SPECINTI V4

Quick start

From raw image to calibrated spectrum
in just a few clicks

The idea

You have a few freshly acquired raw images of a low-resolution stellar spectrum. You have no dark, bias or flat-field frames — in other words, no DOFs at all.

This guide shows you how to obtain the calibrated spectrum of the star in just a few moments and a handful of clicks, while simultaneously determining the wavelength calibration and the instrumental response of your equipment.

We shall finish by processing a supernova, just as simply as we have processed a nearby star.

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Before you start

This guide is deliberately practical. We shall start with raw FITS images and follow the complete path through to the calibrated spectrum.

What we are going to do

1. choose the images to process;
2. tell SpecINTI where they are;
3. define the spectral region;
4. identify the star's spectral type;
5. calculate the wavelength calibration and instrumental response;
6. use this information to process further spectra.

The example data

The data used in this guide can be downloaded **here**. Simply unzip the archive before you begin.

The chosen star is **79 Cyg**, spectral type A0V. The images are named `79cyg-1.fits`, ..., `79cyg-5.fits`.

1 The files to process

We shall begin with the spectrum of a hot star of spectral type A. We shall see later why this is particularly well suited to the task. The data may have been acquired with an Alpy 600, UVEX4, Star'Ex LR (Low Resolution), TinyStar'Ex (TSE), or any other spectrograph, provided that the full visible spectrum is covered.

The stellar spectra should be gathered in a folder on your computer. For example, we shall assume that the folder path is:

```
E:/spectro/antibes_TSE_20260906/
```

Note: *Get into the habit of using a consistent naming convention for your folders and files, and stick to it. In our example, the folder name tells us that the observations were made in the Antibes region (06), with a TSE (TinyStar'Ex) spectrograph, on 6 September 2026. You are, of course, free to adopt whatever naming convention suits you best.*

You can download the data used in this example **by clicking here** (then unzip the contents of the archive).

The observed object is the star **79 Cyg**.

The images are in FITS format and are named `79cyg-1.fits`, ..., `79cyg-5.fits`, in acquisition order.

The star chosen for this example was not selected at random. It is a spectral type A star, more precisely A0V. SpecINTI makes use of the spectral characteristics of this class of star to calibrate the instrument. Two operations are performed in particular: determining the **wavelength calibration**, which establishes the relationship between image pixels and wavelengths, and determining the **instrumental response**, which characterises the response of the instrument to the incoming light as a function of wavelength.

A star of this type is required only during the calibration stage. For routine processing, all kinds of spectra — stars, galaxies, nebulae, comets, ... — can of course be processed.

2 Install and launch SpecINTI

The official SpecINTI website **is here** (click to open it).

You can download the programme and its associated files free of charge, choosing the appropriate environment (Windows, macOS or Linux). Unzip the downloaded file into a folder of your choice; this becomes the application folder. The programme is called **specinti.exe**. You can place a shortcut to it on your computer's desktop.

For a full description of the interface and how to use it, consult the **user manual** (click to open it).

Launch the programme. The first launch may be a little slow; subsequent launches should be considerably quicker.

Normally, the interface should appear as shown in figure 1. This is the software's so-called 'standard' interface. If you do not see *`CALIBRATION LR`* at the top of the window, click the 'Return to calibration' button at the bottom.

