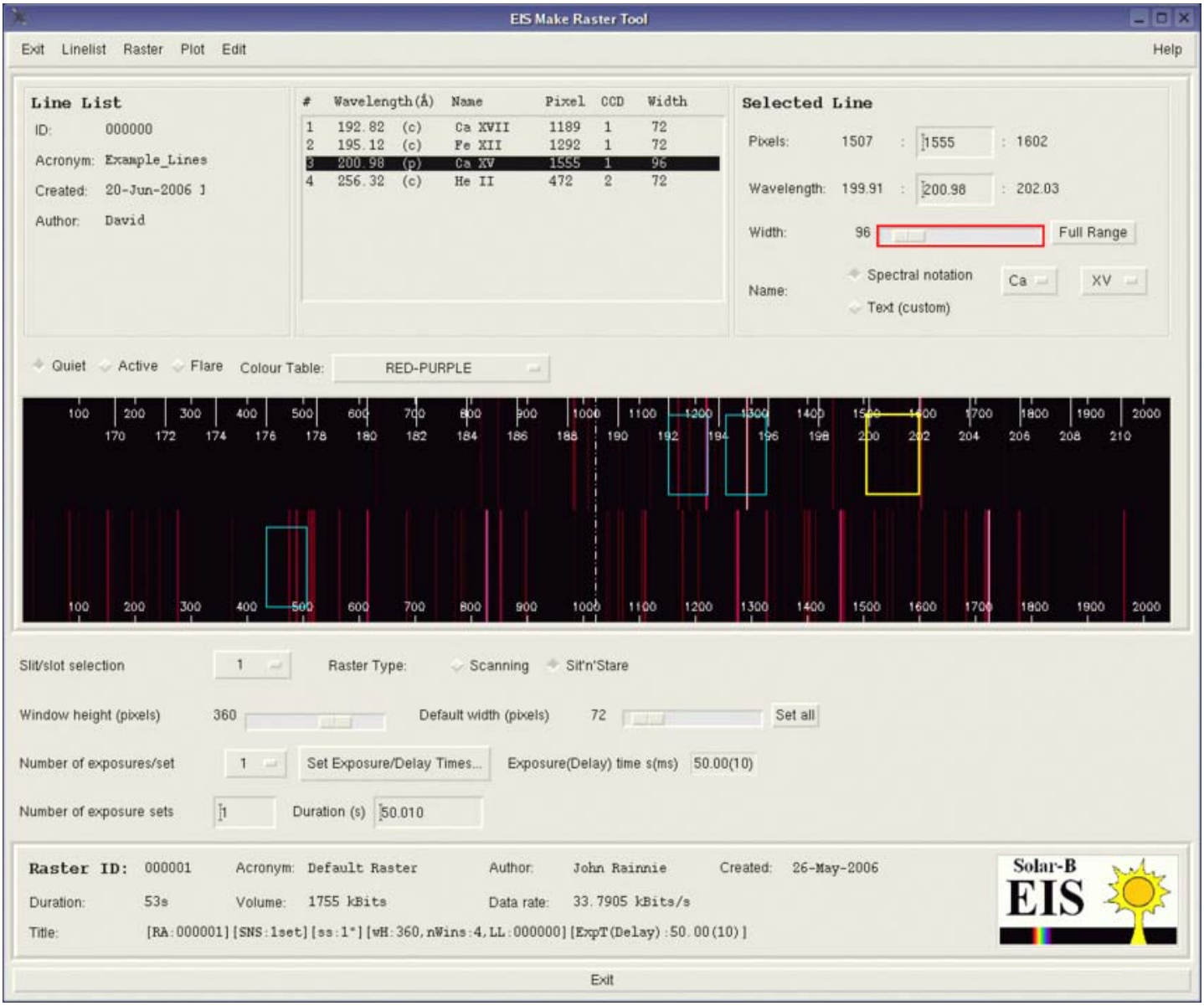
-- DaveWilliams - 20 Jun 2006

* Change the height of the slit image:

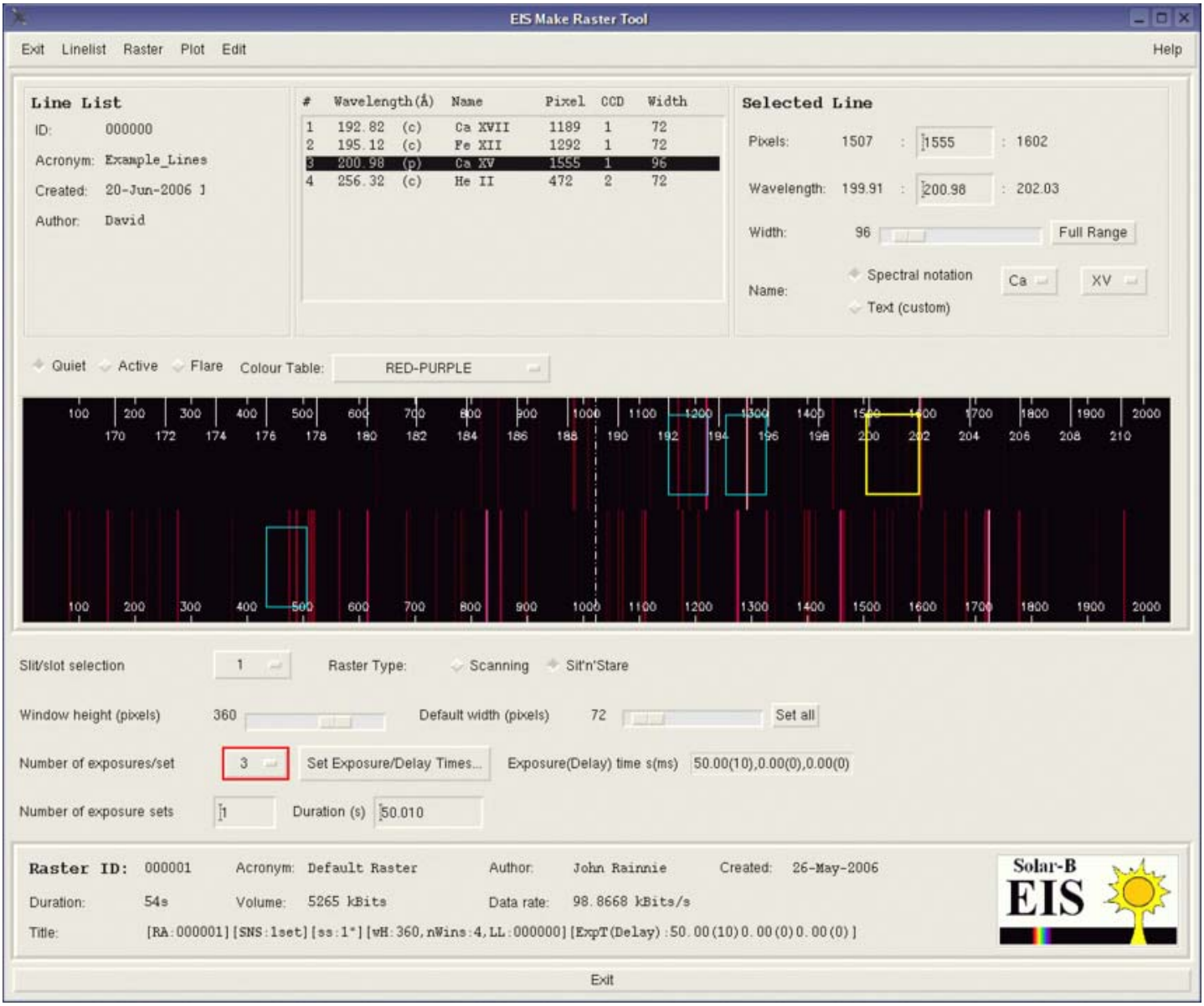


* Change the width of all the spectral windows:

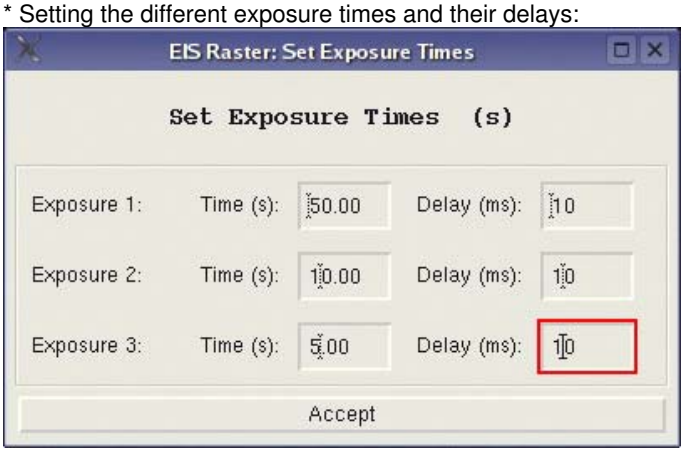
* Changing the width of only the Ca XV window:



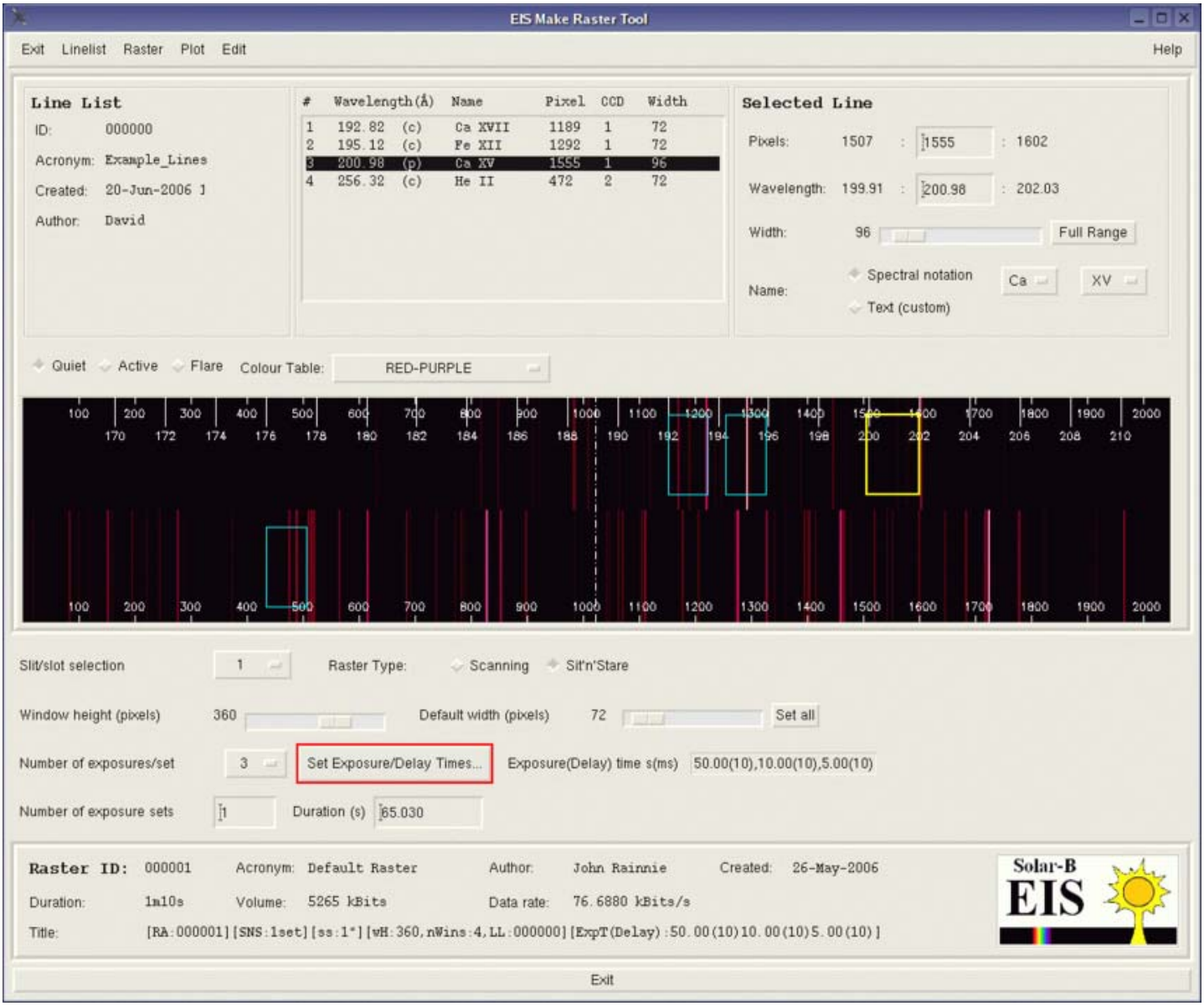
* Changing the number of different exposure durations per exposure "set":



