



RSpec Update Version 2.3

Dear RSpec User,

Welcome to this new version!

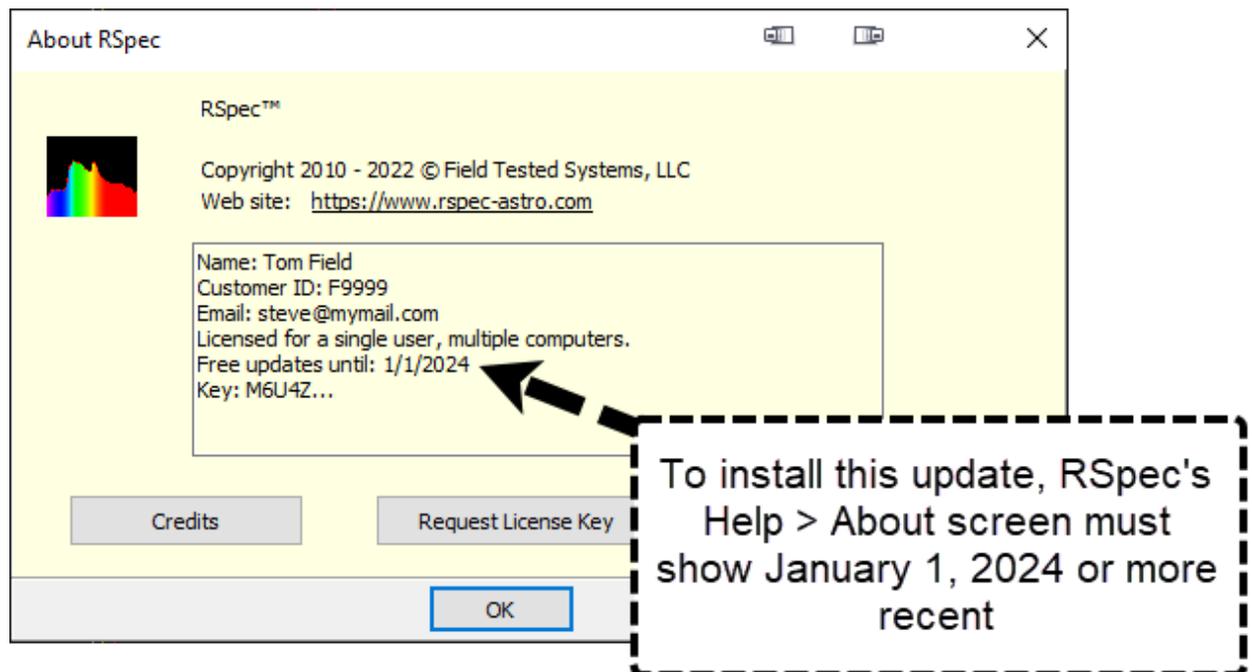
For videos about the new features described below, click [here](#).

Visit our online forum: <https://groups.io/g/RSpec-Astronomy>. We have a great community there.

If you're updating from an older version:

Our software license entitles you to free updates for 12 months after purchase.

To install this update, the Help > About screen in RSpec must be **January 1, 2024**, or more recent, as shown below:

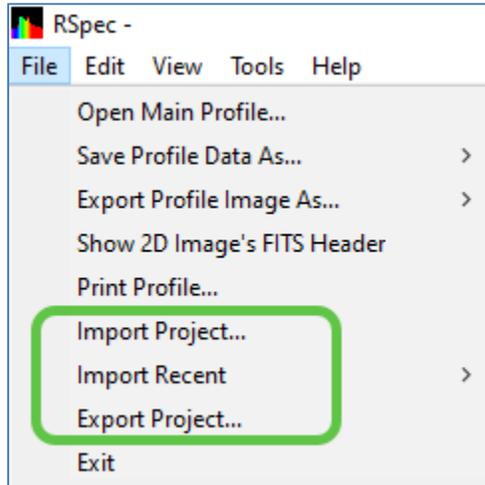


If you need to purchase an update, see this [link](#).

I'm always interested in getting feedback and hearing what you're doing with the software. Please let me know what features and changes you'd like to see in RSpec. I'd also love to hear what you think of the new features.

New features in Version 2.3

- **New feature:** RSpec can now import and export most of the files and settings for an image. Use the Export function to archive the files you used when creating a profile. Use the Import function to reload all of the files into RSpec, restoring the calibration and other important settings.



When you export a project, the resulting ZIP file contains:

- The current image file (JPG, PNG, TIFF, FITS, AVI, etc.)
- The location of the orange capture-region lines
- All settings from Subtract Background
- The Binning settings (from the toolbar button)
- All settings from the Histogram stretch window if it's open
- Rotate and Slant/Tilt settings
- The Appearance screen
- The Calibrate screen
- The Instrument Response screen if it's open

When you import a project, RSpec applies all of the above settings. Note that this new feature does not import or export .dat and 1D FITS files from the profile graph region.

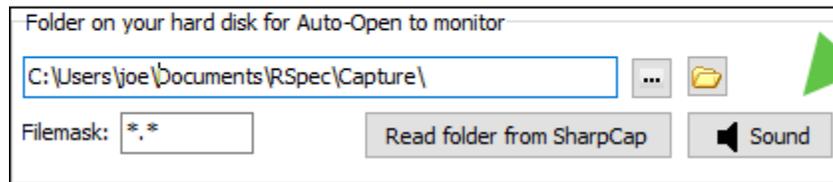
What to try Importing a project? See the RSpec\Documents\Sample Spectra\Sample Projects folder.

- **New feature:** When you hold down the Ctrl-key and click anywhere in the graphing region, if the Appearance screen is open, it selects the label closest to where you clicked.

If you use a lot of labels on the Appearance screen, you know how time-consuming it can be to find a specific label (like, say, "Hydrogen Beta") in the label list. With this new

feature, you can instantly jump to a label by just Control-clicking near it on the graph.

- **New feature:** When RSpec auto-opens a file, it can now optionally play a customizable tone. You can disable, or configure the length and pitch of the tone on the Options > Advanced tab:



Many users love RSpec's Auto-Open feature because they can continue to use their usual camera capture software and have RSpec automatically open any new image that their camera control software saves to their disk.

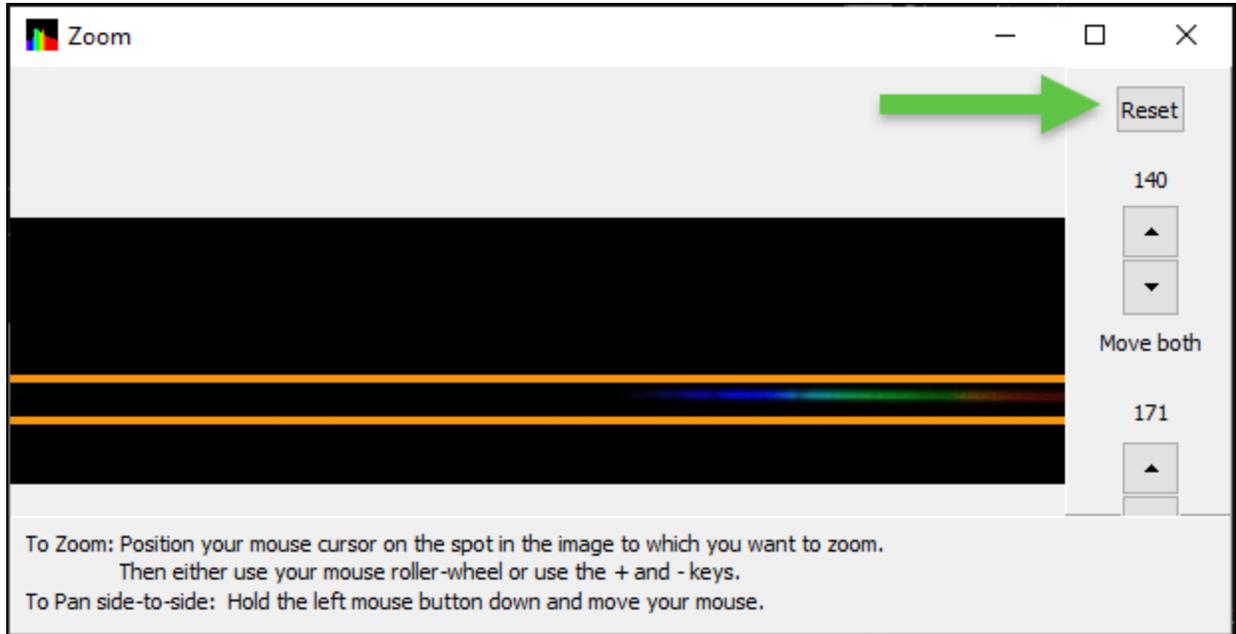
When you enable RSpec to play a sound, when it auto-opens an image, RSpec audibly alerts you that it has detected and loaded a new image. This eliminates the need for you to closely watch the RSpec title bar to spot when a new filename appears.

You can also mute the sound by toggling the button below:

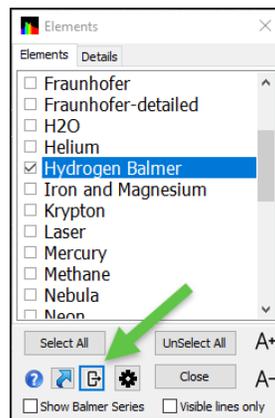


- **New feature:** When you're on the Magnifier screen, the mouse roller wheel has always allowed you to zoom with your mouse roller wheel. In this version of RSpec, you can lower the sensitivity of the zoom, so you can very carefully zoom to the exact amount you want. When you use your mouse roller wheel, hold down the CTRL key for slower zooming. Hold down the ALT key for even slower zooming.

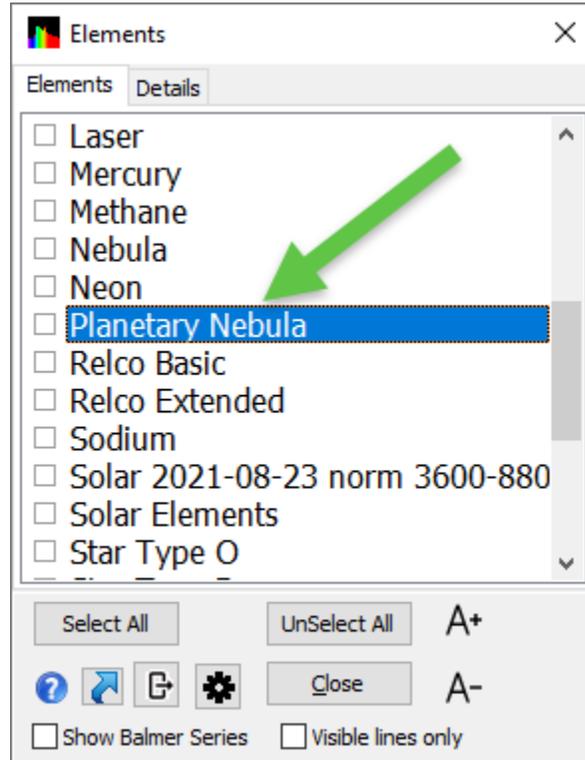
- The Reset button on the Magnifier screen is now more accessible at the upper right.



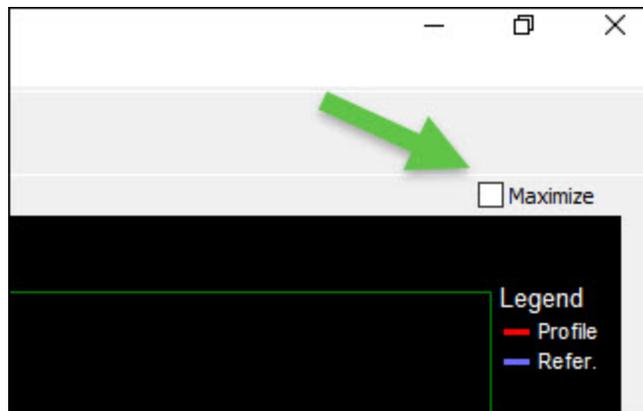
- **New feature:** The *Elements* screen has a new Export button. Clicking this button exports all of the Element lines being displayed on the profile to all new labels on the *Appearance* screen. This allows you to very rapidly create Labels for every Element line currently visible on the profile screen:



- The Elements window contains a new entry for Planetary Nebula:



- RSpec now “remembers” where the Elements window was positioned and puts it in the same spot when you re-open it.
- The Maximize checkbox that was added in the previous release can now be toggled with the **F8** function key.



- RSpec automatically crops FITS images that are larger than 30 megapixels down to 30 megapixels.

Other Changes

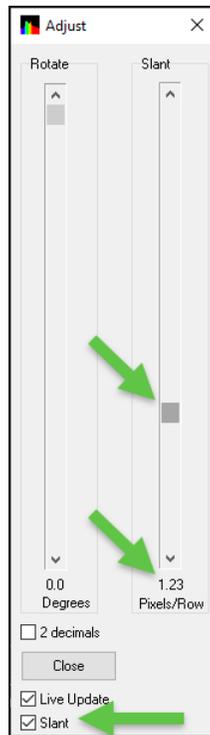
- When binning is enabled on the toolbar, RSpec now displays a green checkmark on the toolbar icon. This makes it easy for you to spot if it is on:



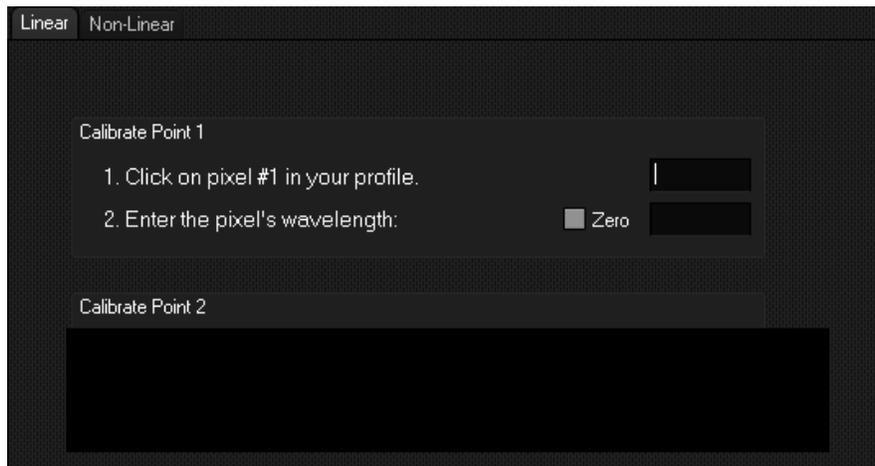
- The toolbar button that deletes all profile points between the Measure Lines has been changed to be more unique and self-explanatory.



- When you are using the Rotate screen's Slant option, RSpec remembers the amount of slant even if you close and re-open the screen.



- **Bug fix:** in Dark mode, some users reported they had trouble seeing and/or clicking in the fields on the "Linear" Calibration screen. This bug has been fixed.



Previous Version 2.1.0.26

- **New feature:** The SharpCap Bridge now allows you to explicitly name the folder that RSpec should monitor. This new feature is helpful if RSpec is unable to find SharpCap on your computer.
- **New feature:** RSpec has a new Dark mode for use at night. Use the RSpec > View menu to toggle Dark Mode on and off. Dark Mode is preferred by some users, especially at night.

In addition, many users also find *Microsoft's* Dark mode helpful in their nighttime observing sessions. To enable Windows dark mode, on the Windows Start Menu, navigate to Settings > Personalization > Colors, then open the drop-down menu for "Choose your color" and pick Dark. This setting will change the look of the Windows Start menu and apps.

- **New feature:** RSpec's toolbar buttons are now twice as big, making them much easier to read:



- **Translation:** The German translation of RSpec has been updated. (Thanks to Erik W.!)
- **Bug fix:** RSpec was not properly applying changes to the "Point Size"-field on the Appearance screen to the Main profile.
- **Bug fix:** In some circumstances, when dividing to create an instrument response curve on the math screen, RSpec was adding an extra point at the very left (0,0) or very right of the spectrum.

RSpec Update Version 2.1

The notes below are a brief overview. For the most complete information, see the online videos under "Update 18" at this [link](#).

Previous Version 2.1.0.26

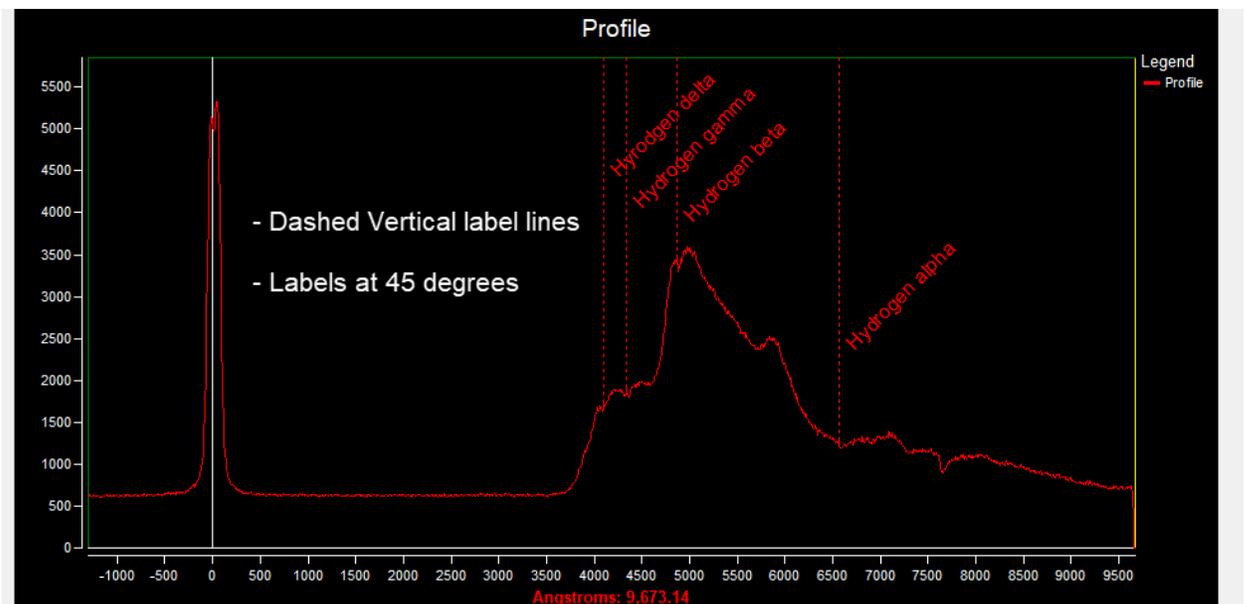
- In some cases, clicking on the Crop toolbar button on the left (Image File) window resulted in an error message. This bug is fixed in this release.

Previous Version 2.1.0.25:

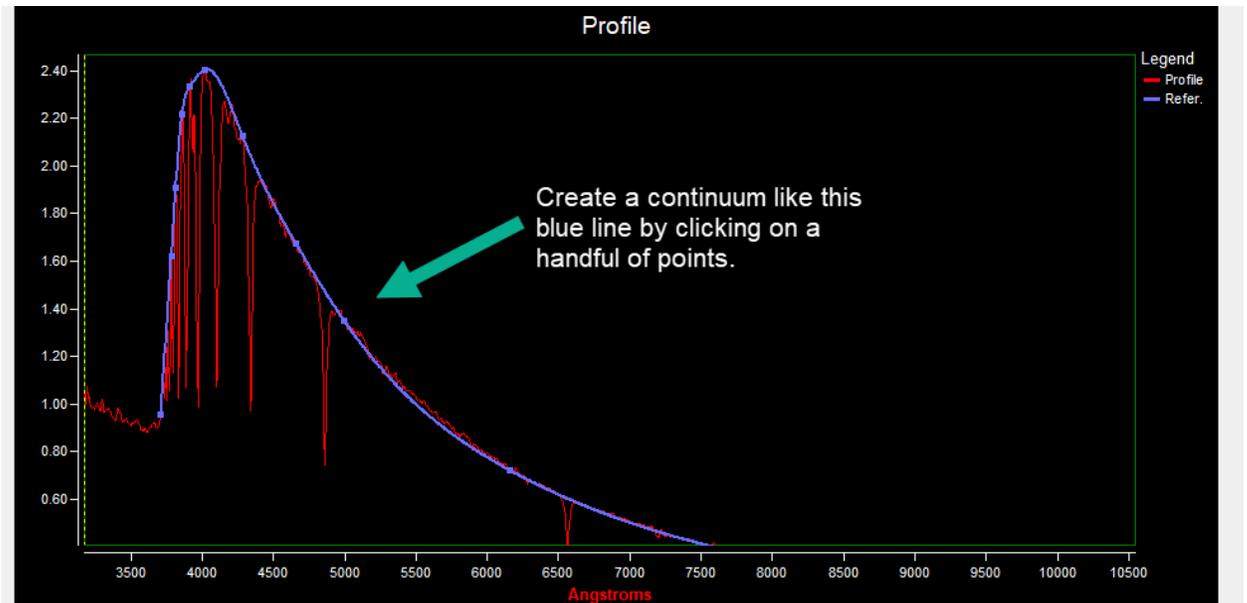
- **Magnetic Mouse:** when you move the mouse cursor in the graphing area, the mouse is now magnetic. In the past, it was often a struggle to click on points and graph lines because they are so tiny. With the Magnetic Mouse, if you click *near* a point or line, RSpec detects the nearby object and assumes that you intended to click on it.

Says Tom, "I feel this is one of the more significant enhancements to the usability of RSpec that I've ever implemented. The Magnetic Mouse makes it a pleasure to work with profile graphs."

- **Appearance Screen:** A new button sorts labels by wavelength or text. This feature helps you keep your labels on the Appearance screen organized and easily found.
- **Appearance Screen:** labels can now be oriented at 45°. (See the screenshot below for an example.)
- **Appearance Screen:** vertical label lines can now be dotted rather than solid. °. (See the screenshot below for an example.)