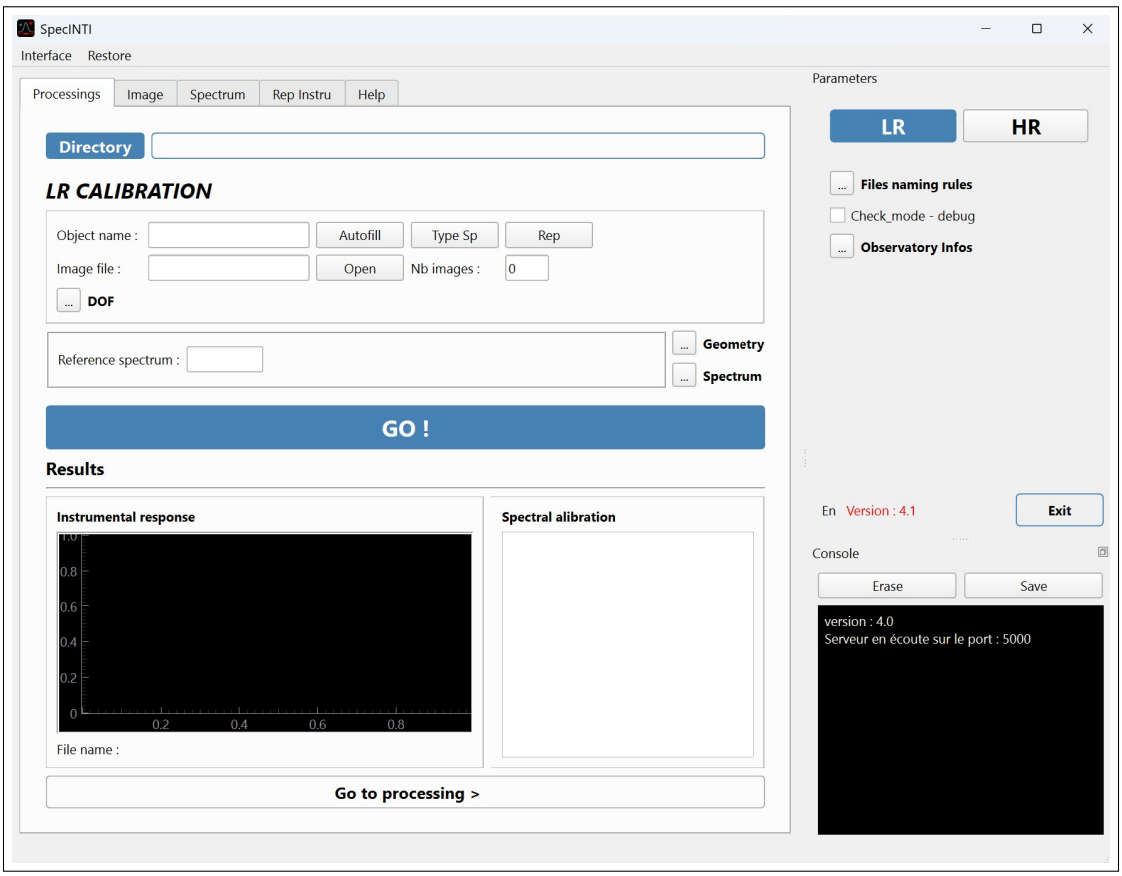


Figure 1. The SpecINTI interface at start-up.

3 Select the working folder

The working folder is the one in which you have copied the data from your observation. You must tell the software the path to this folder. In our example:

```
E:/spectro/antibes_TSE_20260906/
```

.

Click the 'Directory' button at the top of the interface. In the dialogue box that opens, navigate to the chosen folder and select it. The result should look like the one shown in figure 2.

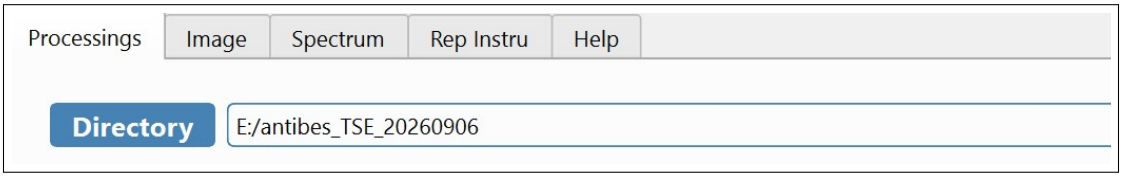


Figure 2. Selecting the working folder.

4 Enter your observatory information

Any good spectral-processing programme should include in the FITS header of the processed spectrum enough information to trace the origin of the data. SpecINTI requires you to enter this information because we aim to produce data with genuine scientific value.

Click ‘Observatory info’ and fill in the various fields in the dialogue box that opens (figure 3). Then click the red cross to finish.

This step is a little tedious, but the information will be retained the next time you open the software. You therefore need to enter it only once, unless you change instrument or observe from another location.

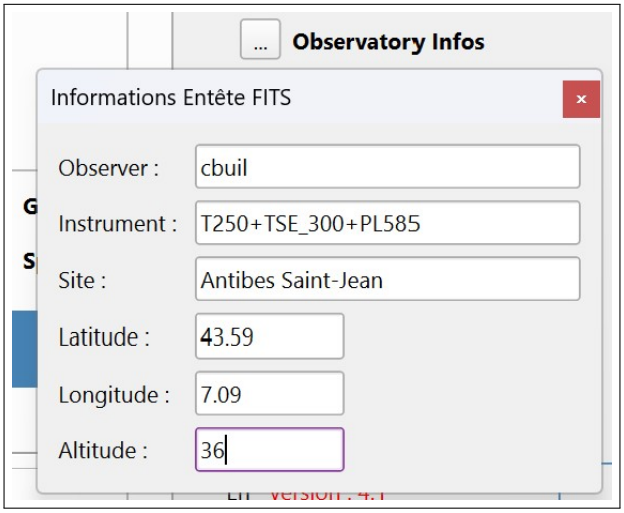


Figure 3. Brief information about the observer, the observing site (longitude is given as positive east of Greenwich, and altitude in metres) and the instrument used. In this example: a 250 mm aperture telescope, a TSE spectrograph fitted with a 300 lines/mm grating, and a Player One Uranus pro camera. The content of these fields is entirely up to you: enter whatever information you would like to include.

5 Select the object to process

Click the ‘Dir’ button and, in the list that opens, double-click any one of the five image files in the sequence; it does not matter which one.

SpecINTI then fills in the fields required for processing automatically. In particular, it identifies the root name of the image files to be processed (here `79cyg-`), their number (here 5), and the catalogue name of the object (here **79 Cyg**). The result is shown in figure 4.



Figure 4. Selecting the files to process and the object’s ‘catalogue’ (or ‘official’) name.