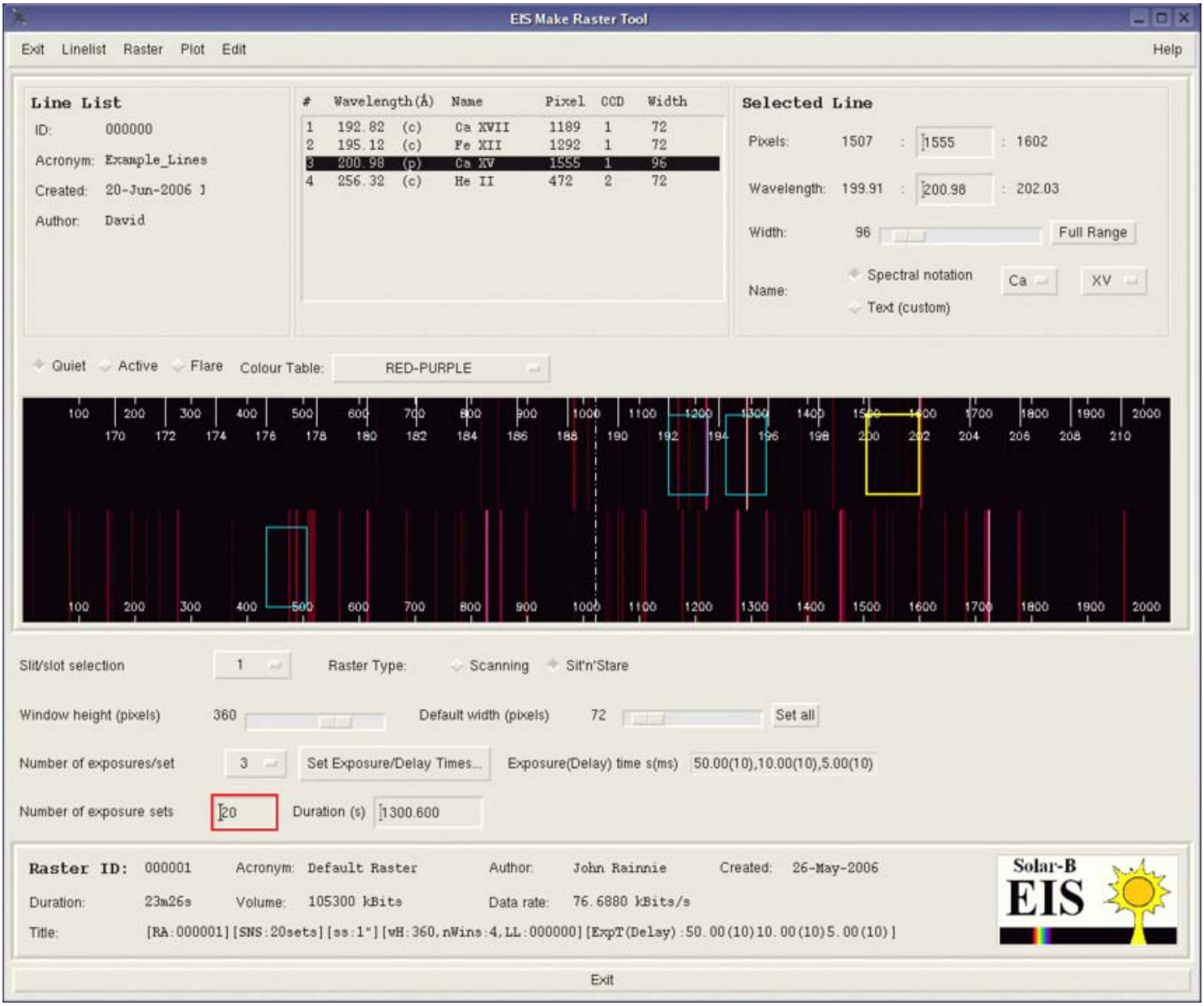
* Setting the different exposure times and their delays:



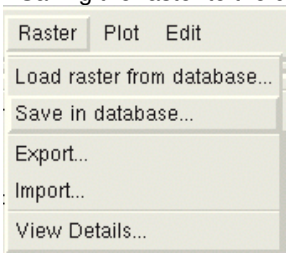
* The new exposure times are now set:



* Change the number of sit'n'stare sets to 20:



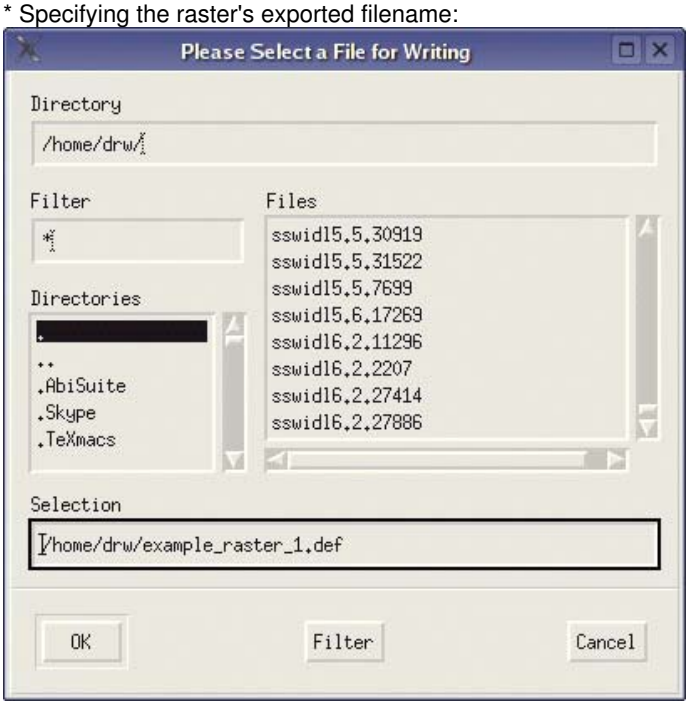
* Saving the raster to the database:



* If the corresponding linelist hasn't yet been saved to the database...:

* Exporting a raster to ASCII format:

* Specifying the raster's exported filename:



* The finished product?:

This topic: SolarB > EISPlanningToolGuide
History: r22 - 20 Jun 2006 - 17:06:09 - DaveWilliams

Copyright © by the contributing authors. All material on this collaboration platform is the property of the contributing authors.
Ideas, requests, problems regarding TWiki? Send feedback