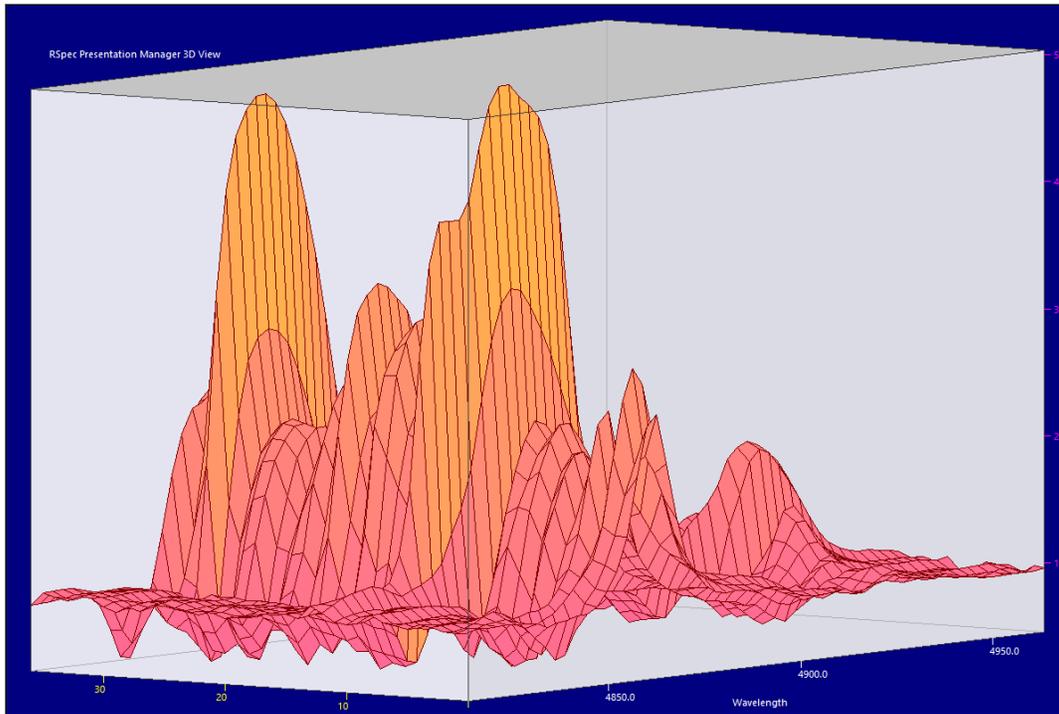


- **Appearance Screen:** Layout files can now be opened directly so you can more easily manage them.
- **Appearance Screen:** There's a new command to delete Layouts that you're no longer using.
- **New Continuum tool:** Create a continuum by clicking on a handful of points. This is very helpful when creating instrument response curves or normalizing/rectifying spectra.



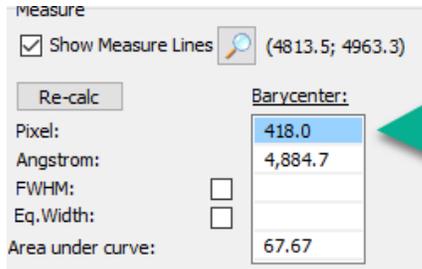
- **Continuum:** A new method (under the "More" button on the Edit Points screen) for creating a continuum has been added. You can now create a continuum that connects the Measure Lines.
- You can **maximize the graphing area** to fill the height of the screen with a new checkbox above the graph. This lets you see more detail in your profile in higher resolution.

- **Presentation Manager:** create a **3D view** showing how your spectra evolve over time. This feature is great for creating time-series that show short term changes in a star, as shown below.



- **Presentation Manager:** a new tool lets you anchor labels on any profile so that they stay properly positioned when you re-scale the offsets.
- **Non-linear Calibration screen:** a new tool shifts your profile by one pixel to the left or right to correct for Doppler shift or mechanical shift of your instrument.
- The **orange capture** lines are restored to their previous position when you re-start RSpec.
- Two new **Element files** have been added. They contain a large number of common element lines to help you identifying features in your spectra. The Details tab on the Elements screen now has a panel containing Notes about some Elements. For example, see the “Calibration AFGKM stars” entry on the Elements window.

- **Speed up:** RSpec is much faster and uses less CPU resources, especially when displaying a large number of Labels from the Appearance screen
- Video processing was sped-up. And, some problems that RSpec had with ZWO cameras have been fixed.
- **Bug fix:** As shown below, a bug has been fixed so that commas used as decimal points no longer fails:



Clicking on the pixel value to transfer it to the Calibration Wizard now works properly in countries that use commas rather than decimal points.

- **The SharpCap Bridge:** RSpec can now process SharpCap video and static images in real-time. See the tutorial videos for more information.

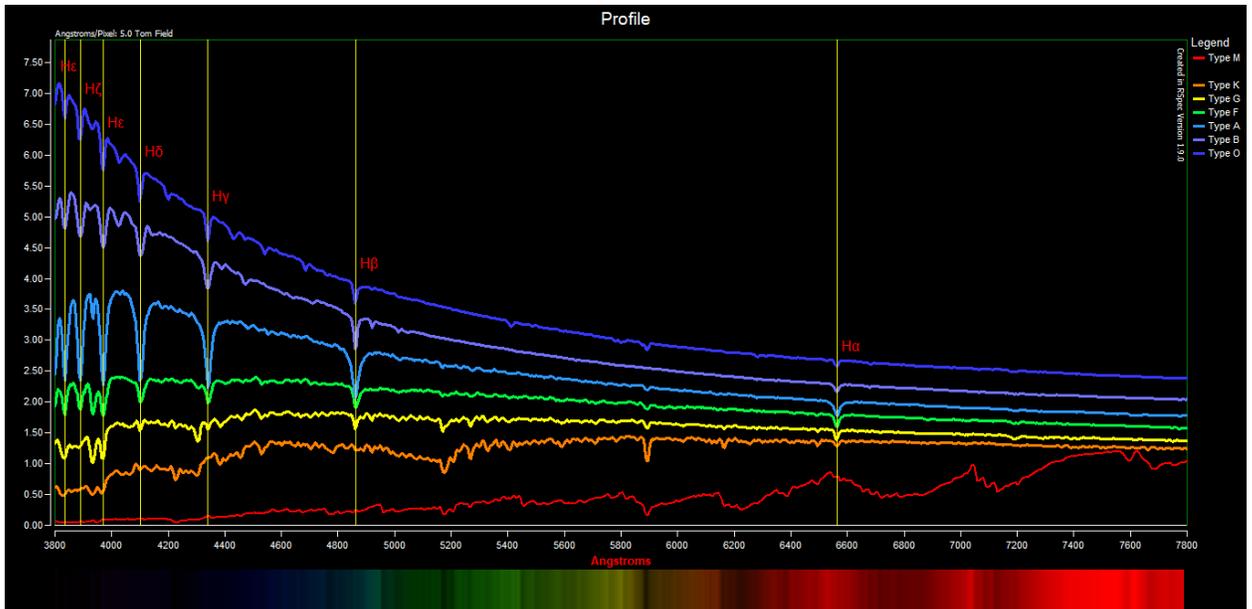
Previous Version 2.0.0.13:

This version adds no new features. It includes a more complete German translation. If you would like to provide a translation for any other languages, please contact us.

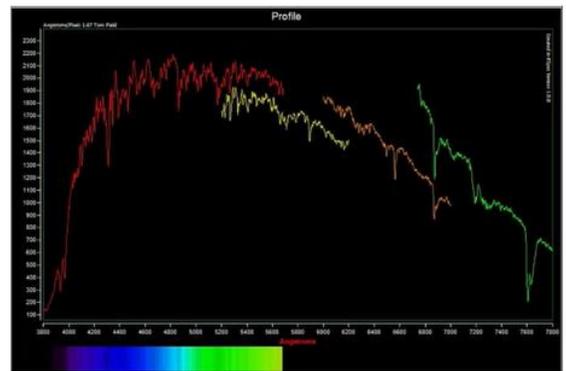
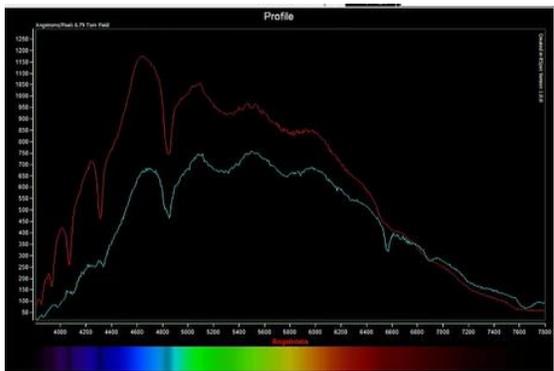
With this minor update, RSpec now tracks bugs better, allowing you to report problems from a pop-up window that appears when there are problems.

Previous Version 2.0.0.10

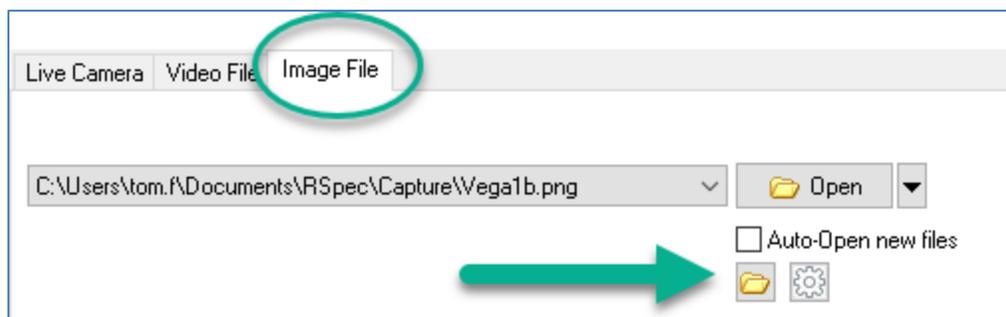
- A new screen called the Presentation Manager allows you to display up to 20 spectra at the same time, as shown below.



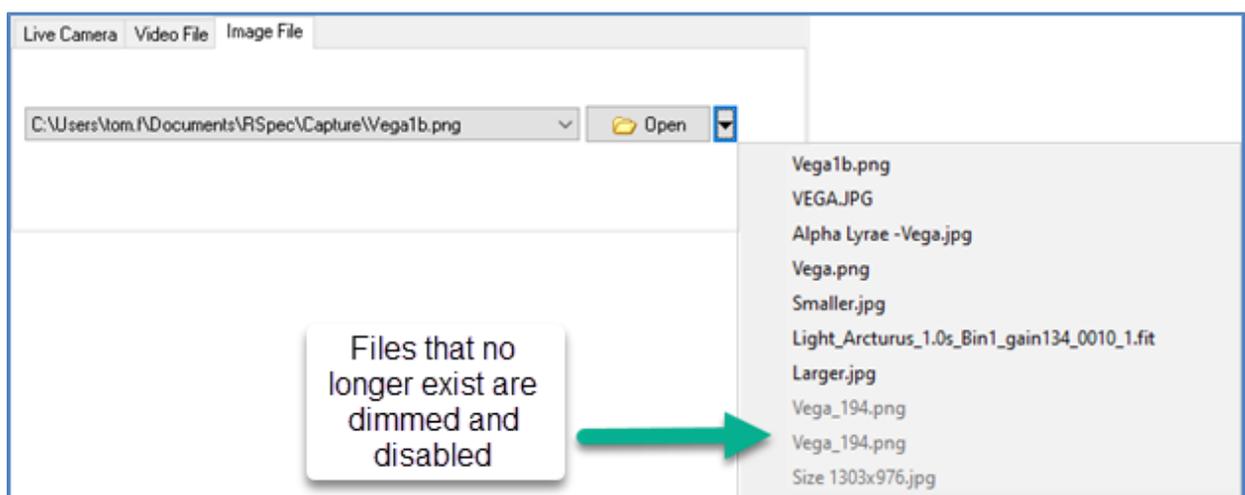
- The Presentation Manager enables you to stitch two side-by-side spectra. This can be helpful in low resolution and higher resolution spectra as shown below:



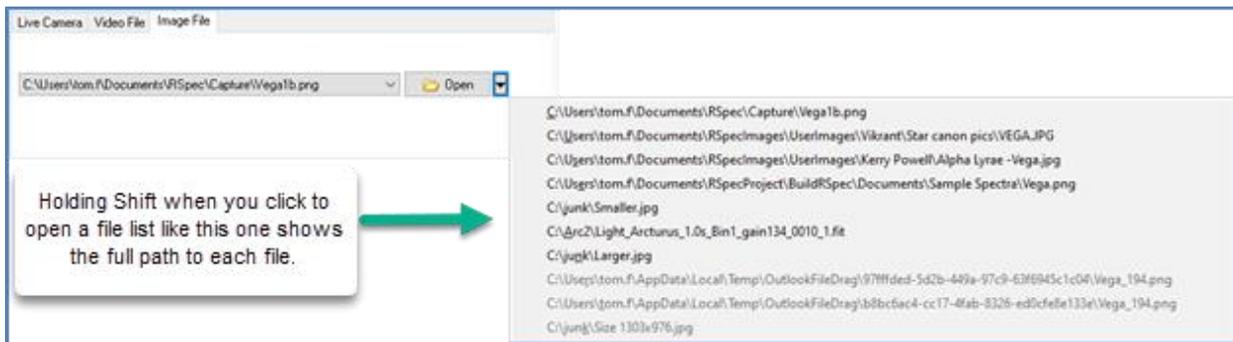
- Two new buttons in the Image File tab will directly open the Capture folder and the Options screen for Capture monitoring:



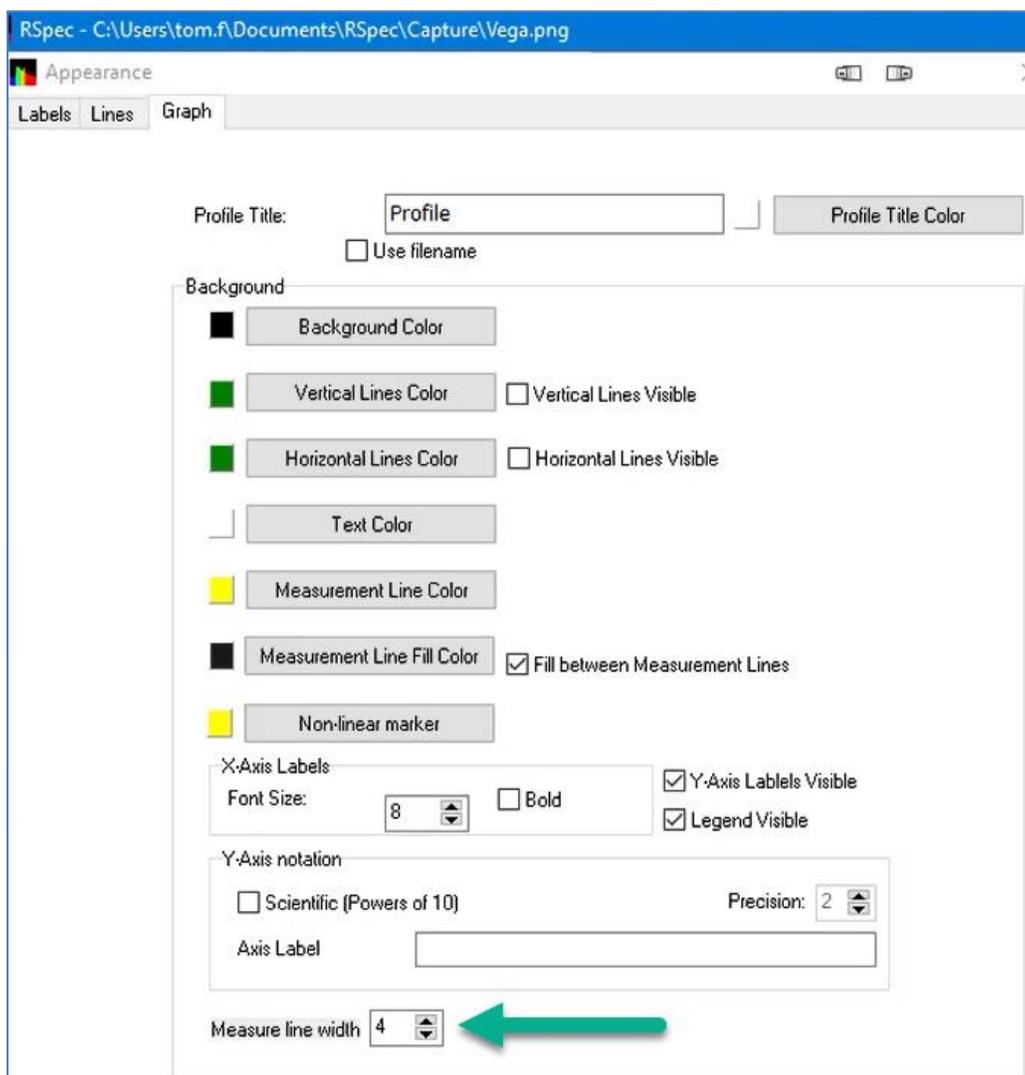
- When RSpec displays a list of files that you've previously used, it dims and disables any files no longer exist.



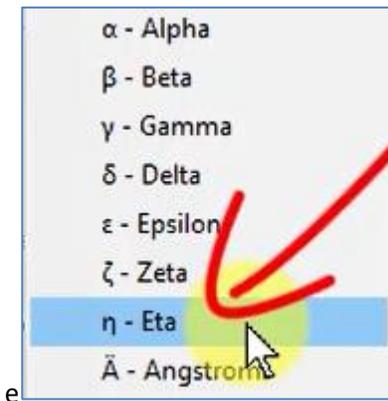
- Holding Shift when you click to open a list of previous used files now shows the full path to the files:



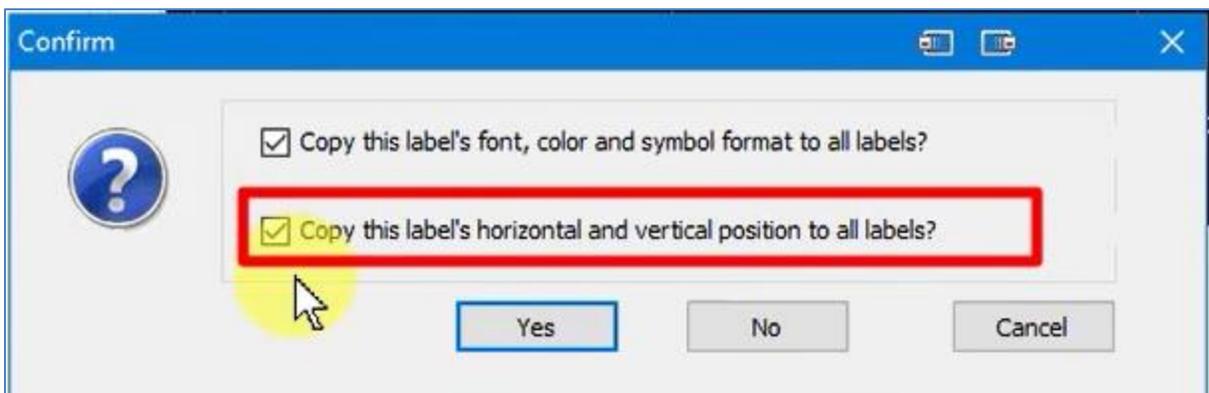
- You can now increase the width of the Measure Lines from the Appearance screen:



- The list of Greek letters that pops up when you right-click in the text fields on the Appearance screen now includes the Greek letter Eta:



- A new checkbox that appears when you click the Appearance screen's "Copy All from..." will vertically and horizontally align all Label text.

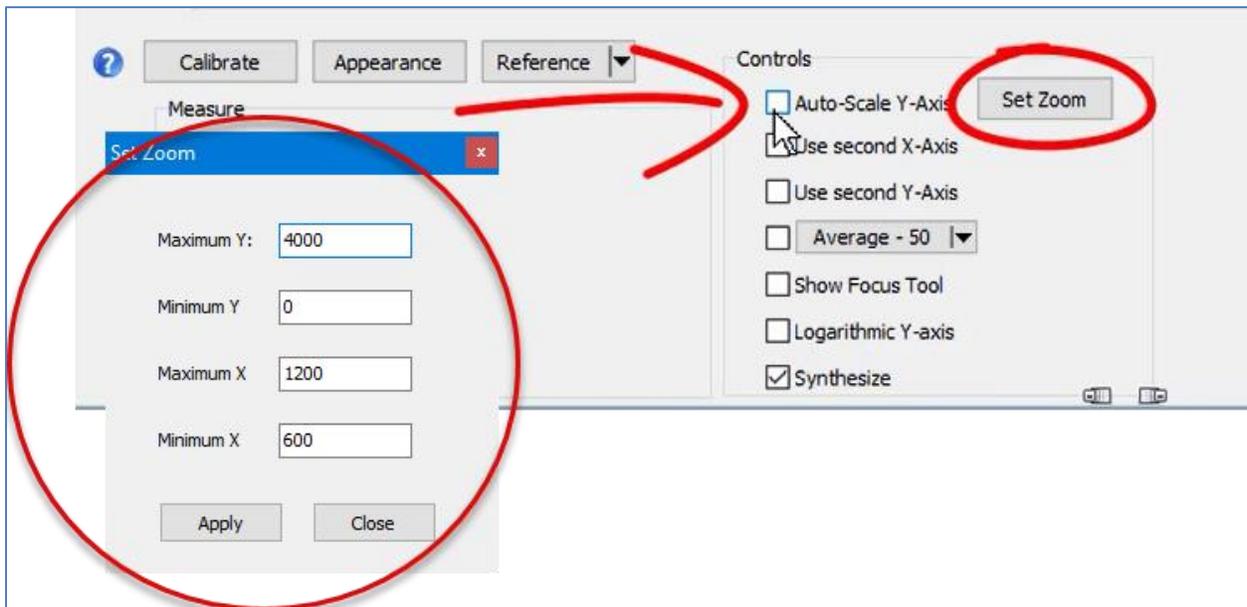


- Profile files (.dat files) that are imported can now be delimited by commas as well as <tab>. This allows you to import data from other sources that may use comma as a delimiter. Turn this option on via the Options screen. (Note that this interferes with the proper reading of international datasets that use a comma to delimit thousands in numbers.)