6 Define the spectral trace

The aim is to mark out the spectral trace in one of the raw images, both horizontally and vertically. This serves two purposes:

- Isolate a set of absorption lines (the Balmer lines) on which the software relies to determine the wavelength calibration. It can automatically recognise the lines present within the selected interval. You therefore do not have to identify the individual lines; you simply define the region in which they lie.

- Define the vertical extent of the object's spectrum so that it can be distinguished from any brighter objects or intense structures, such as the photometric region of the GEN2 slit. This is optional, as it is only useful for faint objects. For a bright object such as this one, the software can automatically determine the vertical position of the spectral trace without any input from you.

The selection is manual, but the software provides considerable assistance.

Click the small three-dot button immediately before 'Geometry'. A window opens (figure 5).

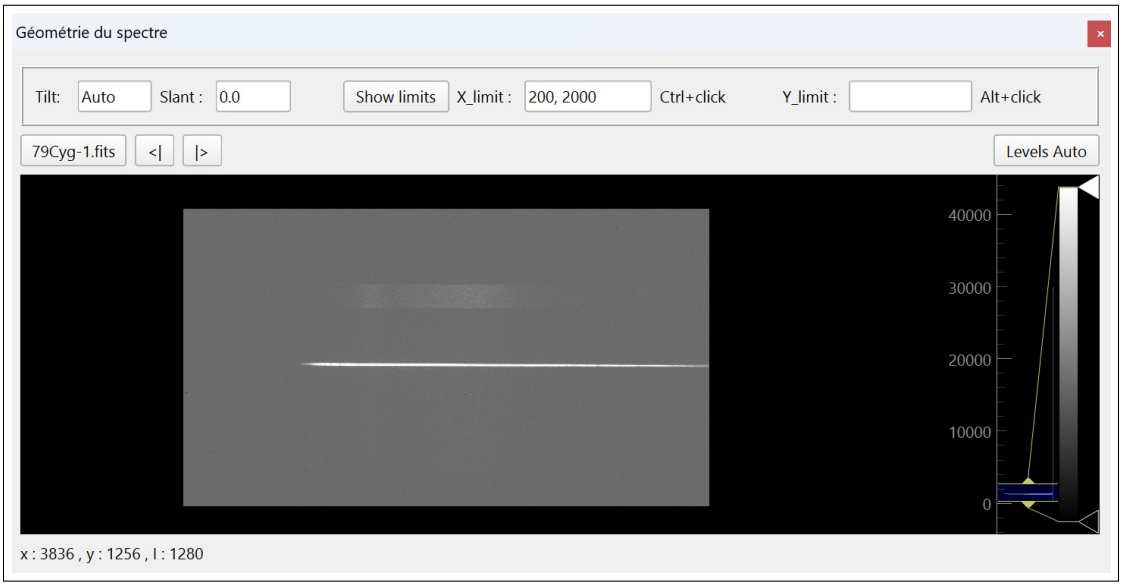


Figure 5. The 'Geometry' window when first opened.

At this stage, you have considerable freedom to adjust the appearance of the first image in the sequence. As usual, you can resize the window. You can also adjust brightness and contrast using the vertical sliders on the right. You can zoom with the mouse wheel, or move around the image by clicking and holding the left mouse button.

You must define two limits, marked by two mouse clicks, enclosing a part of the spectrum containing sufficiently strong and well-contrasted lines. Start at the blue end of the spectrum by holding down 'Ctrl' and clicking the left mouse button: a blue vertical bar appears at the click position (figure 6).

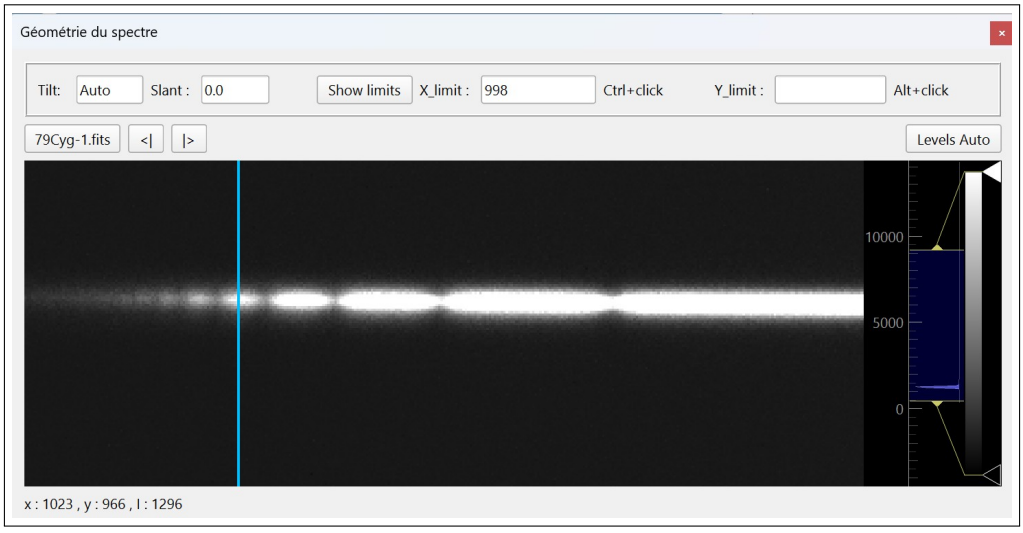


Figure 6. Defining the horizontal limit at the blue end. A significant number of Balmer lines are included on the right, without trying to include the weakest ones.

Now move towards the red end of the spectrum and make a second left click beyond the Hα line (to its right; it is important to include this line within the selected region). A red vertical line then appears (figure 7).

You have now isolated the spectral region in which the software will search for the lines used to calculate the dispersion relation. In our example, this is an image region extending from pixel $x = 998$ to pixel $x = 2543$ (the values of the 'xlimit' parameter).

If you make a mistake, simply redefine the two limits.

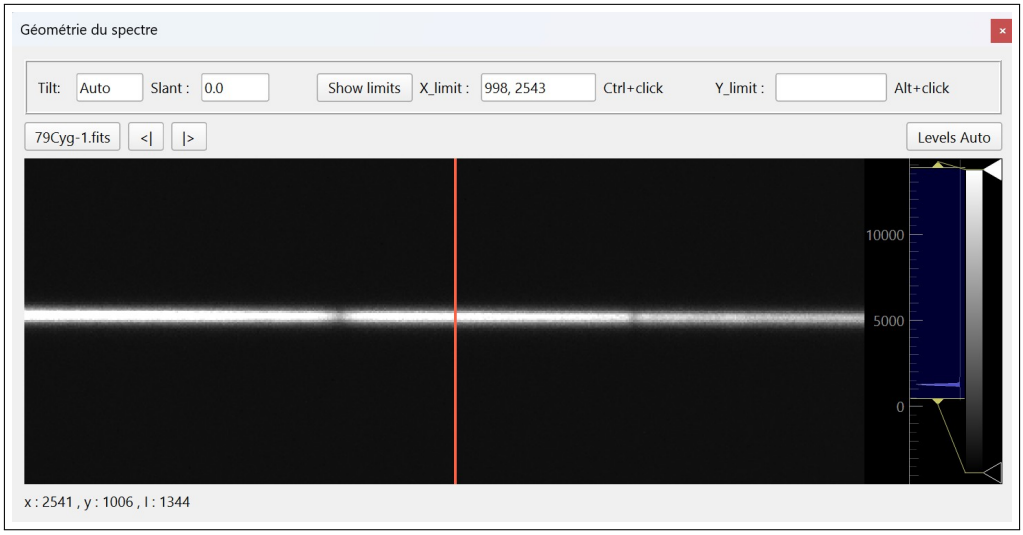


Figure 7. Defining the horizontal limit at the red end. It is important that the selected region includes the Hα line.

To isolate the stellar trace vertically and, if necessary, distinguish it from an interfering object, click below the trace and then above it while holding down 'Alt' (see figure 8). The order in which you define the two limits does not matter.

In the example, the software will search for the stellar trace between $Y = 931$ and $Y = 1142$ (these values are given only as an example).

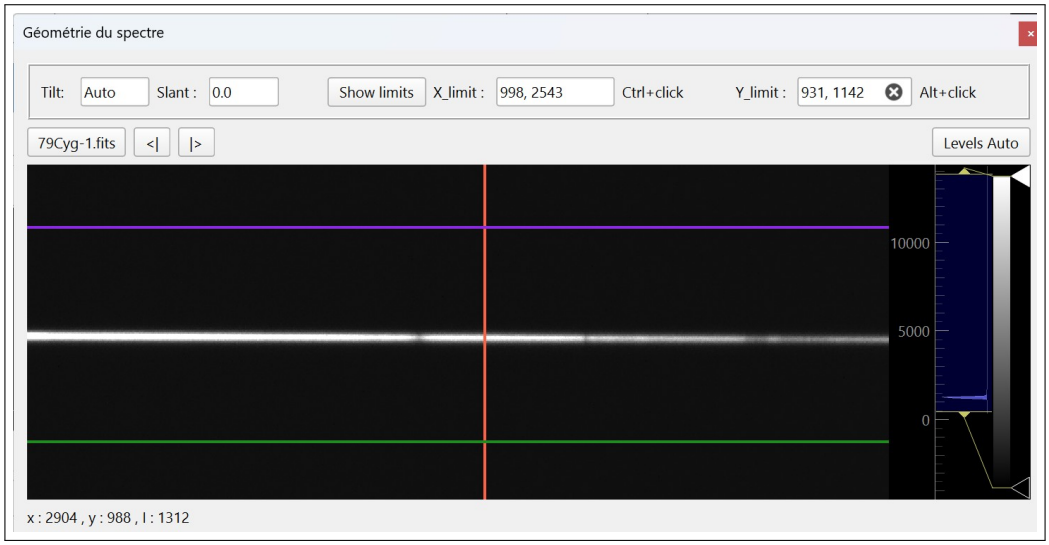


Figure 8. Defining the automatic search region for the spectral trace, between the green and violet lines.