- Radio buttons on the Zoom (Magnifier) screen now allows you to make the Orange selection box lines more narrow.



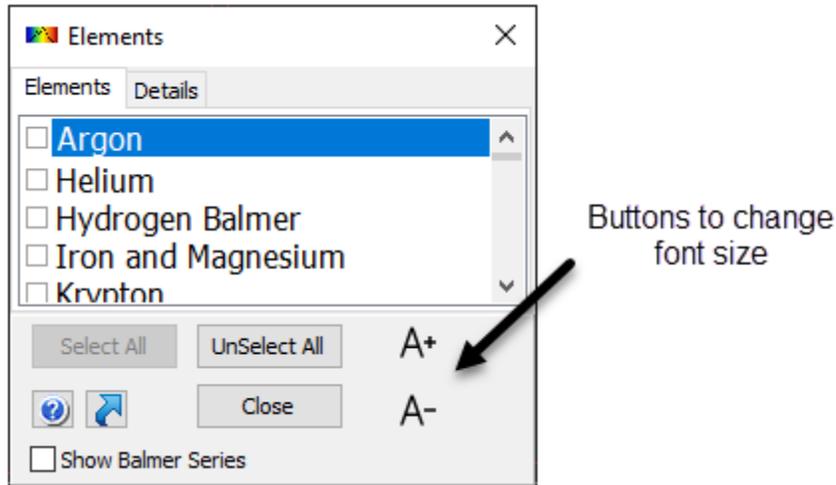
- If you remove the checkmark from the Auto-Scale Y-axis option, a new "Set Zoom" button lets you zoom to any values. This can be useful to standardize your spectra presentations.



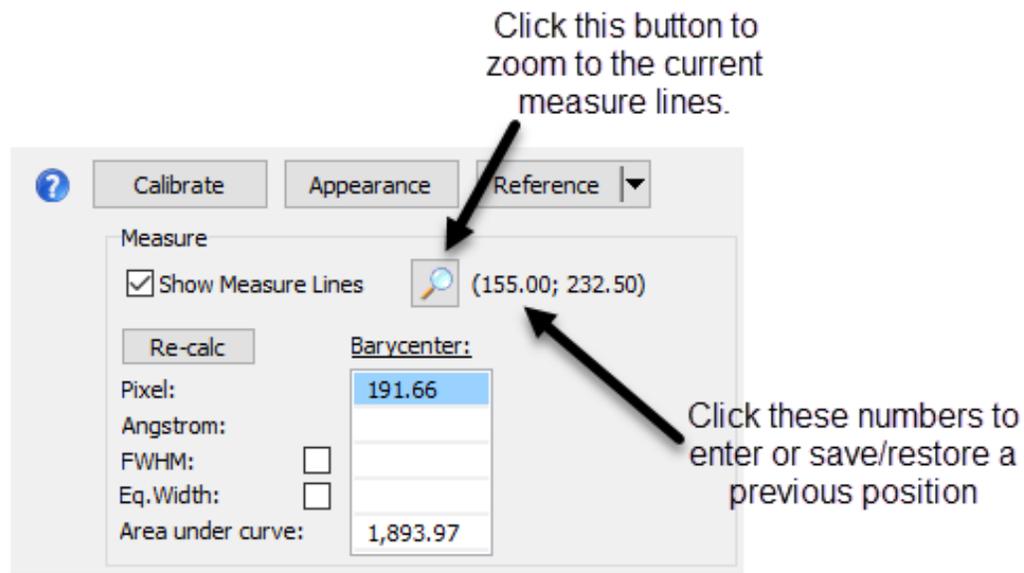
RSpec Update Previous Version 1.9.0.40

The notes below are a brief overview. For the most complete information, see the online video #36, entitled "Update 16" at this [link](#). **Some of the features in this update may already be on your machine if you recently downloaded the software.**

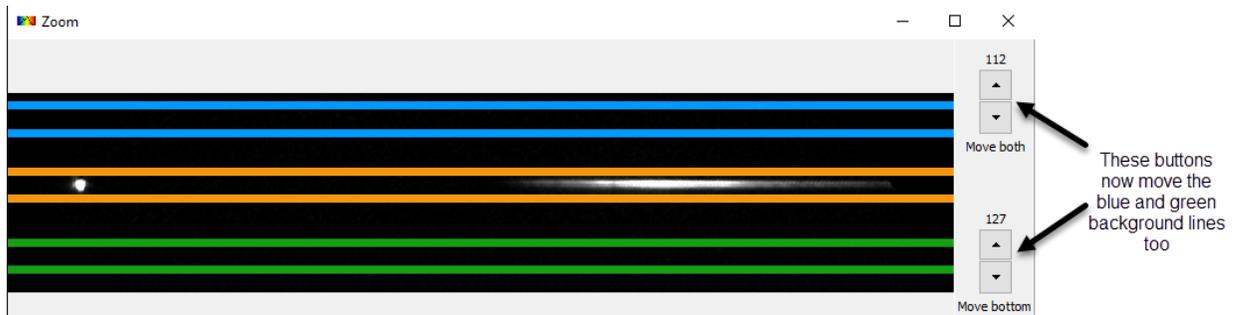
- The Elements window now has buttons to make the fonts larger (for legibility) or smaller (to see more elements without needing to scroll), as shown below:



- You can now zoom the profile graph to the current Measure lines. Reminder: you can also click on the numbers to the right of the button to enter in a new position for the measure lines from the keyboard and to save and recall their previous position:



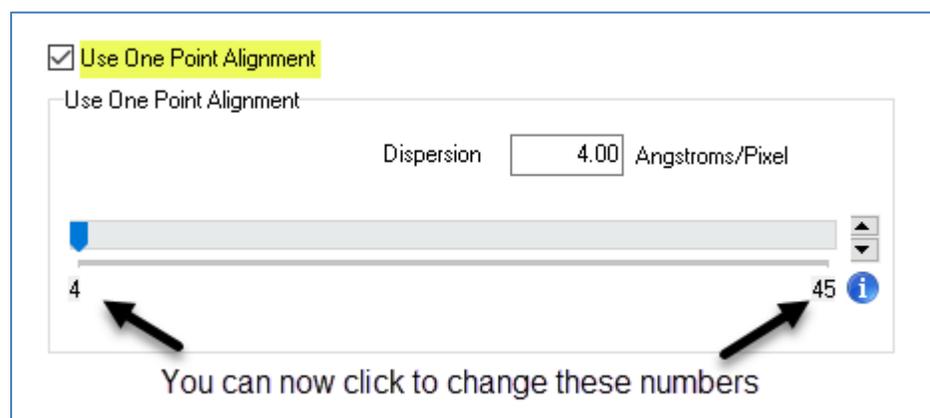
- The Move-buttons on the Magnify/Zoom screen now moves the blue and green lines if they're visible and selected in the legend (in the upper left hand corner of the main screen.)



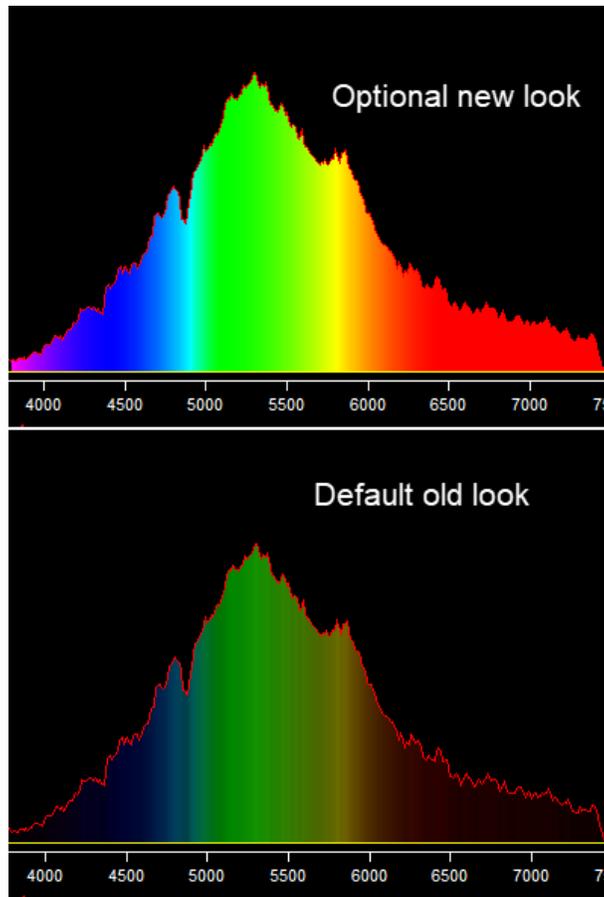
- On some older (XP or Win7) or newly built machines, RSpec would report an error when loading FITS files. This bug has been fixed. You shouldn't be running those versions of Windows anyway. 😊
- In the past, RSpec occasionally had difficulty calculating non-linear 3rd or 4th order calibrations. The statistical algorithm has been improved to eliminate this problem.

Also note that in the past, when doing non-linear calibration, RSpec automatically added a point at 0,0. RSpec no longer adds that point. If when calibrating, you get an unexpected warning that there's a negative slope, you should select a lower order or crop the image on the left and right more closely to the calibration points.

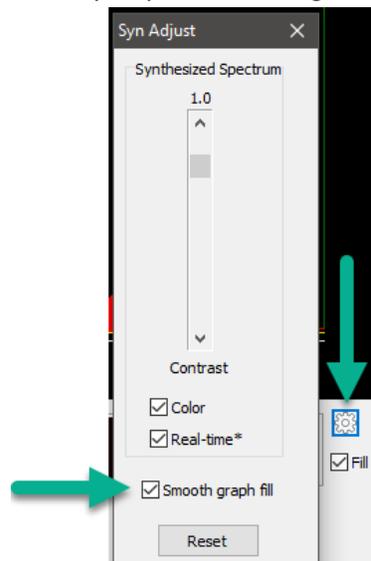
- The horizontal slider for One Point Alignment at times wasn't long enough to accommodate high dispersion spectra (e.g. a DSLR with a objective grating). You can now click on the minimum and maximum numbers to change the range of the slider.



- The brightness of the color fill under the profile can now be solid rather than relative to the brightness to the intensity of the graph.

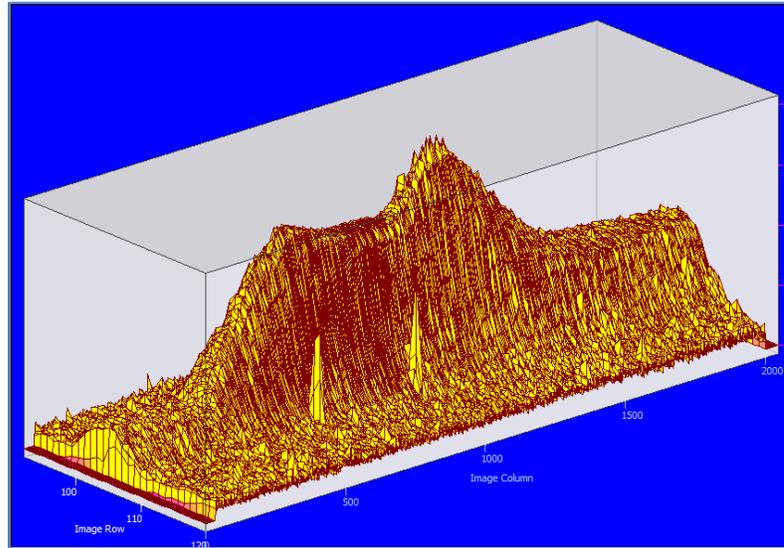


You can choose which of the above fill styles you want using the checkbox shown below:



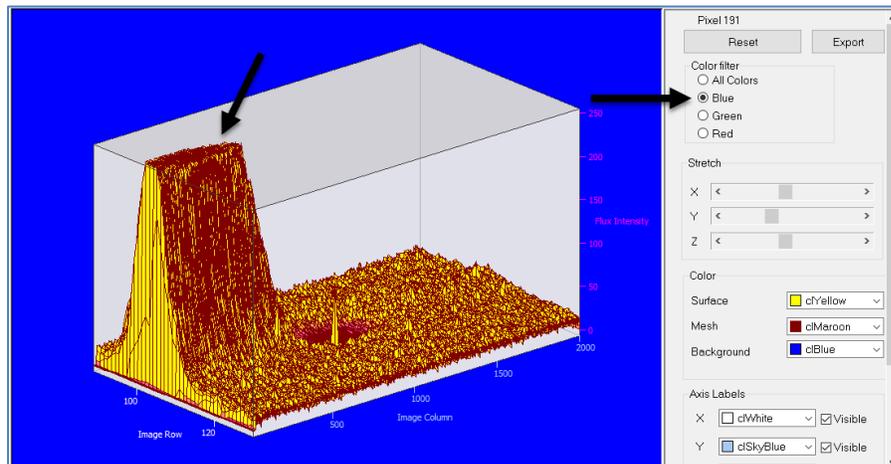
- The 3D Pixel Map now allows you to view a single channel (Red, Green, or Blue) a time.

Let's first look at the Pixel Map for a typical color image. Like all image processing software, RSpec combines the RGB color channels into a single number, the monochrome intensity value:



The above Pixel Map looks fine. All values are well below 255. There are no flat tops. So we might conclude that there are no saturated (over-exposed) pixels. But, to convert RGB to mono, image processing programs combine the individual Red, Green, and Blue pixels using a weighted average, which can hide saturation.

So, now let's look at the same image, but this time we'll use the new radio buttons to view *just the Blue channel*:

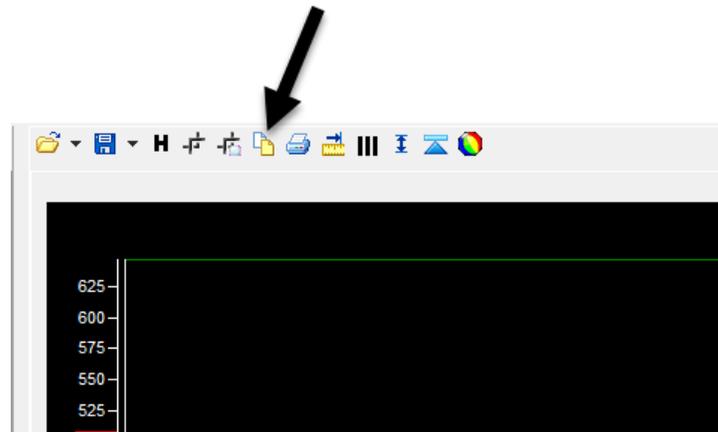


Notice the flat top on the blue end of the spectrum? It is definitely over-exposed. You will need to reduce the exposure time.

You can use the new radio buttons to examine the Pixel Map for each color channel. This will enable you to detect saturated pixels that are hidden when converted to monochrome.

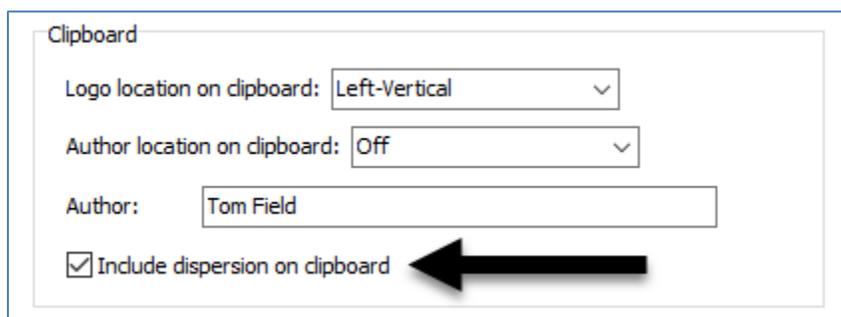
As usual, this feature works on both images and video. Note that if your video frames are very large or your frame rate quite high, the above screen can really slow RSpec down. To avoid that, you can limit the size of the region being analyzed by selecting a sub-region: Open the pixel map and then while holding down the Alt keyboard key and your left mouse button to select a sub-region in an area on the *main screen's image*.

- For many years, this button has copied a screen capture of the Profile graph to the Windows clipboard:

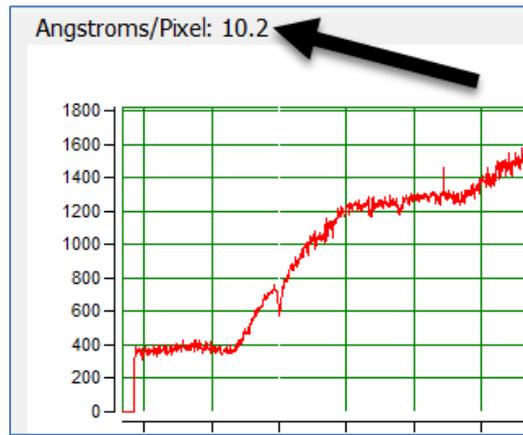


You can now optionally include the Angstroms/pixel value. This value is helpful to others when you are sharing your spectra.

To enable this, on the Options screen, there's a new checkbox, as shown below.



When the above box has a checkmark, if you copy the profile to the clipboard (with the toolbar button or Edit option on the top menu bar on the main screen), the Angstroms/pixel value will appear as shown below when you paste the clipboard contents into a document, as shown here:



- On the Appearance screen, you can now add a label to the profile Y-axis:

The screenshot shows the 'Appearance' dialog box with the 'Labels' tab selected. The 'Y-Axis notation' section is highlighted with a green box, showing the 'Axis Label' set to 'Relative Intensity'. The background graph shows a red profile line on a white grid with a y-axis labeled 'Relative Intensity'.

Labels Lines Graph

Profile Title: Profile Profile Title Color

Use filename

Background

Background Color

Vertical Lines Color Vertical Lines Visible

Horizontal Lines Color Horizontal Lines Visible

Text Color

Measurement Line Color

Measurement Line Fill Color Fill between Measurement Lines

Non-linear marker

X-Axis Labels

Font Size: 8 Bold Y-Axis Labels Visible

Legend Visible

Y-Axis notation

Scientific (Powers of 10) Precision: 2

Axis Label Relative Intensity

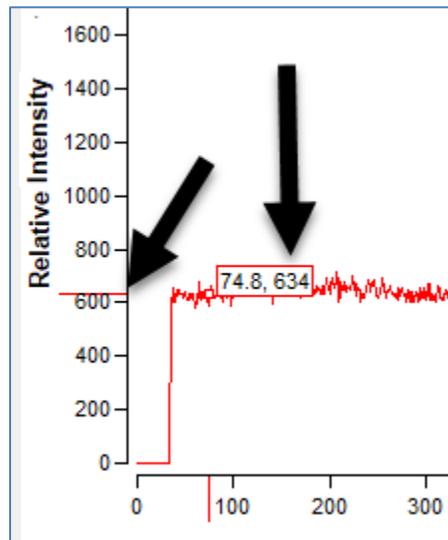
Please calibrate for color synthesis

Save Layout Last Layout Reset to Default Close

Calibrate Appearance Reference

Controls Auto-Scale Y-Axis

Reminder: If the Measure lines are visible (but not the Elements window): when you hover your mouse over the profile line, the floating window will show the y-axis intensity values, as shown below. These unitless relative intensities are the sum between the orange lines of one column in the image.



New Features in RSpec Previous Update Version 1.9.0.17

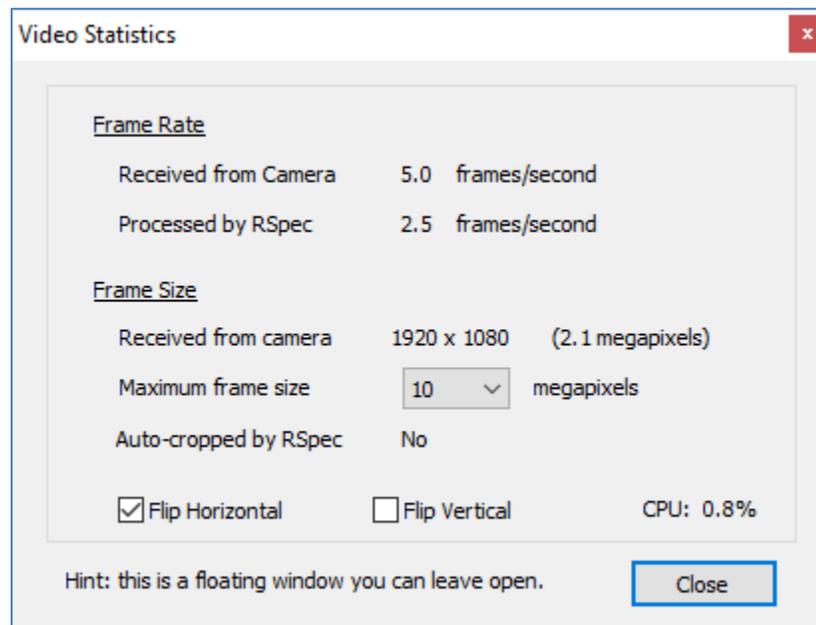
- RSpec's video processing has been significantly enhanced for reliability, speed and flexibility, especially on modern videos cameras with large video frames and fast frame rates:
 - By default, RSpec no longer adds black borders to images for rotation. Images sizes (in pixels) are thus now smaller and faster.

Note: If you have any previously saved calibration files that you saved from the Calibration Wizard screen, you will need to re-create them for accuracy (or use the Options, Advanced tab to re-enable the black borders for square images.)

- A small window beneath the video window shows the current video status:



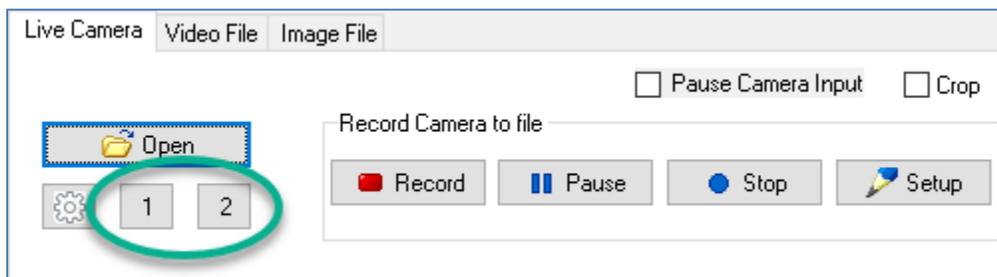
- A new video statistics window provides additional statistics, allows automatic cropping by pixel counts, and enables flipping of the video image vertically and horizontally.



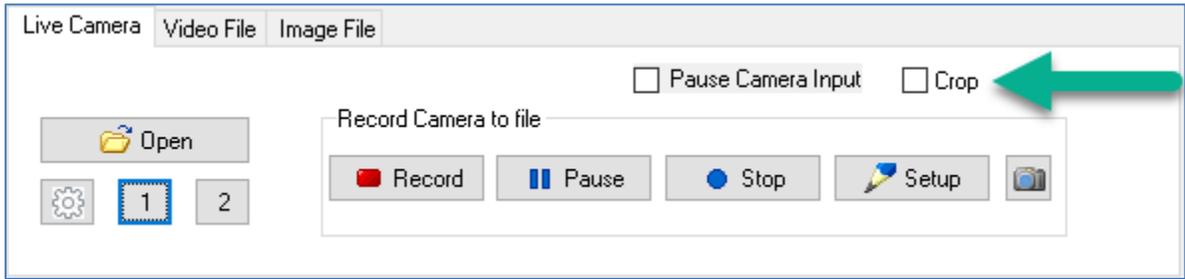
- The Rotate button now flashes red when a rotation is in effect. This is intended to remind you that rotation is expensive computationally. We encourage you to carefully mount your Star Analyser grating so that spectra don't require rotation.



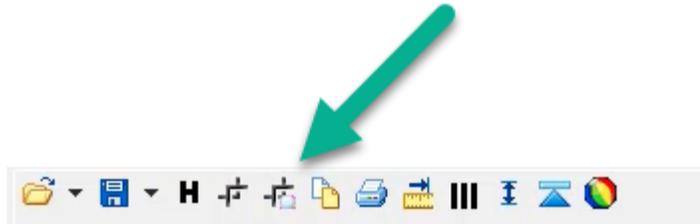
- The two submenus under the Live Video “Configure” button now have their own dedicated buttons labelled “1” and “2.” This makes them faster to access, as shown below:



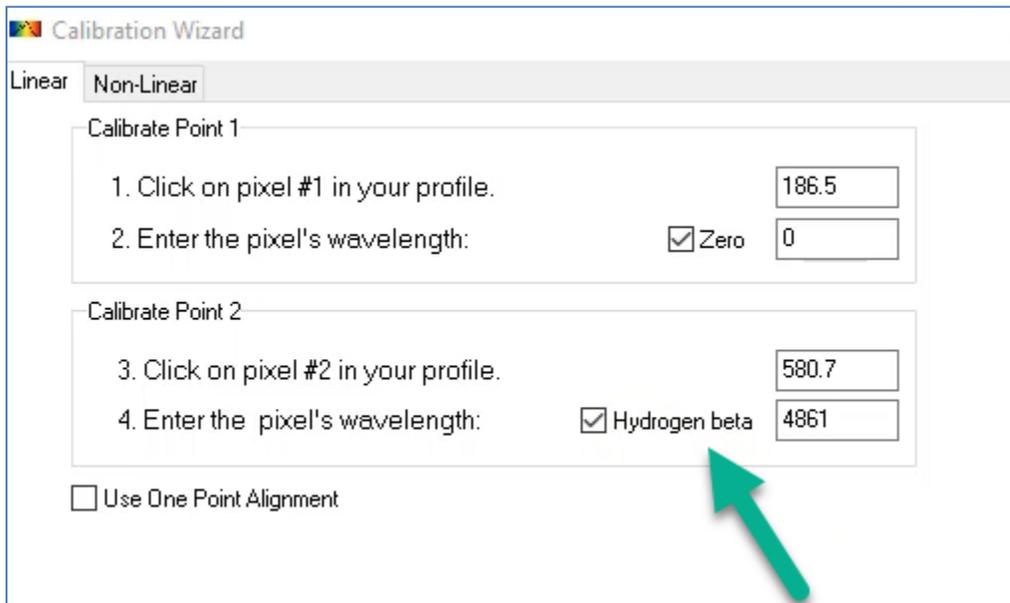
- The Histogram stretch box has been sped up two or three-fold on static images and videos. It can now be used on the entire frame even while videos are playing.
- Videos can now be cropped in real-time. Use CTRL and hold the left mouse button to frame in an area. Then add a checkmark to the box shown below:



- A new toolbar button allows you to crop to the current zoom level on the profile graph:



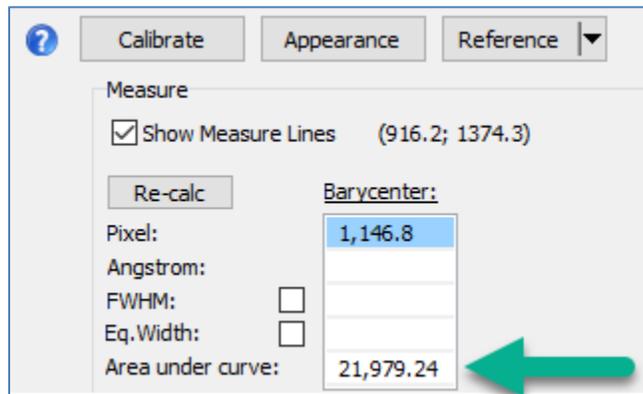
- A new checkbox automatically fills in the Hydrogen beta wavelength on the Calibration Wizard screen:



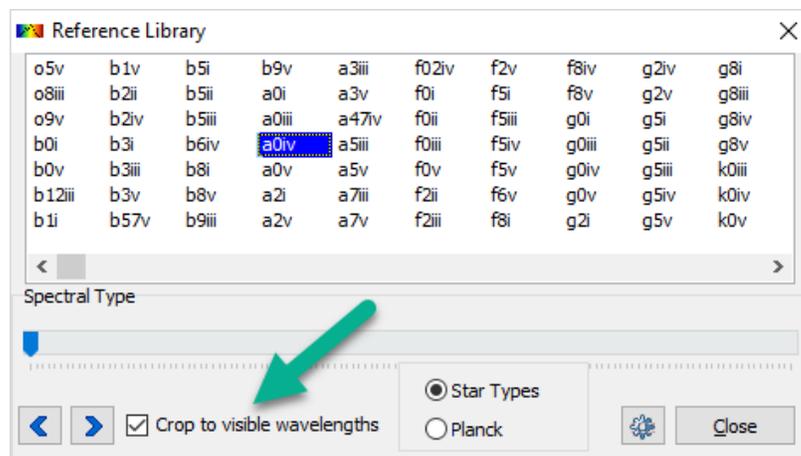
- There are two new ways to splice two spectra side by side. This feature is mainly for slit spectra.
 1. Load one spectrum on the Main profile and the second spectrum on the Reference profile. Then use the Reference, Edit on 2 Series option to combine them.
 2. Use the Folder icon at the top of the profile screen to select more than one profile (using Ctrl or Shift click), as shown below:



- The area under the profile curve between the two Measure lines is now displayed:



- Holding the Shift key down when clicking the Calibrate button will re-load and apply the most recently save Calibration from the Calibration Wizard screen.
- The Reference Library now optionally crops the spectra when they're displayed on the profile graph:



- RSpec can now save 1D FITS images. These files similar the .dat files that RSpec saves x,y profile data. They contain the necessary information to submit them to Pro-Am collaboration databases like the AAVSO AVSpec ([link](#)) and BeSS ([link](#)).. You will need to contact the database owners for details on how to submit these files.
- The Header button above the image window (on the left hand side of the RSpec screen) will now display the header information on RAW, TIFF, JPG, BMP files. In the past it only showed header information for FITS files.
- When exporting a video from images (using the Tools, Create Video menu option) you can now choose the video codec to be used.
- A bug was fixed that in some circumstances caused wavelengths to be lost when loading a saved layout on the Appearance screen.
- If you drag a window to a second monitor and then close and restart RSpec, the window is now properly shown on the 2nd monitor rather than the primary monitor.

RSpec Previous Update Version 1.8.0

- A new feature enables very fast rotation of your spectrum image.

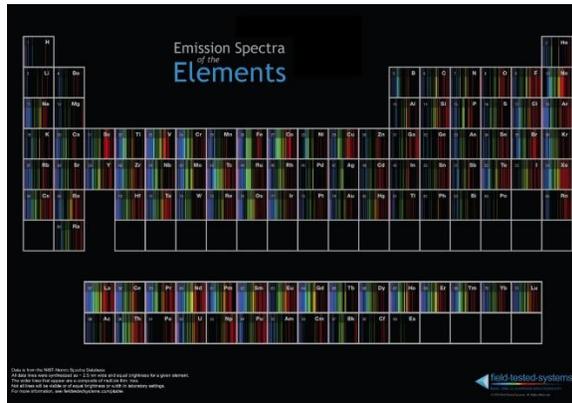
*Hold down the **ALT** key and then click and hold the left mouse button on the zero order star. Then drag (while continuing to hold down the left mouse button) through the spectrum. When you release the mouse, the spectrum will be rotated horizontal.*

- Image cropping: Camera sensors often have lots of pixels. But your spectra actually sit in only a small number of those pixels. By boxing-in or zooming your image, you can include only the pixels you need. RSpec runs much faster on smaller images.

To crop your image: hold down the **CTRL** key and then *hold down* the left mouse button. Move the cursor until you have a red box around your spectrum. Release the mouse button and click the “Crop” button on the *left-hand* toolbar: . In many cases, especially with spectra from the large sensor of DSLRs, you’ll see dramatic a dramatic speedup of RSpec.

- Our beautiful Periodic Table of Spectra is now available with better shipping rates outside the US. This poster is identical to the one that we’ve been selling for the past year, except that the international version is not laminated.

Cost is \$29.95 plus \$6.95 shipping. International: [link](#). US customers: [link](#).



RSpec Update Version 1.8.0.30

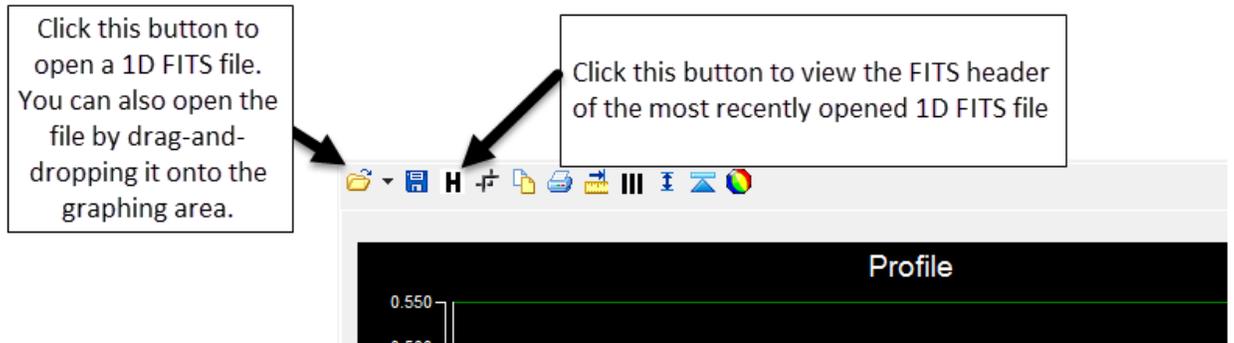
- Versions 1.8.0.30, 1.8.0.29 and 1.8.0.28 were minor updates that fine-tuned the automatic cropping of very large DSLR images and made other internal changes for better performance of the software. Below are the enhancements for previous releases.
- Version 1.8.0.27 was a minor release that added a live chat button to the toolbar and eliminated some false alarms from anti-virus programs. Below are the enhancements that were in 1.8.0.26:

Video #31 (“Update 13”) on the RSpec video page ([link](#)) demonstrates the videos below:

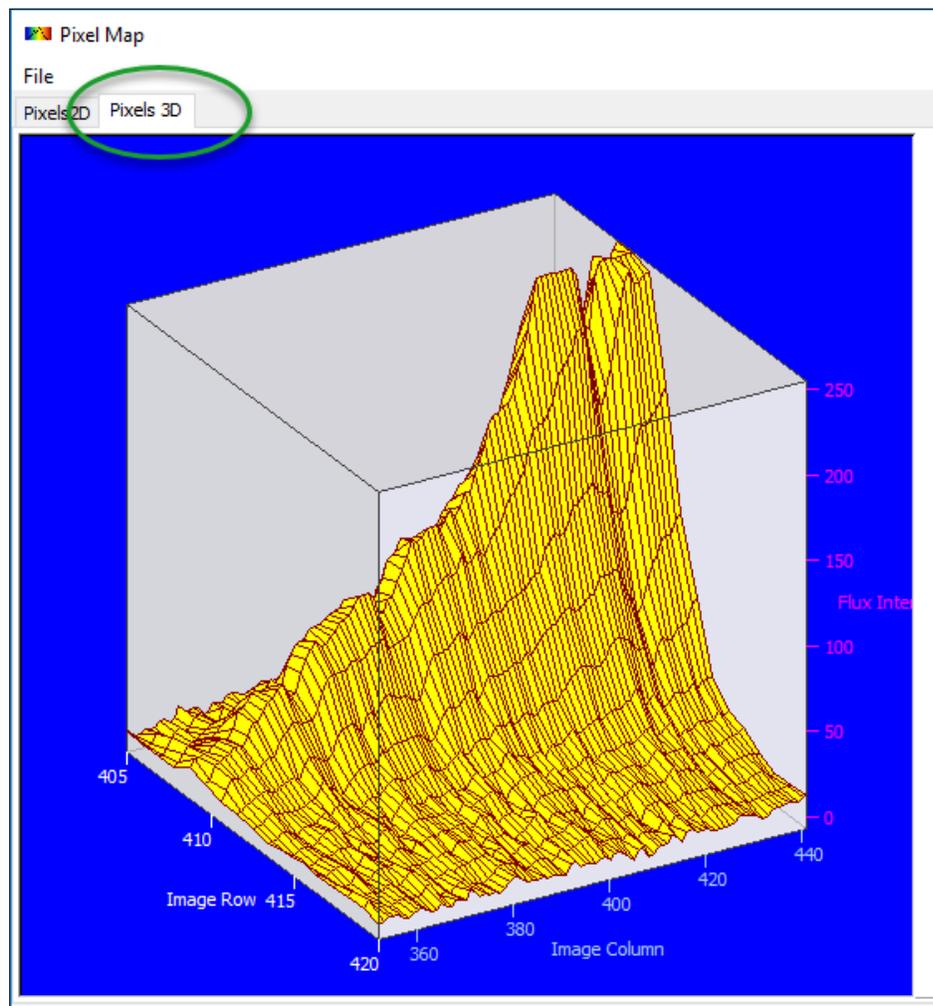
- In the past, the most common way to open image files (FITS, JPG, RAW, BMP, etc.) was to click on the Open-button on the left hand screen. Now, rather than using the Open button, you can drag and drop image files onto the left image window.
- RSpec can now read 1D FITS spectra.

1D FITS files are similar in content to RSpec’s .dat files that are created by the floppy button on the toolbar above to profile graph. Many on-line databases use the 1D FITS format to share profile graphs in x,y coordinates (wavelength and flux intensity). For examples of interesting data you can now load into RSpec, see the BeSS database ([link](#)) or the A.R.A.S Spectral Database ([link](#))

- RSpec can now display the FITS header of the most recently opened 1D FITS file.



- A new tab on the Pixel Map displays a 3D view of your spectrum. This very useful tool allows you to explore your spectra in a new way, examining it exposure levels, artifacts, hot pixels, and other details.



We are now offering a beautiful color poster of the Periodic Table of Spectra. It's laminated and printed in brilliant color.

Click this [link](#) to go to our site for more info on the poster (and spectra mugs, tee shirts and iPhone covers.)



Tom showing Neil deGrasse Tyson our new poster.

In previous releases, RSpec sometimes encountered problems when loading extremely large images like those that come from large format DSLRs. This problem has been eliminated. The program now automatically crops the margins in large images so that their final size is 16 megapixels.

The Spline Smoothing slider on the Edit Points screen has been made less sensitive. It's now easier to drag the slider to fine tune your fit.

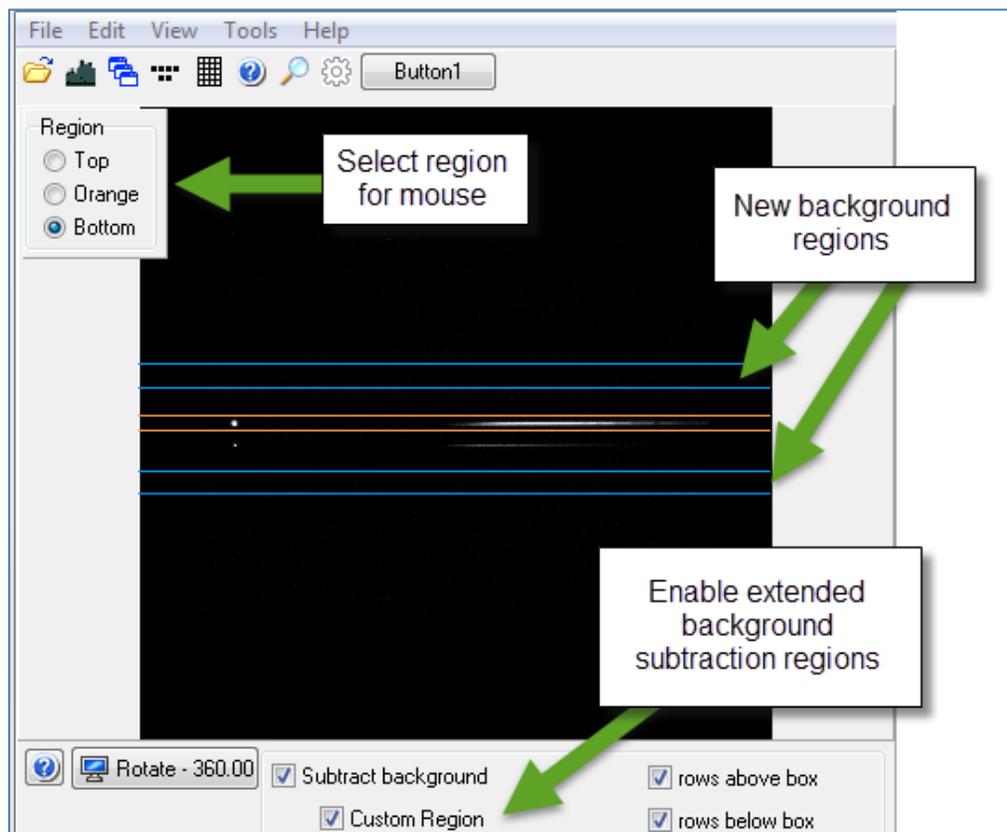
RSpec Update Version 1.8.08

- **Discontinuous Background Removal:** In the past, the regions that were used for subtracting backgrounds had to be immediately adjacent to the orange capture box. This restriction could be limiting at times. For example, the adjacent region might contain other stars or spectra that would interfere with the background removal.

To remove this limitation, RSpec has a new checkbox that allows you to specify regions that are *disconnected from the orange region*. (See screen capture below.)

To move the new capture lines, first select the region in the top, left Region window. Then use your mouse to move the new boxes in the same way you've always moved the orange lines in the past.

Note that the RSpec Options screen allows you to select whether to subtract the average or median of the blue regions from your spectrum. Median is recommended.



- **Real-time Correction for Instrument Response:** You'll recall that correcting for instrument response is how you remove the effects of your camera's reduced sensitivity in the red and blue regions. This correction process is sometimes called "flux calibration." Video #15 on the RSpec site ([link](#)) discusses this process.

After you have corrected for your instrument's response, you can compare your profile graphs to professional graphs to determine the star's approximate temperature and OBAFGKM type.

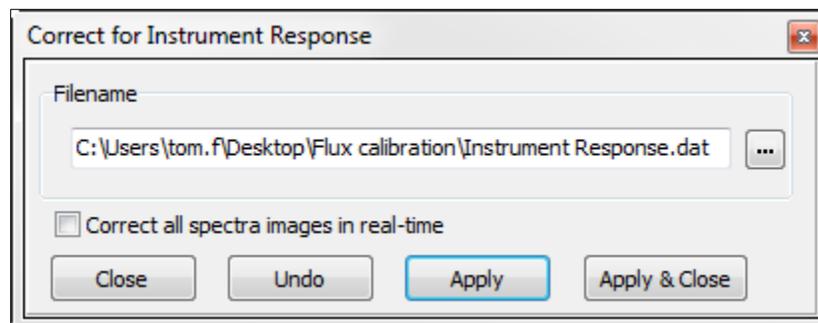
In the past, the process of applying an instrument response file required opening the file and then a series of mouse clicks. In other words, it wasn't fast or easy.

Starting with this version, RSpec can apply your instrument response calibration file in *one click*. You simply specify an instrument response calibration file that you have previously created. Reminder: you create these calibration files using the steps in the video linked-to above. On a given hardware configuration, you only need one file, say that made from a Type A star. With that one file, you can do instrument response correction on *any* star type. (Note that all of your targets should be at a relatively high elevation to reduce reddening from extinction.)

When you click on the new  icon on the toolbar, the window below appears. Specify your instrument response file and then click the Apply button.

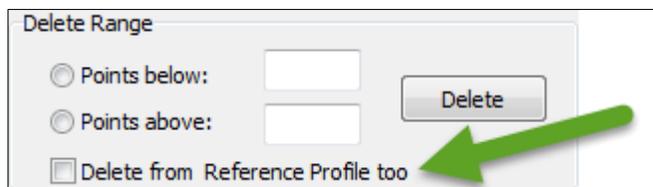
You can also check the "Correct all..." box so RSpec immediately corrects every image that it processes. You can even correct live or recorded astronomical videos, frame by frame, in real-time. This is great for survey work because by dragging the orange capture lines, you can quickly examine the spectral energy distribution of many stars in crowded field of view.