You can close the 'Spectral geometry' window by clicking the red-background cross on the right.

7 Select the reference spectrum

During calibration, the software compares the spectrum you have observed with the spectrum expected for its spectral type, using a library of reference spectra installed with SpecINTI. This comparison makes it possible to determine the spectral response of the instrument. For this step, you must observe an A-type star, whose spectrum has the useful characteristic of displaying strong, well-separated Balmer lines. This is the case for our target, 79 Cyg.

Tip: *A-type stars are plentiful in the night sky. You will find the brightest ones, and those least affected by interstellar reddening, in SpecINTI's built-in help, or by using the excellent* ***spectro-starfinder*** *utility.*

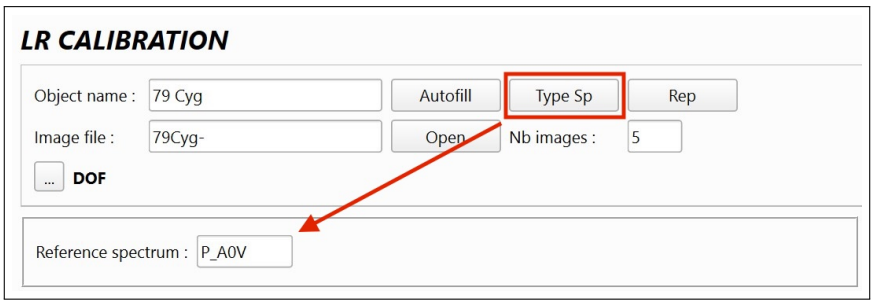


Figure 9. Automatic estimate of the spectral type closest to the observed star (here A0V). Simply click the 'Spectral Type' button. The reference spectrum is selected from the Pickles spectral library, installed with the application.

8 Calculate the wavelength calibration and instrumental response

We can now perform, with a single click, an operation often regarded as tedious: calibrating the instrument.

Click the large 'Go!' button. Figure 10 shows the result of the calculation, carried out for you automatically.

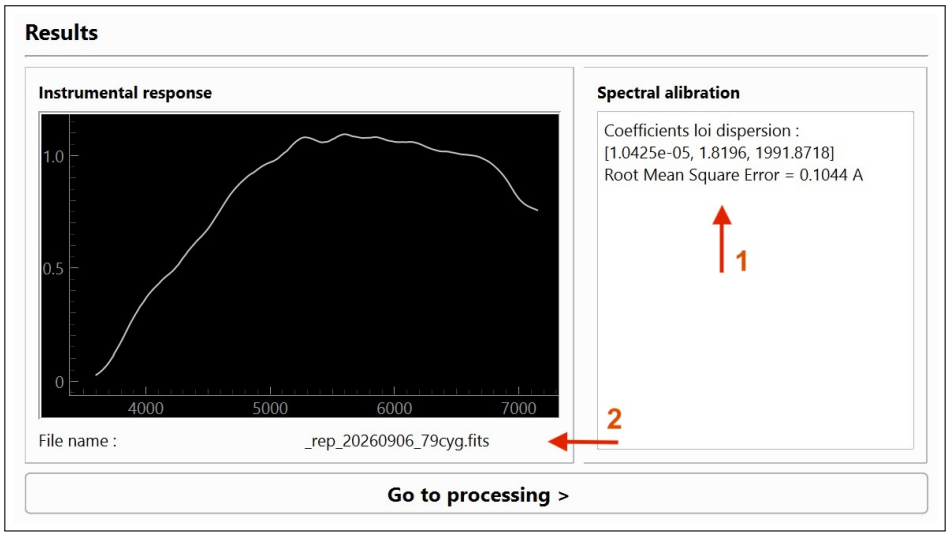


Figure 10. Result of the wavelength calibration and instrumental-response calculation.

In this figure, **1** shows the wavelength calibration in the form of a second-order polynomial and **2** shows the instrument's spectral response, which also includes the effect of the atmosphere through which the light has travelled.

This response curve is automatically saved in a file in the working folder; its name is displayed by the software.

9 Routine processing of spectra

You now have everything you need to process the data from a complete observing session. Normally, there is no need to return to the calibration window.

To demonstrate this, we shall process the spectrum of 79 Cyg, which we used to calibrate the instrument, as though it were simply another star.

Click the large 'Proceed to processing' button at the bottom of the interface. Figure 11 shows the new window, specifically designed for processing low-resolution spectra.