If you'd like to experiment with the files that were used in the tutorial videos that accompany this release, you can download them from the bottom of this page: <http://www.rspec-astro.com/setupdownload>. (Thanks to Torsten Hansen for the video of Albireo.)

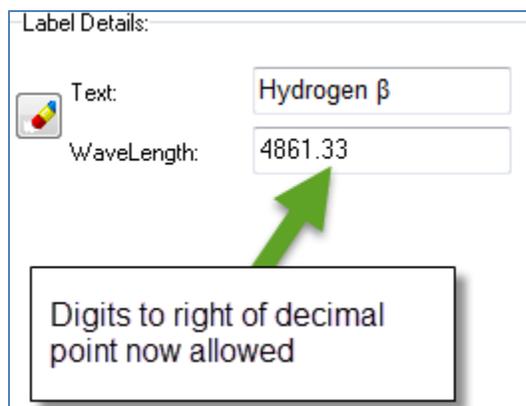


Enhancements to Cropping:

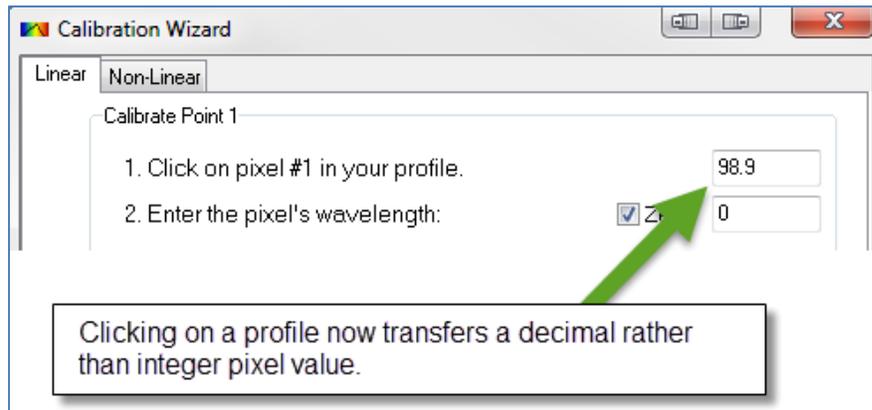
The Edit Points screen (shown below) now has an option to delete the points from the Reference curve at the same time.



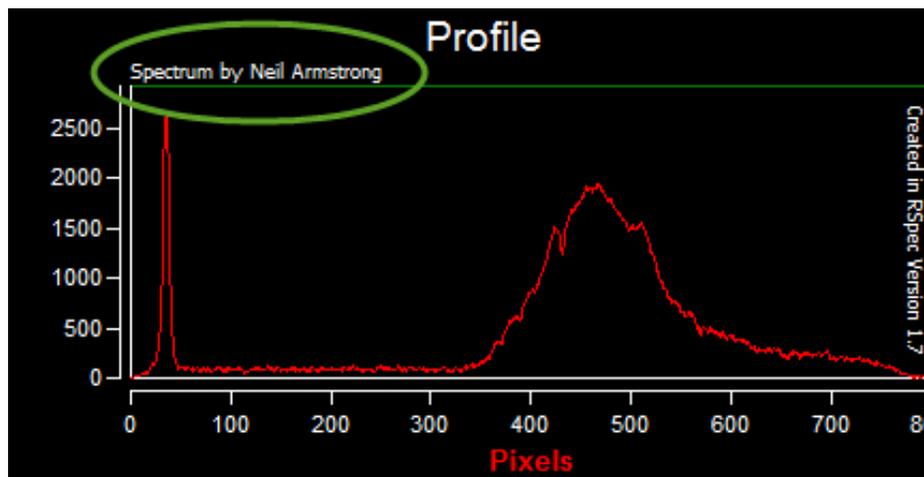
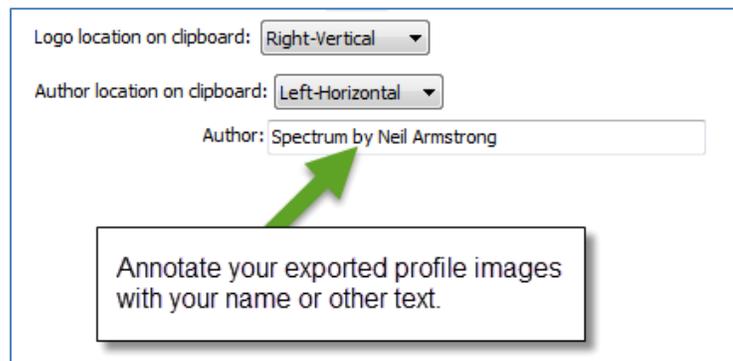
- If you hold down the Shift-key as you click the Crop-button  on the toolbar, RSpec does the deletion without asking you for a confirmation.
- If you hold down Shift-key and the Ctrl-key as you click the Crop-button  on the toolbar, RSpec also deletes from the Reference curve without asking for a confirmation.
- **Appearance screen:** Decimal digits (like 4861.33) are now allowed when locating labels, as shown below. This is helpful if you work in nanometers or high-resolution spectra.



- **Two-Point Calibration Screen:** When you click on the profile graph to select a pixel value for two-point calibration, the value transferred into the field shown below is now a full floating-point value rather than a whole number.

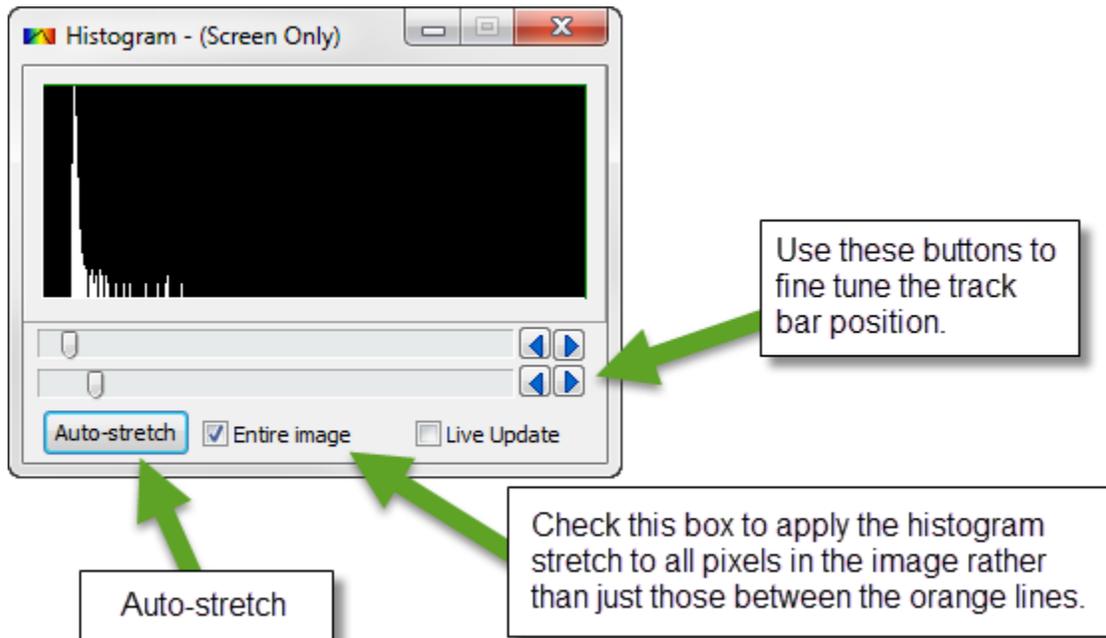


- **Get Credit for Your Accomplishments:** The Options screen allows you to enter your name (or any other text you wish). RSpec will include this text on jpg and clipboard exports of the profile graph. For example, you could use your name, or the instrument, or any other text you wish.



- **Saving One-Point Calibration:** The Save button on the One-Point Calibration screen no longer requires that you have previously done a two-point calibration.
- **Resizable Rotate Windows:** The Rotate window is no longer fixed in height. You can grab the top and bottom edges to make it taller from top to bottom. The taller screen makes it even easier to drag the Rotation scroll bar to the position where you want it.
- **Higher Precision on Rotate screen:** There is a checkbox on the Rotate window that allows you to specify rotation angle in .05 degrees rather than .5 degrees. This is for users whose particular work requires this kind of precision.
- **Remote Control:** This version of RSpec has some software hooks that allow remote control of the software by third parties. For example, the University of Western Australia used these features in their wonderful outreach and educational work on their Spirit telescope. If you'd like to hear more about how to remotely control RSpec, contact us for details.
- **Quickly Load Previous Linear Calibration:** After you've saved a two point, linear calibration using the Save button: on subsequent runs of RSpec, Shift click the Calibrate button to instantly load and apply that previously saved calibration.
- **Histogram Screen Saves Settings Between Usage:** The Histogram window now "remembers" its settings between uses.
- **New Histogram check-box for "Entire Image":** A new checkbox on the histogram screen allows you to apply it to the entire image rather than just between the orange lines. (See screen capture below.) Note that checking this box may slow down the software as it processes the entire image. As a result of optimizations in this release, RSpec histogram processing is actually faster on FITS images processed in 32-bit format than any other formats.

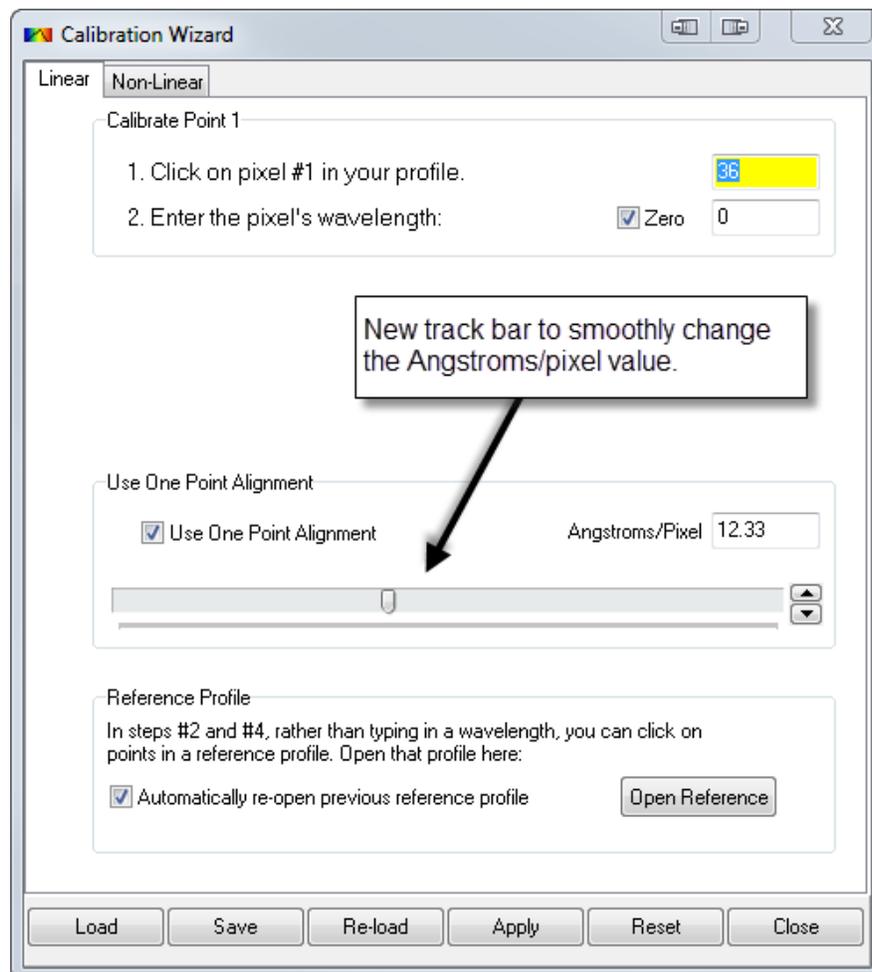
- New Histogram spin buttons:** The histogram screen now has small spin buttons that allow you to make small changes in the track bars. (See screen capture below.) Note that when the histogram is being used, RSpec is actually faster on 32-bits FITS images than it is on any others.



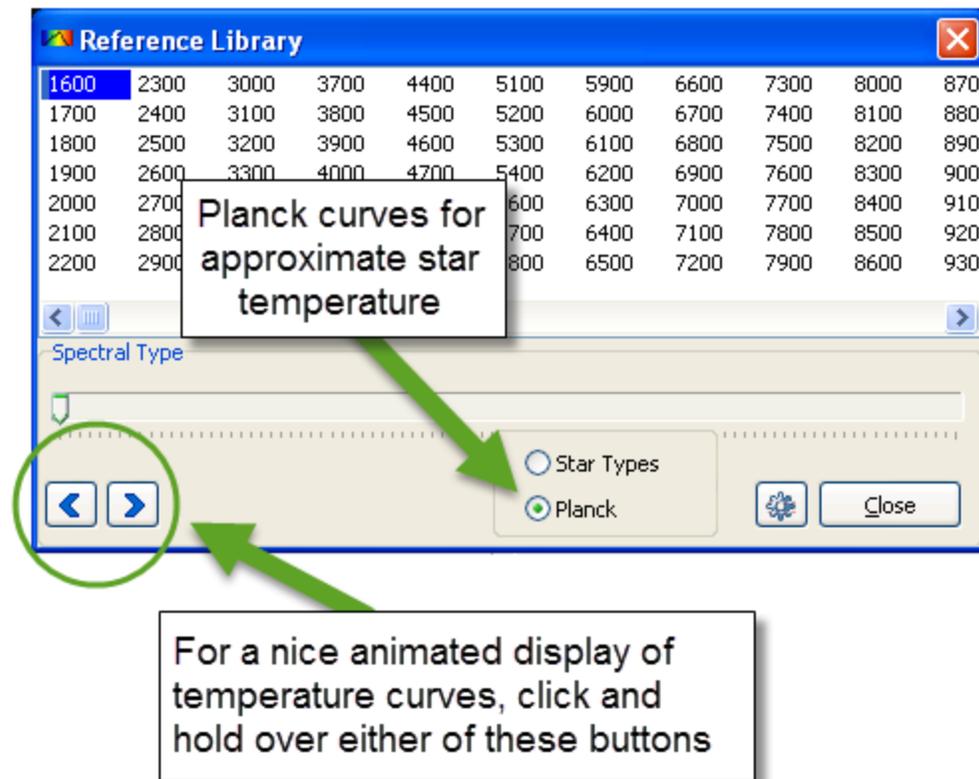
- Default Non-Linear Calibration:** The non-linear calibration screen allows you to save a particular calibration as a default calibration. If you check the "Apply default..."-box below, when you start RSpec at a later time, the software will apply this calibration automatically.



- The Calibration Wizard's One Point Alignment feature now has a sliding track bar that allows you to smoothly adjust the dispersion (in Angstrom/pixel) as you look for a match between your data and reference data. If your initial two-point calibration of a spectra doesn't result in a match with the Hydrogen Balmer lines, you can use this slider to "slide" the spectrum left and right until you find a match. (Note: this feature was included in some of the more recent new downloads of RSpec so if you're using a very recent version of RSpec, you may have seen this feature already.)



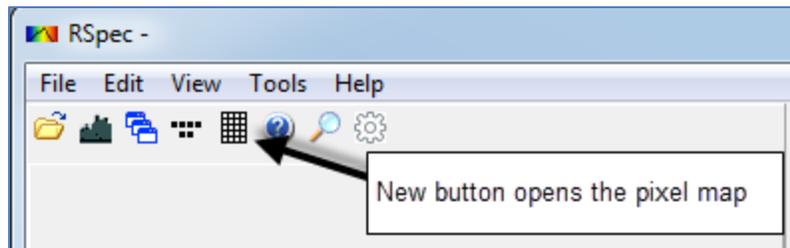
- After you've calibrated a profile for instrument response, you can now determine the star's approximate temperature by selecting the Planck curve option on the Reference Library screen, as shown below.



Changes in Version 1.7

There are *two videos* that demonstrate the new features in this version. Use the RSpec Help menu's "Video Library" option, or at this [link](#) to view the videos on-line. They're named "New Features 10" and "New Features 10b."

- There's a new button on the tool bar to open a pixel map:



The pixel map shows the ADU value for each pixel (between the orange capture lines) in your image:

The screenshot shows the "Pixel Map" window with a grid of ADU values. The grid has 10 columns and 10 rows. The first column contains row numbers (357-365) and the first row contains column numbers (346-354). A callout box points to the first column with the text "Image column number". Another callout box points to the first row with the text "Image row number". A third callout box points to a cell containing the value 4251 with the text "ADU Values for each camera pixel." The text "This is a 32-bit image." is visible at the bottom left of the window.

	346	347	348	349	350	351	352	353	354	
357	4251	4301	4404	4331	4718	4717	4696	4670	4683	4559
358	4853	4821	4914	5162	5441	5422	5542	5330	5388	5194
359	5536	5656	5791	6198	6504	6582	6825	6690	6545	6312
360	6319	6510	6656	7285	7954	8208	8246	7922	7942	7732
361	7843	7906	7993	8608	9540	9995	10034	10162	9849	9641
362	9136	8875	9183	9705	11052	11697	11962	11682	11602	11397
363	10125	9806	10232	10982	12354	12443	13300	13183	13125	12845
364	11522	11216	11541	12479	13674	14492	15123	14846	14892	14528
365	13627	13627	13627	13627	15823	17425	17920	17920	17920	17920

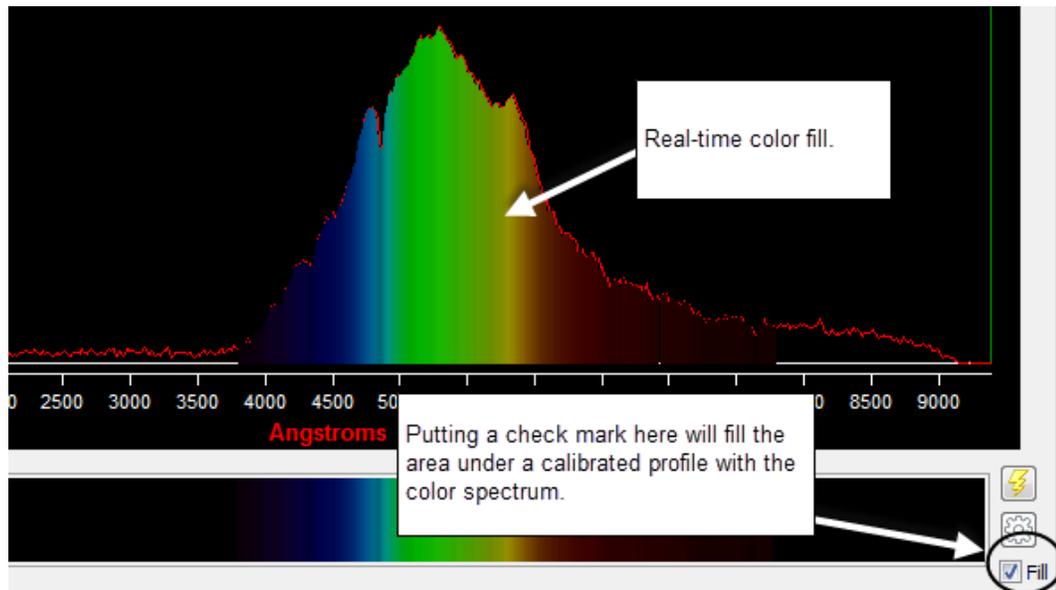
Eight bit cameras (like video cameras) can have a maximum ADU value of 255. FITS images will also display a maximum value of 255 unless you turn on 32-bit processing on the Advanced tab of the Tools, Options screen. (32-bit processing can slow down the software and is generally not needed except for high precision work.)

A common mistake when imaging is to underexpose your images, which results in poor spectra because the SNR is poor. Unless other factors (like noise, tracking, etc.) prevent it, you should increase your exposure time so that the maximum ADU *of the spectrum* (not the star itself) is about 80 - 90% of your camera's full well depth (on modern CCDs). Above that, modern cameras lose linearity. (It's okay to overexpose the star.)

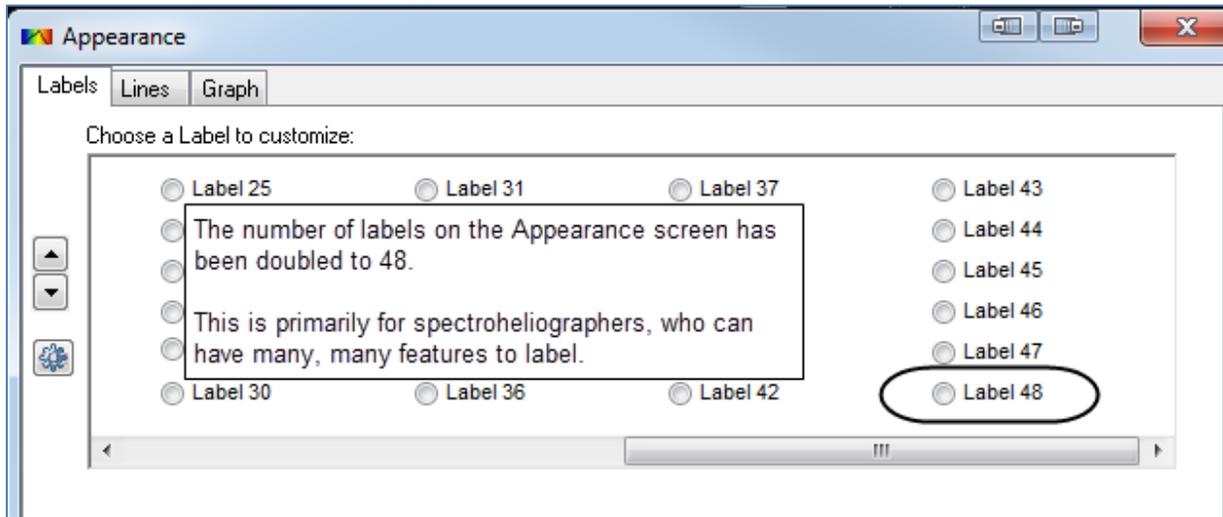
You can also bracket in a region between the orange lines to examine. Do this by holding down the Ctrl key and the left mouse button and dragging a box around the region in your image.