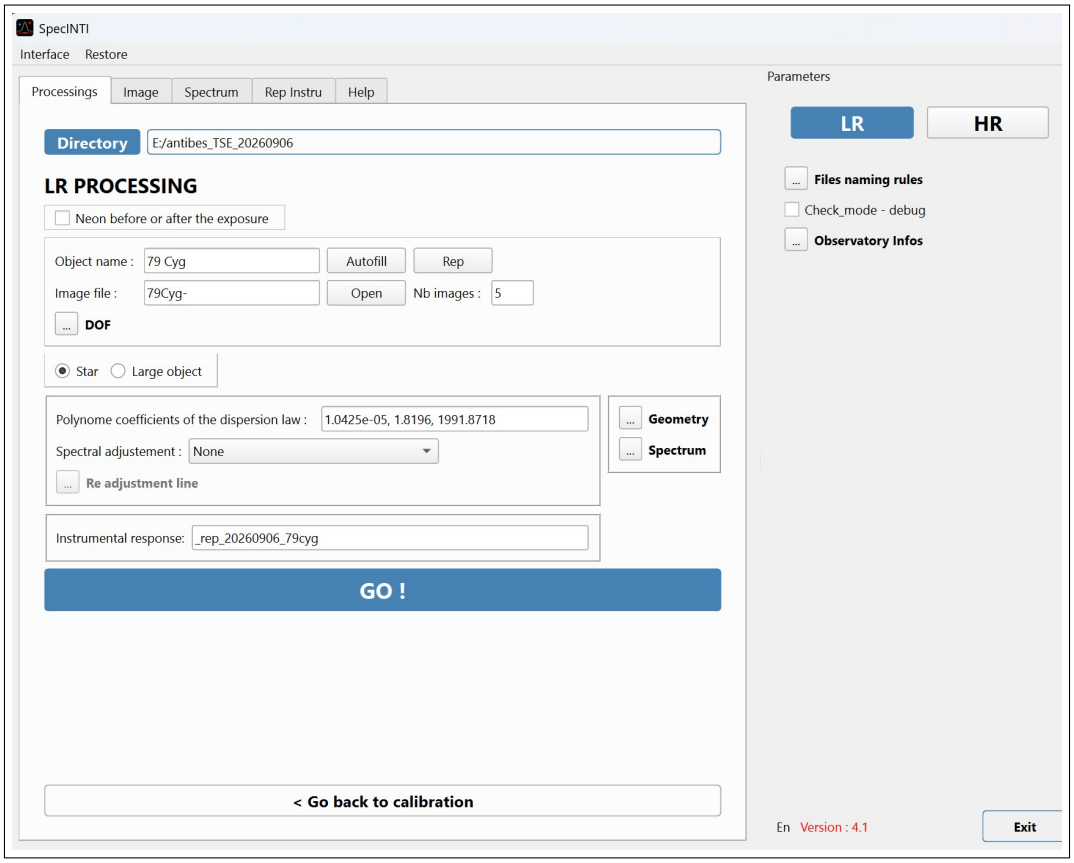


Figure 11. The 'control room' from which you can process all your low-resolution spectra through SpecINTI's standard interface.

Looking carefully at figure 12, you will notice that the calibration parameters calculated earlier are still present. In particular, the name of the last object processed (79 Cyg) is retained, but more importantly, so are the references to the wavelength-dispersion relation and the instrumental response calculated previously.

These are the data that will be used to process spectra from the PROCESSING LR window.

Important. The only information not transferred from the calibration window to the processing window concerns the horizontal and vertical selection regions. From the 'Processing LR' window,

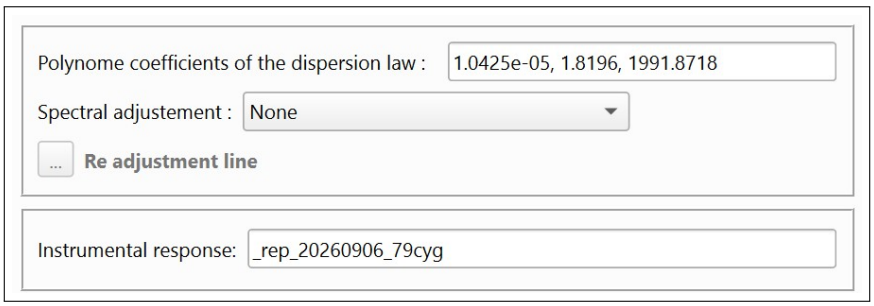


Figure 12. Detail of the processing window, showing the stored calibration data.

you must click 'Geometry' again and redefine these regions (they are therefore independent of those used for calibration), as shown in figure 13.

The purpose of the horizontal selection is no longer to isolate Balmer lines, but to define a sufficiently large pixel range to allow a geometrical parameter such as the angular deviation between the direction of the spectral trace and the horizontal axis of the image — known as the *tilt* — to be calculated accurately. This selection normally remains unchanged when moving from one star to another.