The Pixel Map screen's File menu allows you to export the pixel data to Excel where you can further analyze the pixel intensity data.

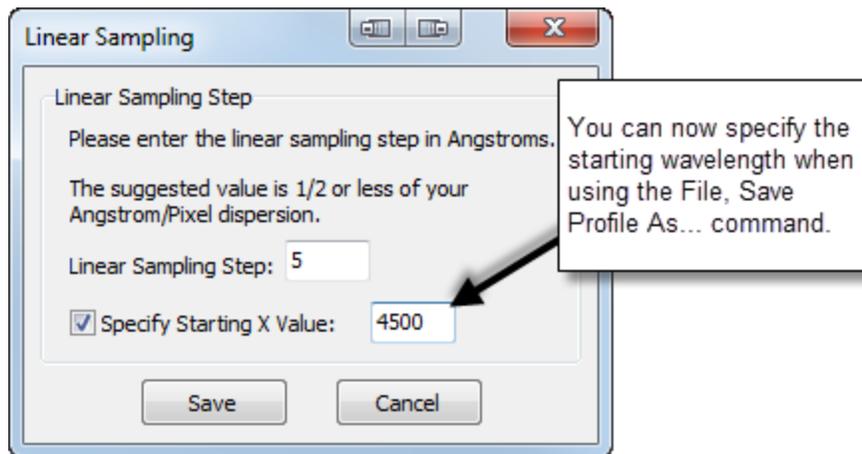
- The software now color-fills the area under a calibrated spectrum:



- The number of labels available on the Appearance screen has been doubled:

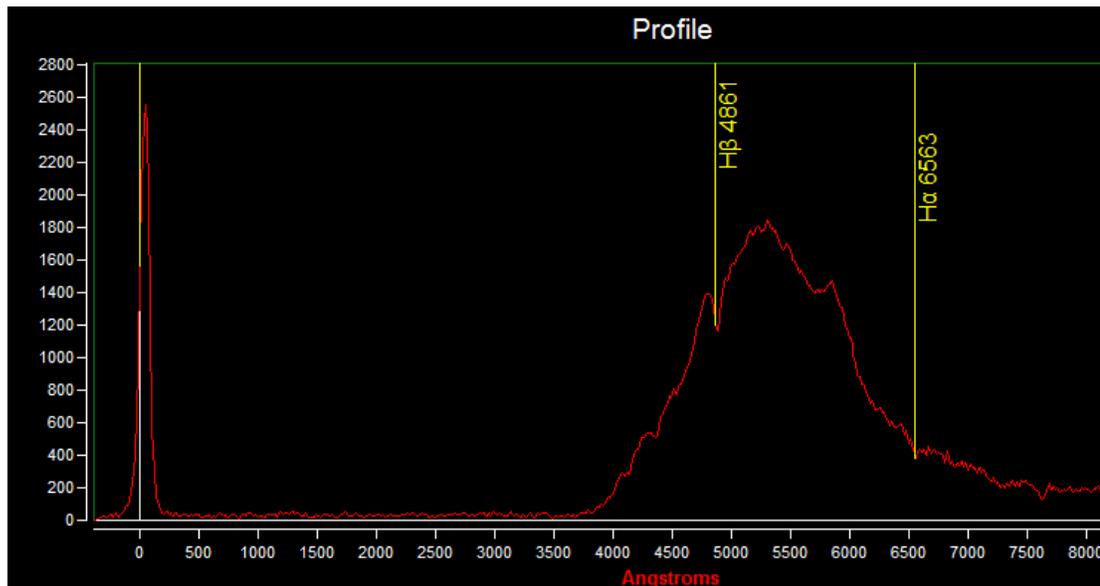


- When exporting x-y profile data to a .dat file for importing into another program, you can now specify the starting wavelength. The screen below appears only if the profile was calibrated using the *Non-Linear* calibration screen and the Options screen has a checkmark next to “Generate linear X values...”

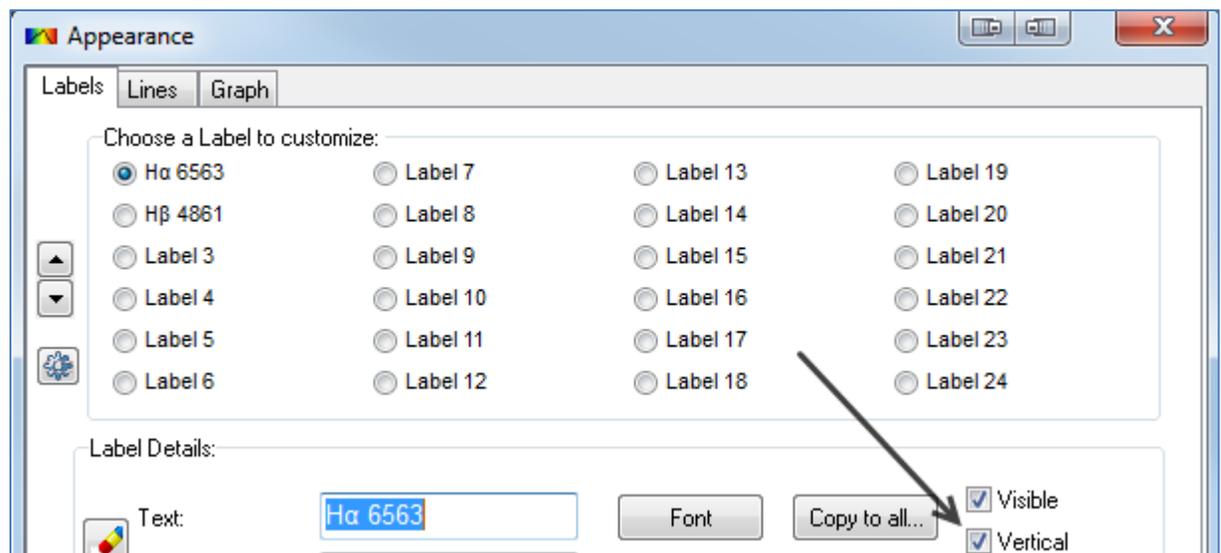


Changes in Version 1.6 –

- You can now display label text vertically, as shown below.



Use the checkbox shown below to change the orientation of the text:

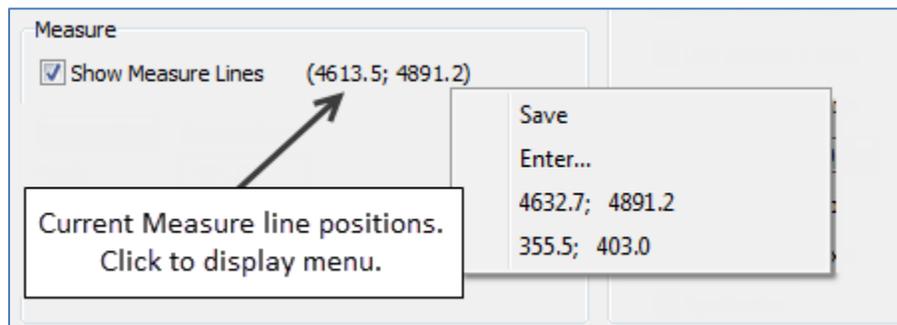


- RSpec can now calculate the Equivalent Width (EW) of any emission or absorption feature. The videos show how to use this feature. Not familiar with EW? Wikipedia can act as your introduction: [link](#).

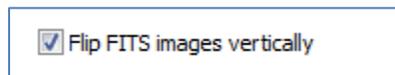
As we noted in the video walk-through: for scientifically valid data that you can share and compare with others', it's important that your work flow be repeatable and congruent with the scientific community's consensus. Below are some important points. Questions? The

experts in our Yahoo forum can help: [link](#).

- Camera flux values should be proportional to the amount of light falling on them. This is a requirement for any meaningful measurement of flux. Astronomical CCD cameras are generally linear over a significant proportion of their range but become non-linear as they approach saturation. Webcams and video cameras are typically deliberately designed to be non-linear (gamma-corrected) so that shadow areas are correctly exposed while preventing brighter areas being over-exposed.
 - The image should be processed correctly with dark, flat and background corrections applied.
 - EW calculation is very sensitive to the correct determination of the continuum level and shape in the region of the line. This is crucial. Small errors here can give large errors in EW.
 - Thought should be given to how to decide the wavelength range over which the EW is to be calculated. This can for example be done by estimating where the line meets the continuum or, where repeat measurements of the same line are planned, by setting fixed limits outside where the line is expected to fall.
- RSpec now displays the current position (x-value) of the two Measure Lines. Click on the numbers themselves to display a menu that allows you to save the current position, to move the lines to a previously saved position, or to manually type in a desired position:



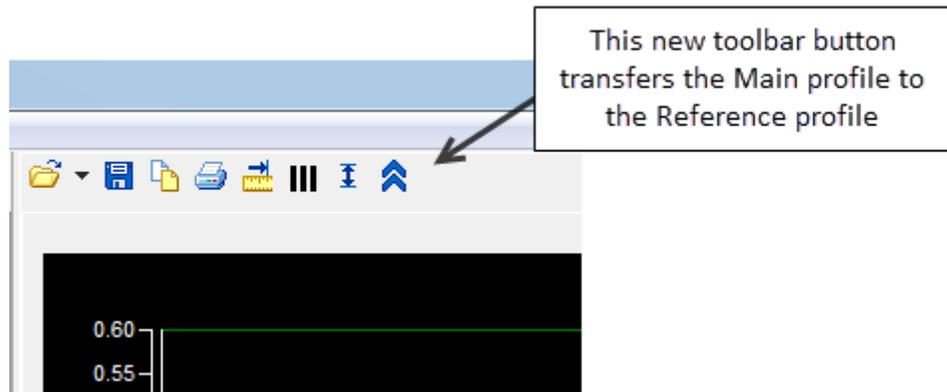
- You can now flip FITS images vertically by adding a checkbox here on the Options screen:



This has no impact on calculations (except background removal). Some other astronomy programs display images upside-down when compared to RSpec. This allows you to view spectra in RSpec in the same orientation as these other programs.

- RSpec now uses the absolutely latest optimizations available for the Intel® multi-core CPUs. On some advanced calculations, as well as video processing with a modern CPU, you'll see significant speedups.

- A new toolbar button will transfer the Main profile to the Reference profile. This makes it easier when you want to compare your current profile with another. Load the first profile. Click the button to move it to the Reference. Then load the second profile:



- The Page-up and Page-down keys on your keyboard now zoom in and out respectively. This is primarily for laptop users who don't have a mouse with a roller wheel on top.

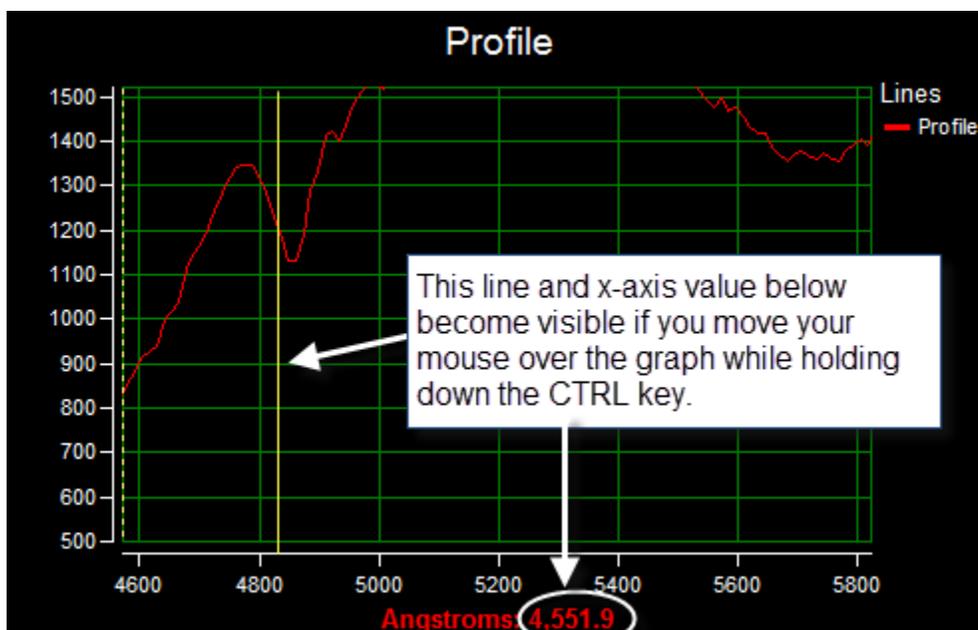
Changes in Version 1.4

You can view a video walk-through of these features from the RSpec Help menu's "Video Library" option, or at this [link](#) on-line.

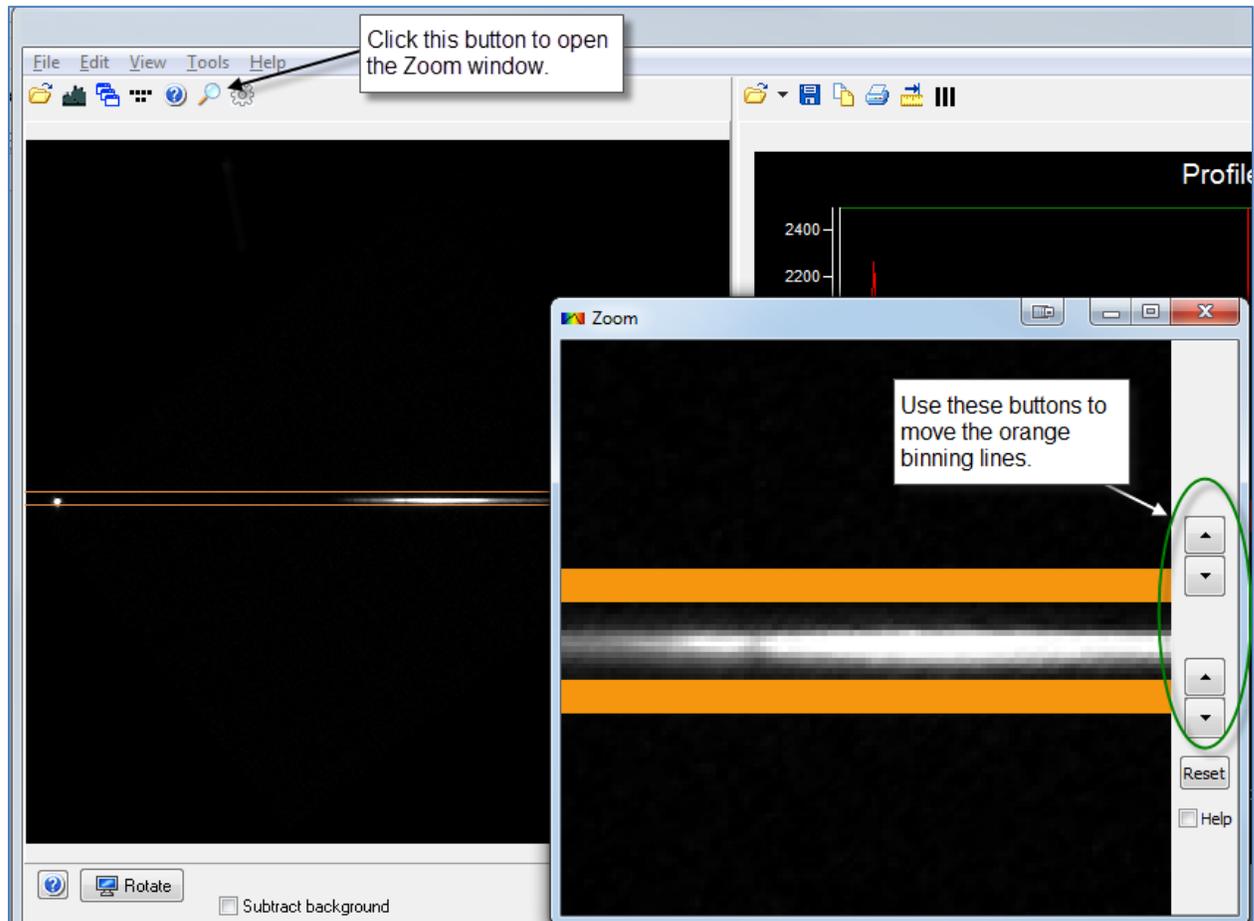
- There is a new video at the bottom of the video list (under Help, Video Library) named "How to use One Point Calibration." This video has been posted on the website for some time ([link](#)).

We've found that the most frequent question that new users ask is "How do I calibrate my spectra when the object I'm observing isn't an "easy" star like Vega." This video will answer that question.

- If you move the mouse over your spectrum profile graph while holding down both the CTRL key and the SHIFT key, a new vertical marker appears. And the x-axis label is augmented with the Angstrom value. (See below for an example.) This can be very helpful when you're examining a profile or comparing two profiles. The color of this line can be changed on the Appearance screen.

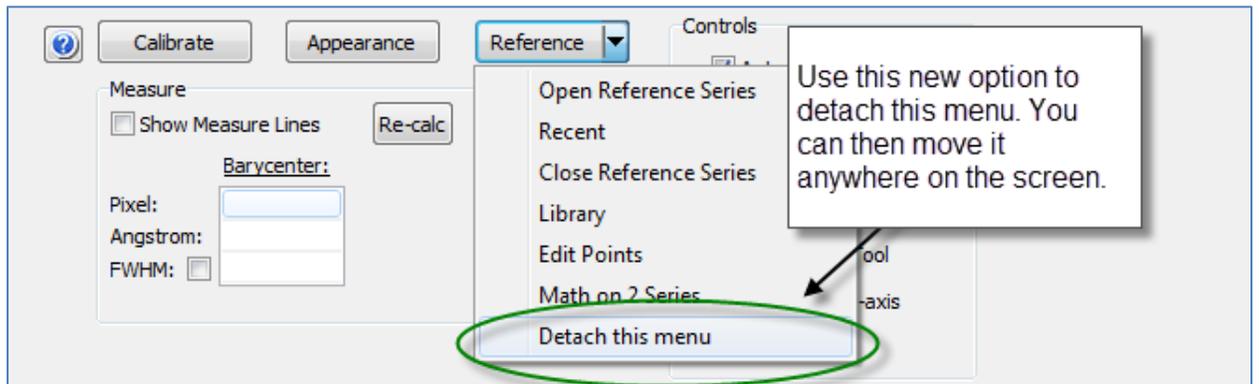


- A new Zoom window allows you to zoom in on the spectrum image from your camera. You can use this window to fine tune the placement of the two orange capture lines. Careful placement of these lines can often result in higher quality profile graphs. As elsewhere in RSpec, changes you make update the profile graph in real-time, so you can see the impact of your changes in real-time.

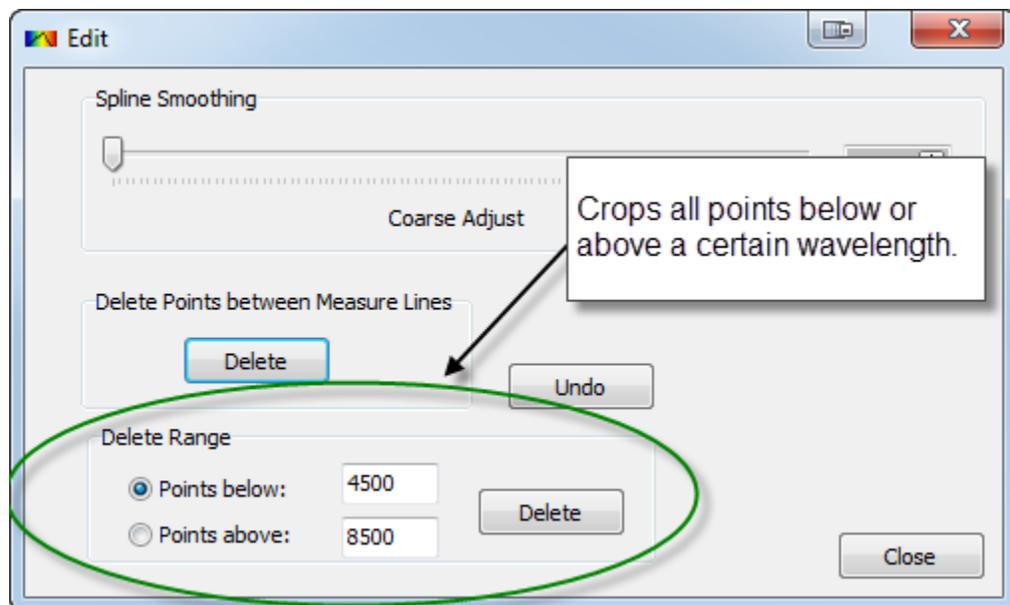


In the Zoom window above, you can use your mouse wheel to zoom towards and away from the mouse cursor. Click and drag to scroll side to side. Use the arrow buttons on the right to move the orange lines up and down.

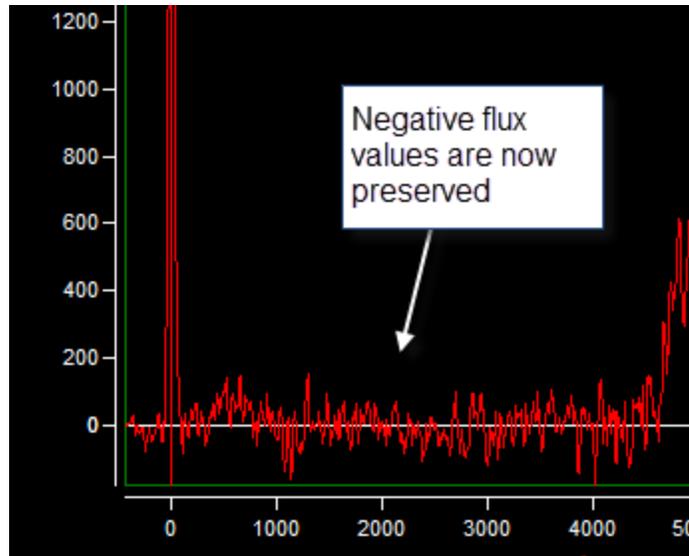
- You can now detach the pop-up Reference menu, as shown below. Once detached, you can move the menu anywhere on the screen you wish where it will float, ready for use. As a detached (floating) menu, it's always open, which eliminates the need to click the Reference button each time you want to use a command:



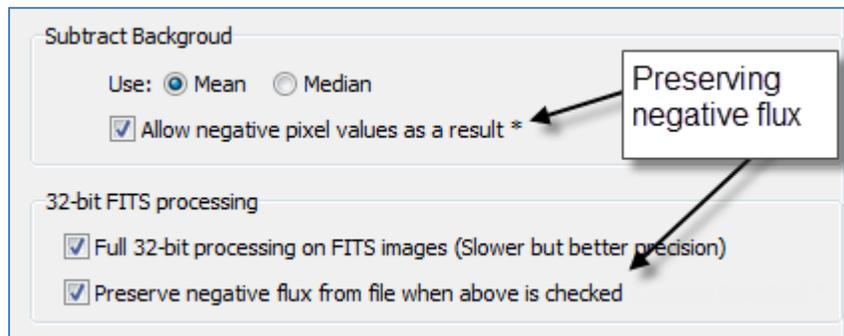
- RSpec now speaks Dutch! Use the Tools, Language menu option. (Thanks to Marc T. for the translation!)
- A new panel on the Edit window allows you to delete all points to the left or right of a specific wavelength. For example, you could use this command to eliminate all the points starting at the zero-order star up to the UV:



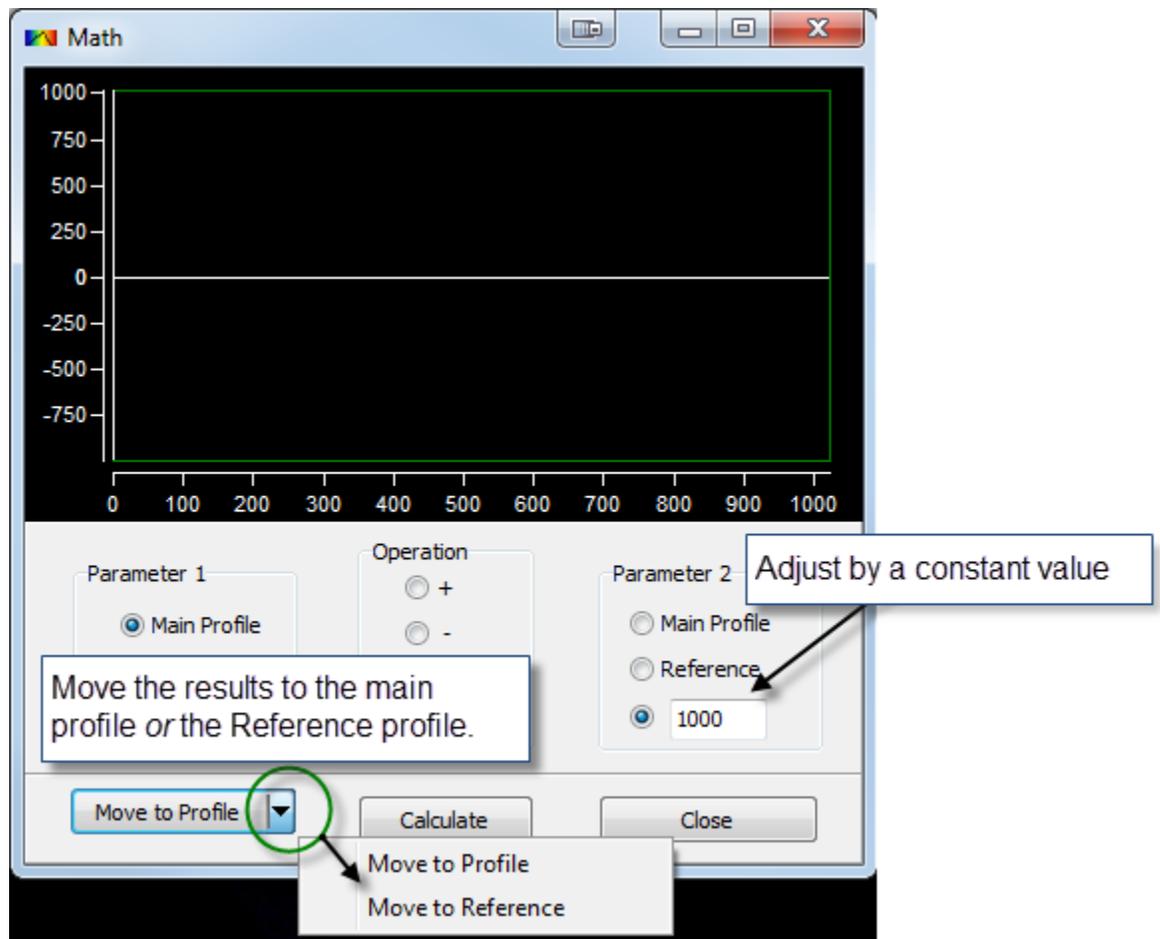
- RSpec now handles negative flux values. When subtracting the background from a spectrum image, due to random noise, it's possible for the flux (intensity) value of some pixels to be negative. In the past, RSpec rounded negative numbers up to zero. At first this might seem trivial. Although it is generally a small effect, it affects the mean zero level and can give problems if trying to normalize to the continuum or when measuring the intensity of lines.



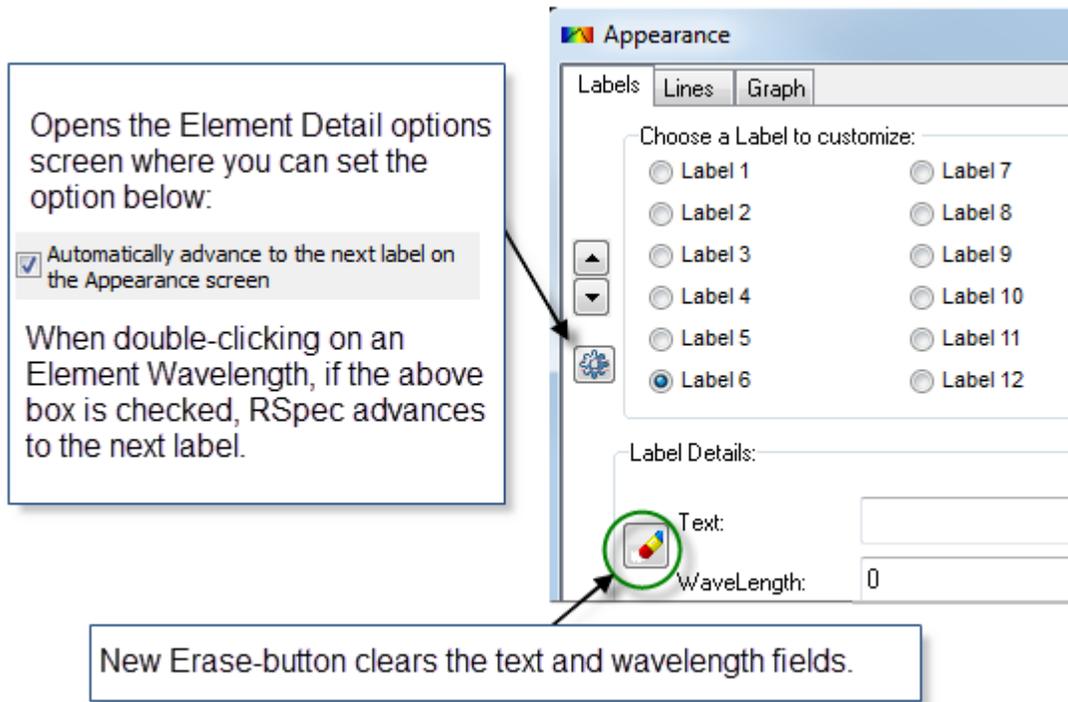
For general day-to-day use, there is no need to enable negative flux handling. However, for more advanced work, you can enable it on the Options screen, as shown below:



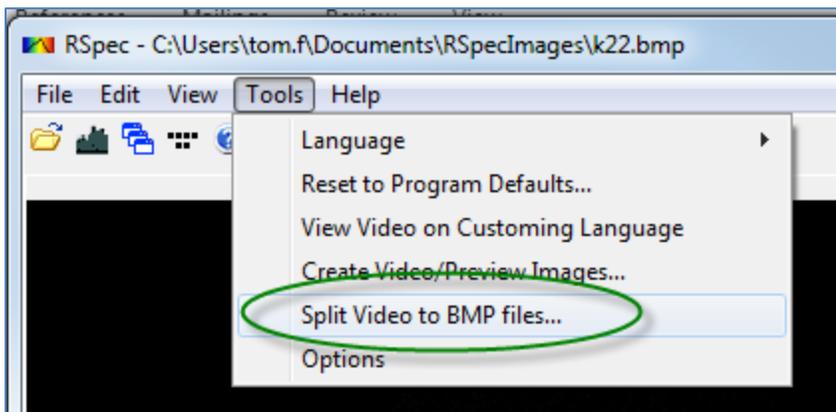
- The Math screen now allows you to adjust by a constant value. You can also now move the results back to the Reference profile rather than the main Profile.



- The Appearance screen now has an “Erase” button and a Setup button. The Setup button allows you to configure RSpec so that when you right-click on a wavelength on the Element Detail screen, the next label on the Appearance screen is selected. (See the Video Library on this update for a more lengthy discussion.)



- A new command on the top tool bar allows you to split the frames in a video into individual bmp image files. You can then preview the frames using the Tools menu’s “Create Video/Preview Images” screen. This process lets you examine the profile of each frame and select the frames that you want to include in a stacked video you create and then play with averaging.



- On the Non-linear Calibration screen, you can now view the Polynomial Factors used to fit the points. The window can now be re-sized vertically, revealing more rows:

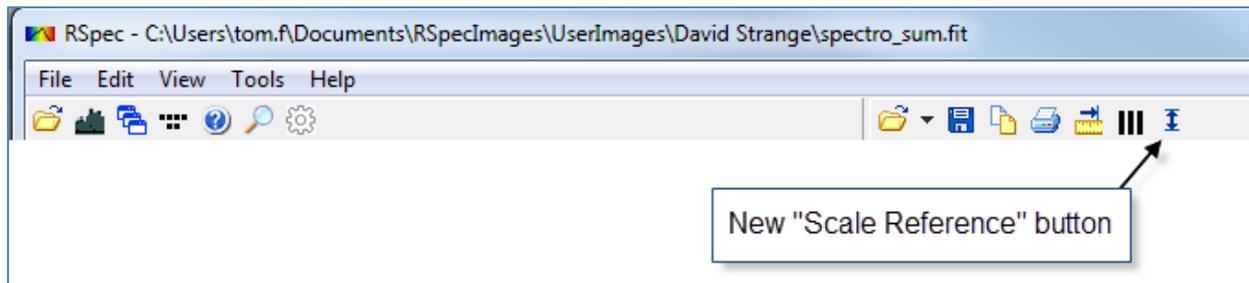
The screenshot shows the 'Calibration Wizard' software interface. It features a 'Linear' and 'Non-Linear' tab, with 'Non-Linear' selected. A graph plots 'Wavelength' (0 to 7000) against 'Pixel' (0 to 800). Below the graph is a table with columns 'Pixel', 'Wavelength', and 'Residual'. The table contains four rows of data, with the first row highlighted. Below the table is a 'Calculate' button and an 'RMS: 0.0000' label. A 'Polynomial Factors' window is open, displaying the equation: $\text{Lambda} = x^4 \cdot 0 + x^3 \cdot -1.1713E-06 + x^2 \cdot 1.3964E-03 + x \cdot 1.1851E+01 - 4.2481E+02$. A 'Close' button is visible in the Polynomial Factors window. Annotations include: 'Additional rows have been added to this grid' pointing to rows 5-10 in the table; and 'Clicking the RMS value causes the Polynomial Factors to be displayed' pointing to the 'RMS: 0.0000' label. The bottom of the window has buttons for 'Load', 'Save', 'Re-load', 'Apply', 'Reset', and 'Close'.

	Pixel	Wavelength	Residual
1	35.70	0	0.0
2	390.00	4340	0.0
3	432.00	4861	0.0
4	569.59	6562	0.0
5			
6			
7			
8			
9			
10			

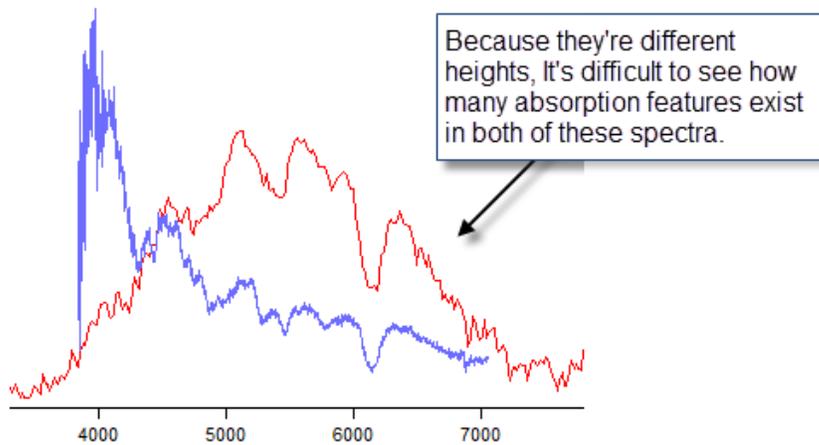
- We've raised the number of decimal places RSpec optionally displays from two to four. Set this on the Options screen, shown below. This is only for displayed values. Internal calculations are still done in full 32-bit precision.

The screenshot shows a control panel for 'Precision of wavelength displayed' set to 4. The control consists of a text label 'Precision of wavelength displayed:' followed by a numeric input field containing the number '4' and a small up/down arrow icon.

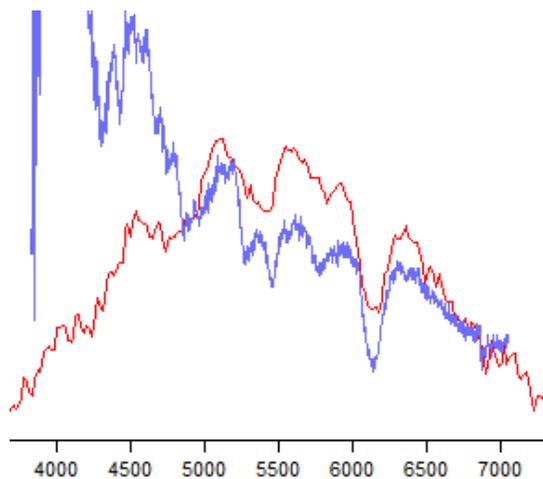
- There's a great new command that lets you easily change the scale (height) of the Reference profile graph. Here's the button:



When you're comparing two spectra for similar features, it can be difficult to spot which features exist in both graphs:



Using the new "Scale Reference" button you can easily change the height of the purple curve above so that features are almost overlapping. This makes spotting similarities considerably easier:

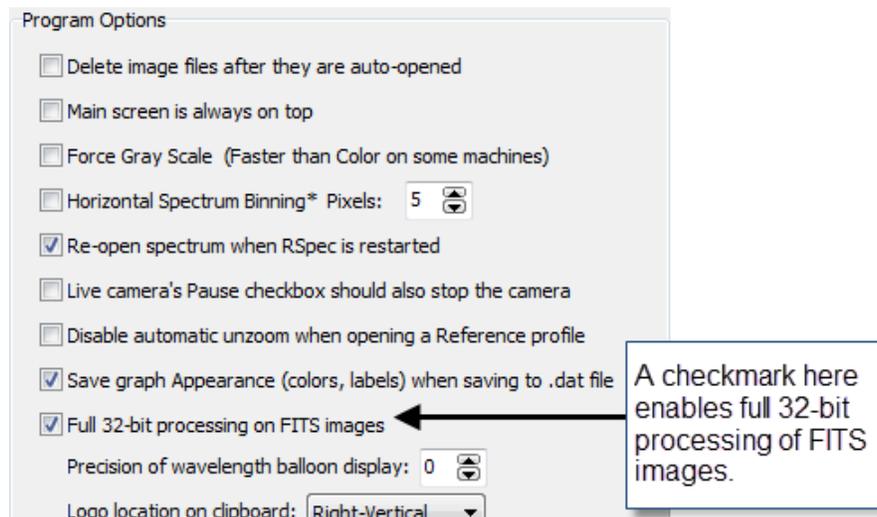


Changes in Version 1.3.0 Build 39

A video walk-through of these new features can be viewed on-line here: [link](#).

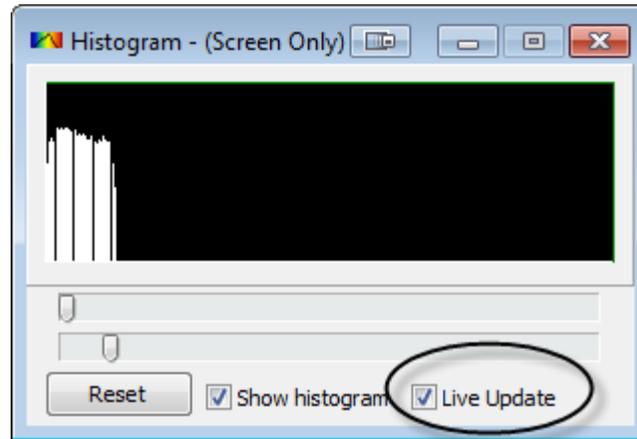
- In the past, RSpec would scale down the FITS file flux intensities (the Y-axis values on the graph). This did not distort the data, because the scaling was linear. However, on certain types of data (with extremely high star intensities compared to a weak spectrum) this could result some of the small changes in the profile graph not being visible. This would be evident by the profile graph's peaks appearing flattened or the lines "stair-stepped".

This limitation has been removed. RSpec now optionally reads FITS file in *in full 32-bit precision*. In this mode, the Y-values on the profile graph are the exact ADU flux values from your FITS file. To enable the 32-bit mode, put a checkmark on the Options screen as shown below. This mode may be a someone slower on very large format images. On most data, you will not see a significant improvement in your profile. We suggest you leave this mode disabled unless you observe some of the stair-stepping described, or need to compare different profile graphs for absolute intensity.

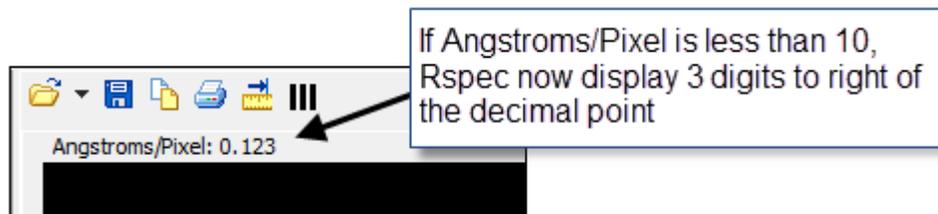


Note: *Rotation of digital images in some cases can cause significant degradation of data due to the introduction in artifacts. Experienced spectroscopists recommend that if you are doing high precision spectroscopy, you should not rely on image rotation. Instead, you should align your spectrograph and sensor with one another so that the spectrum falls exactly horizontal across your sensor. This eliminates the need for rotation and the possible artifacts it may generate.*

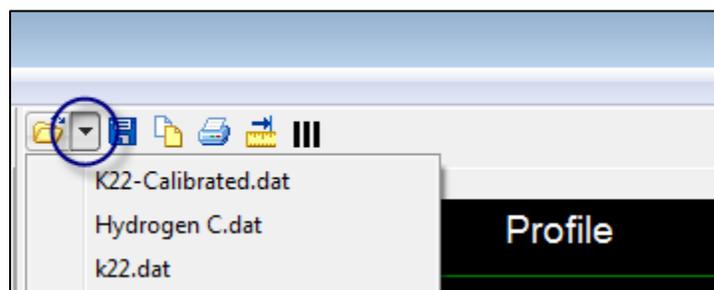
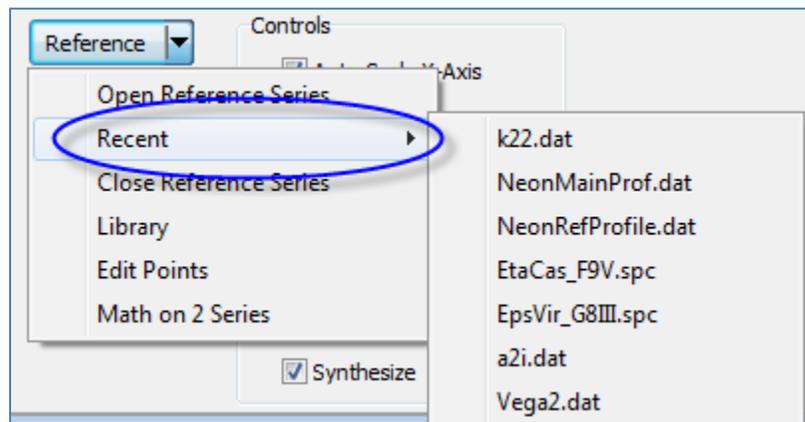
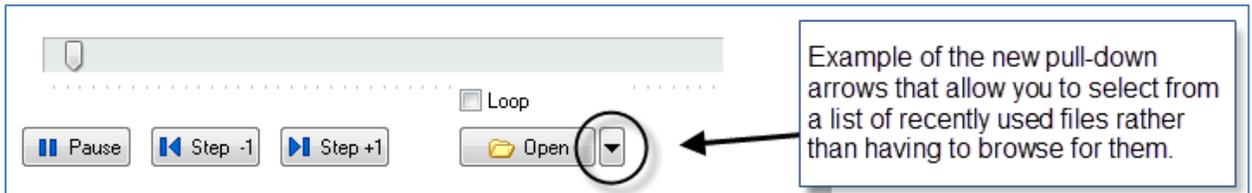
- In the past, on slower computers, dragging the track bars at the bottom of the Histogram window could be sluggish on very large images. You can now eliminate this sluggishness by turning off RSpec's "Live Update." The software will then wait until you release the left mouse button before updating the screen. (The Rotate screen has a similar option.)