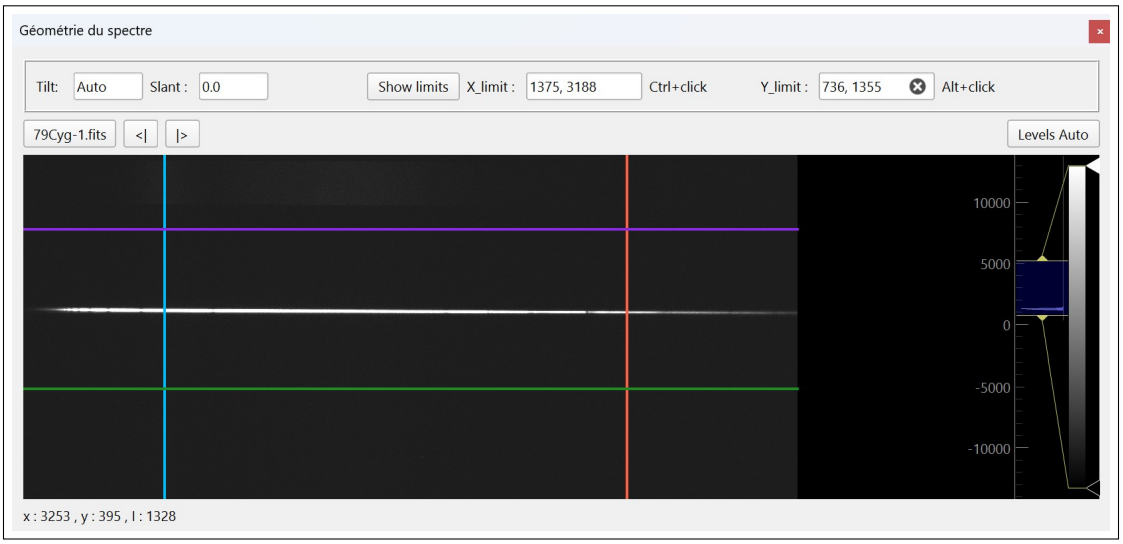


Figure 13. Typical selection regions for routine spectral processing. The separation between the two horizontal limits is sufficient to calculate the spectral *tilt* accurately. The selected parts of the spectrum are also sufficiently intense to ensure a precise calculation.

Then click the large 'Go!' button. SpecINTI performs the complete processing of 79 Cyg without requiring any further parameter changes. After a few moments, the result appears in a new 'Spectrum' tab, which provides numerous analysis possibilities.

The processed spectral profile is also saved in the working folder, here under the name `_79cyg_20260906_82.fits`. The object name and observation date are included in the filename.

To conclude, we have seen how the complete processing of a spectrum can be carried out graphically, with only a few clicks. We have nevertheless had to perform a number of settings which will no longer be required in a new processing session. The procedure will then be even faster and simpler.

But we should not stop here, even in a guide devoted merely to getting started, because, in truth, we have done the hardest part. We can now have some fun with our spectrograph and go much further — considerably further.

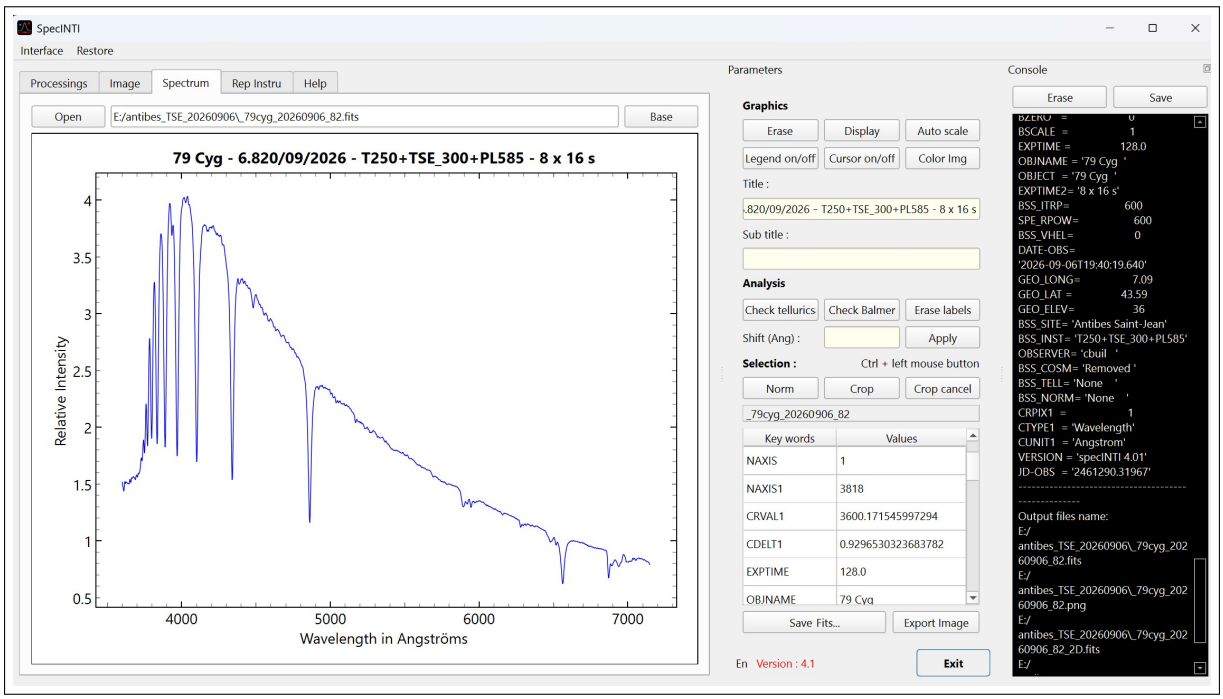


Figure 14. Result of processing the 79 Cyg spectrum in the 'Spectrum' tab.

10 What next?

If you examine the downloaded data supplied to illustrate this introduction to SpecINTI, you will probably have noticed that the observation files for 79 Cyg were accompanied by a few other files:

- Three files named `SN2026aaiv-xxx.fits`. These are spectral images, each exposed for 1800 seconds (30 minutes), of a supernova that appeared in the galaxy NGC 7331 and was acquired on the same night as the 'reference' star 79 Cyg. Reference, because the calibration data obtained from this star will also allow us to extract the supernova spectrum quickly.
- One `_offset.fits` file and one `_dark.fits` file. These are images obtained by averaging individual frames taken in the dark (in the cold of a refrigerator, to be precise), because the exposure time is so long that measuring the thermal signal, together with the offset signal under the same conditions, is useful for reducing the corresponding noise. Notice, however, that we did not bother to acquire a flat-field image: we assume that the spectral response measured from the natural source provided by the star 79 Cyg already incorporates everything a flat field could contribute.

Stay in the PROCESSING LR window, but this time tell the software that we have an offset map and a thermal-signal map, as shown in figure 15, after clicking the 'DOF' button.

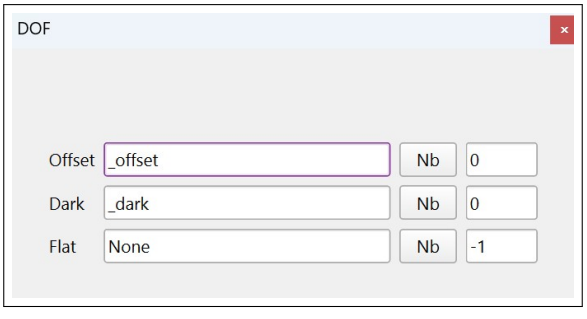


Figure 15. Indicating that DOFs are to be used.

Then tell the software which data you wish to process (figure 16).

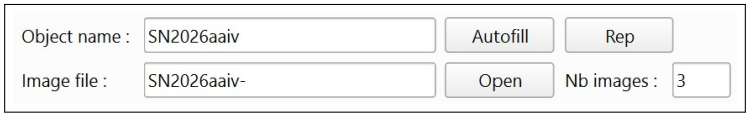


Figure 16. The image files supplied to SpecINTI for processing.

All that remains is to click 'Go!', and your supernova spectrum is processed in a few seconds (figure 17). This is where the simplicity and efficiency of SpecINTI really become apparent.

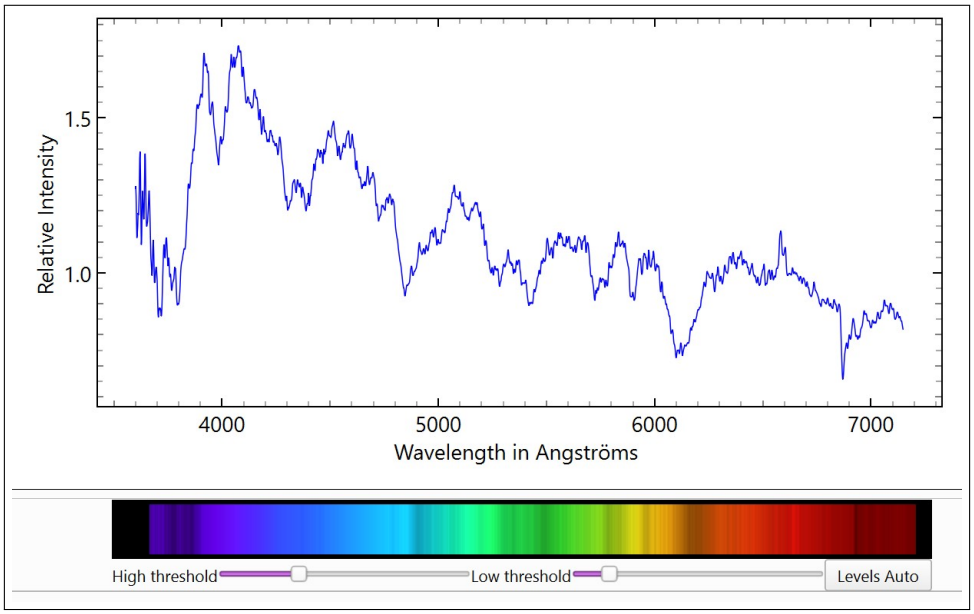


Figure 17. The spectrum of supernova SN2026aaiv in NGC 7331 on 6 September 2026, obtained with a TinyStar'Ex mounted on a 254 mm f/4 Newtonian telescope. The supernova was approximately V = 14 in magnitude.

And now?

You have now seen the essentials of low-resolution processing with SpecINTI. Many possibilities have deliberately been left aside in this introduction: advanced calibration techniques, atmospheric transmission corrections, processing of a variety of objects, and much more.
To go further, consult the **SpecINTI Processing Guide**.

A whole new universe is about to open up to you!