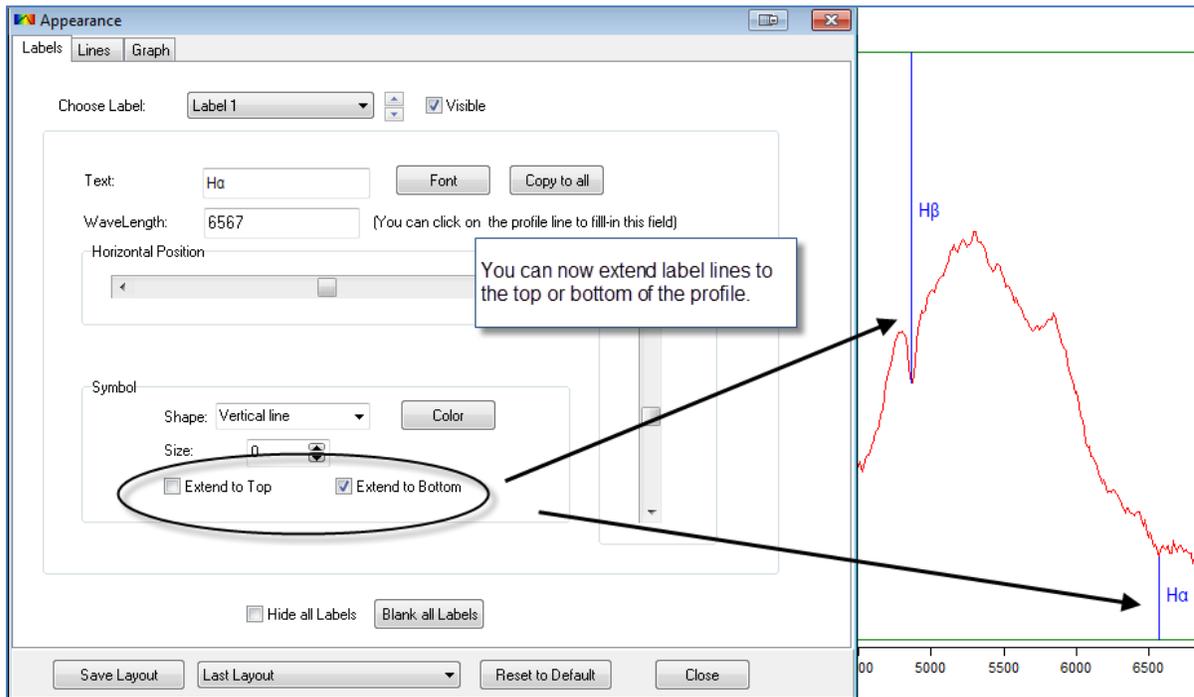
- In previous releases, in certain circumstances RSpec was unable to change the video resolution on some webcams (for example the Toucam and Celestron NexImage). Starting in this release, when you use RSpec's "Live Camera" Configure button, RSpec will ask whether you want the camera to be paused while you make the change. On some cameras (like those listed above) answering "Yes" will enable RSpec to successfully change the resolution. You will need to experiment with this option to see whether it is needed for your particular camera.
- When Angstroms/Pixel is less than 10, RSpec now shows additional digits to the right of the decimal place:



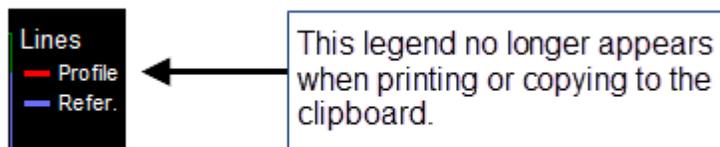
- On all of the buttons that are commonly used to open files, there is now a small arrow that displays a list of the *most recently used files*. This reduces the amount of browsing necessary when trying to open a file that you recently had open:



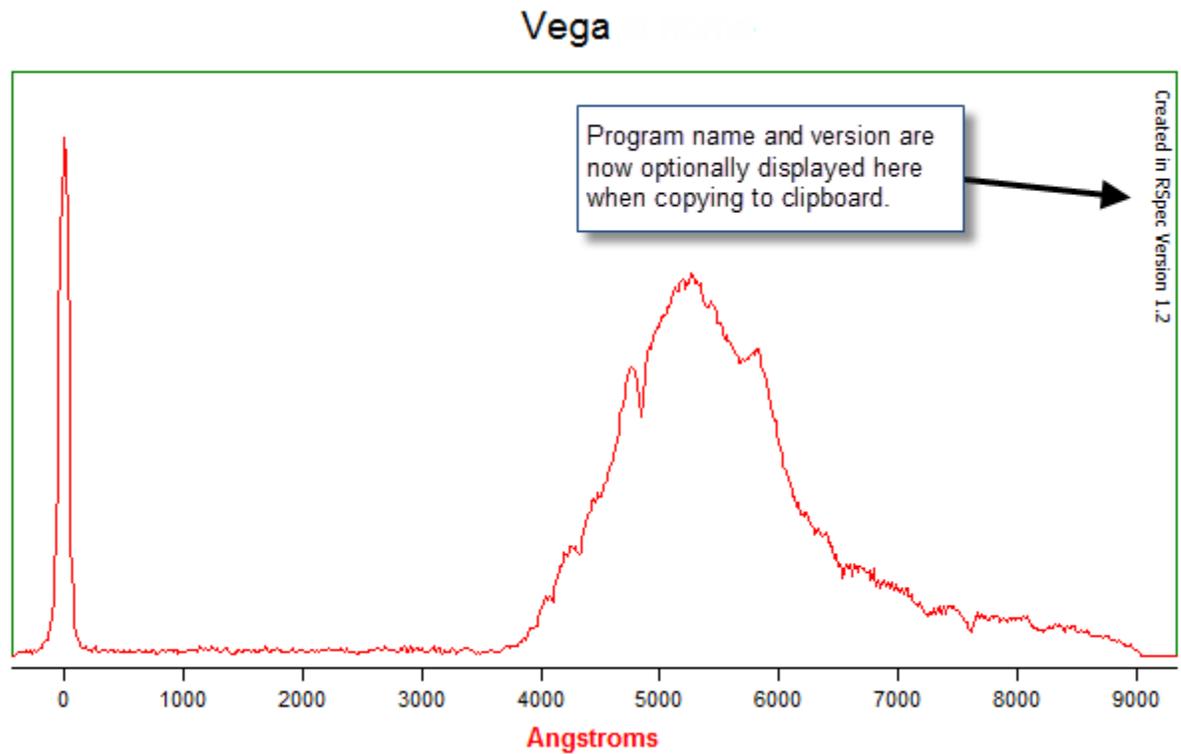
- You can now extend label lines to the top or bottom of the profile graph screen. This makes it much easier to clearly label your profile's features. See the H α and H β lines on the right below:



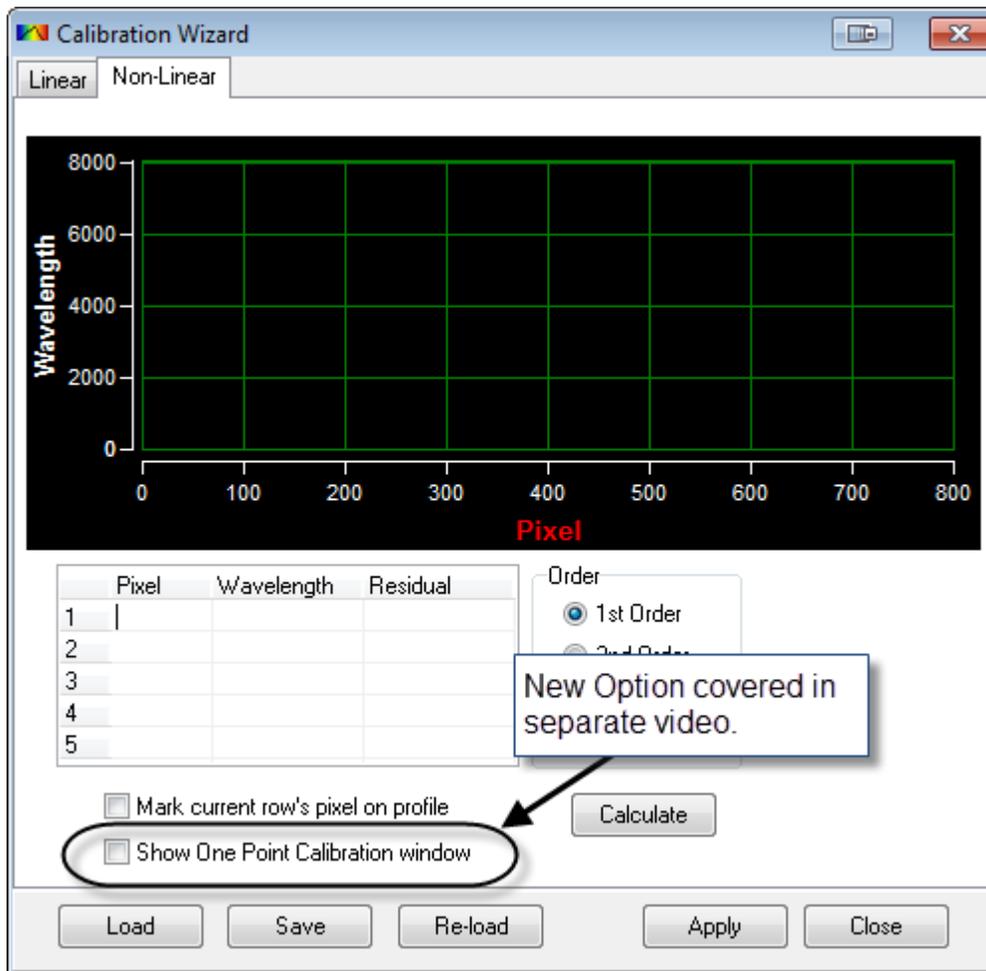
- When you copy to the clipboard a profile that contains a synthesized spectrum, RSpec no longer omits a small square in the lower left and right corners.
- When printing or copying to the clipboard, RSpec no longer includes the "Legend."



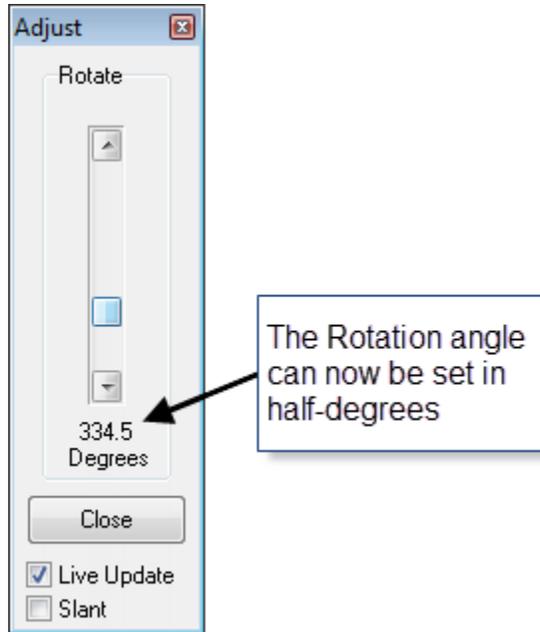
- When copying to the clipboard, as shown below, the upper right-hand corner now displays the program name and version number. The position of this text can be changed (or turned off completely) on the Options screen. By leaving this display visible when posting images to websites, you will help “spread the word” to newcomers about RSpec.



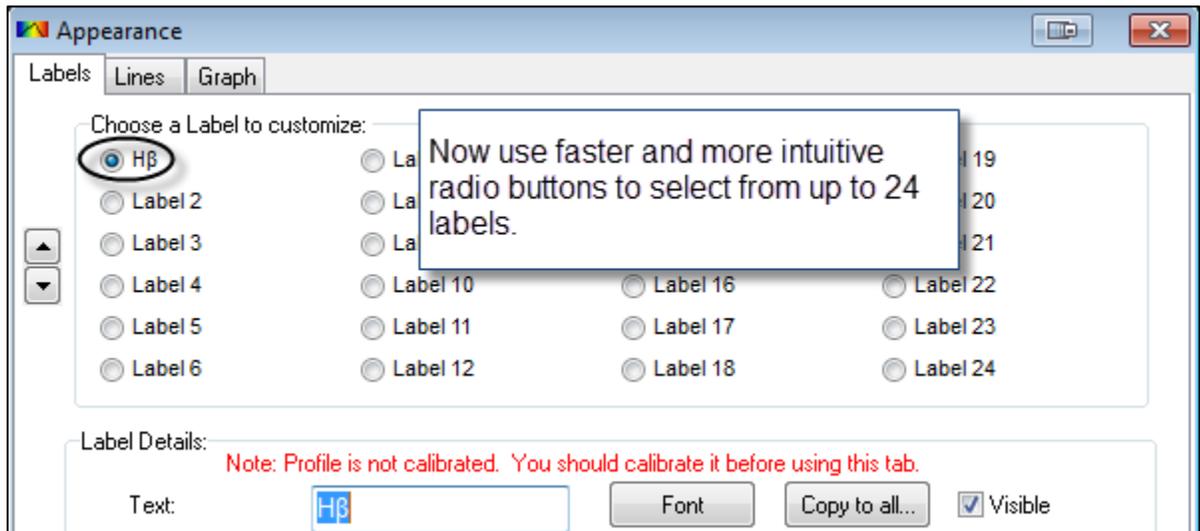
- The Calibrate screen's Non-Linear tab now has an option for *one-point alignment*. (See screen capture below.) This enables you to take a reference image at the beginning of an observing session and then, as long as your hardware doesn't change, use it and *a single known feature like the zero-order star or Balmer line*, to calibrate subsequent images. For more details, see the video library after updating, or this on-line video: [link](#).



- The Rotate slider now allows angles down to ½ degree rather than the previous whole degrees. This allows you to more precisely rotate your image so it's exactly horizontal.

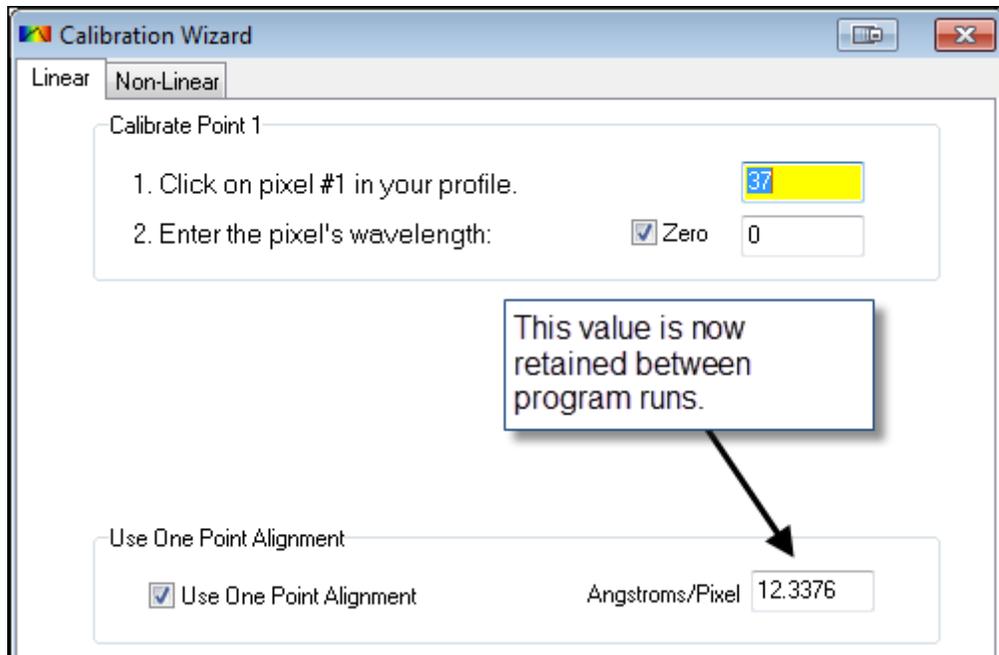


- The Appearance screen now allows 24 labels (up from 12). Rather than selecting a label with a pull-down box, you now use radio buttons, which are much faster and more intuitive.

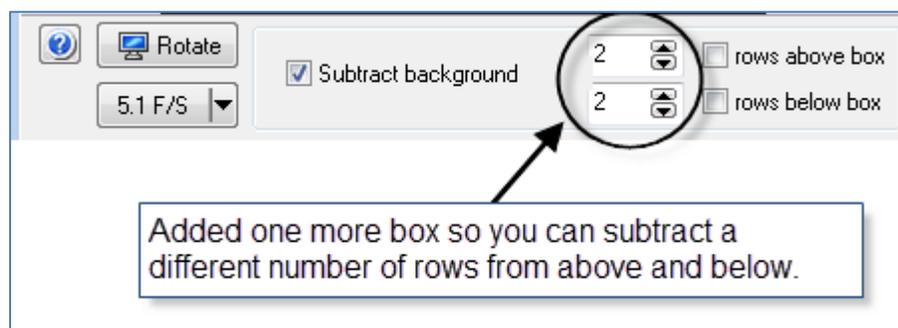


- The contents of the “Angstroms/Pixel”-field for one-point calibration is now retained between runs. (See screen capture below.) This eliminates having to re-type it every time.

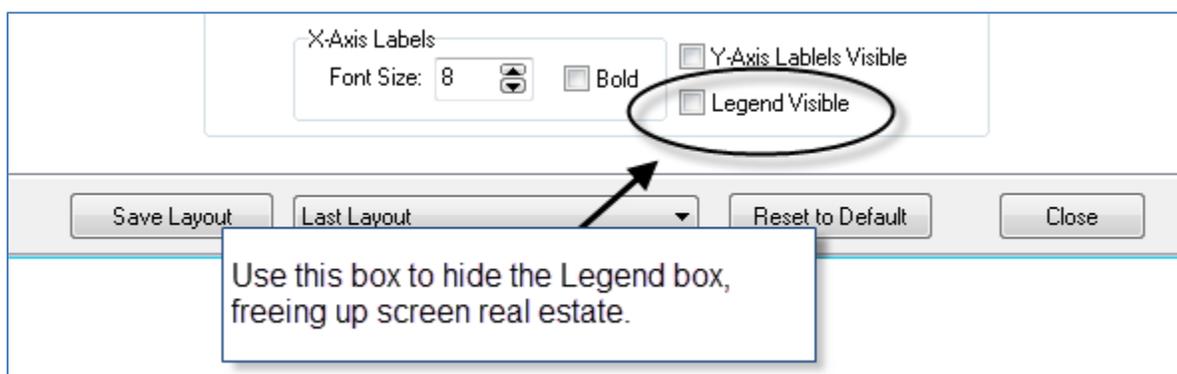
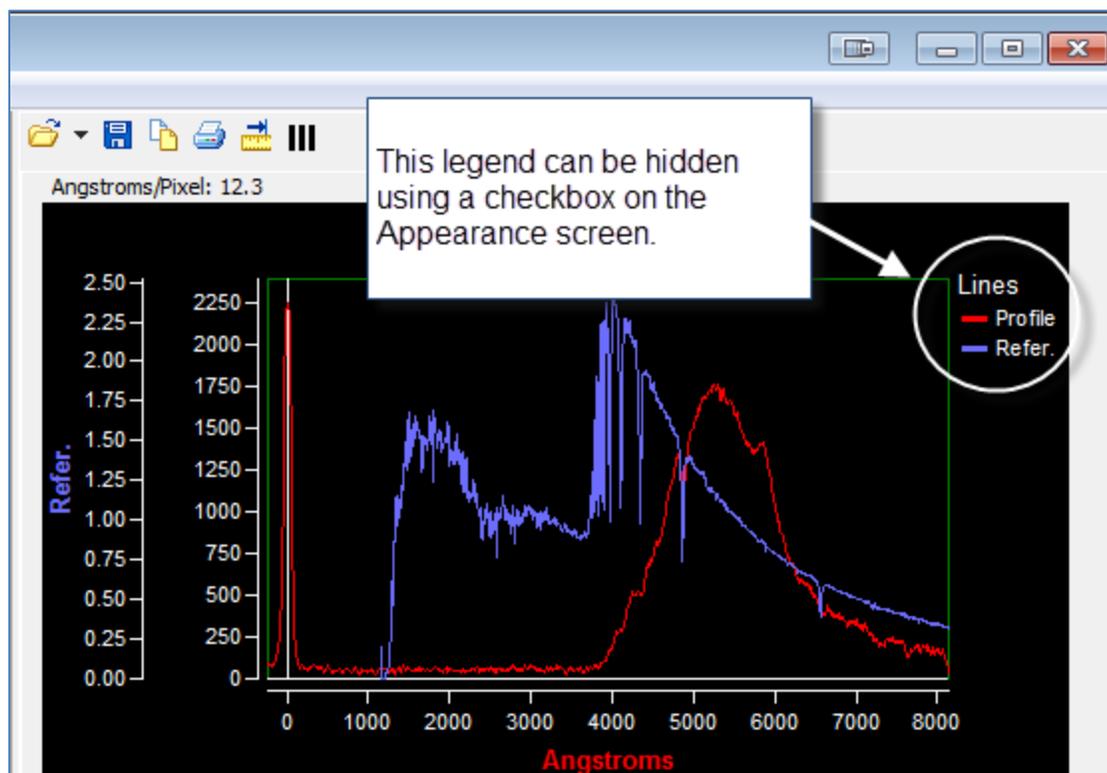
As a reminder, the *one point calibration* function allows you to take a calibration image of a known star at the beginning of an observing session. Unless you change your equipment, you can use the “Angstroms/Pixel” dispersion and the wavelength of a single feature to calibrate all subsequent images. For details, see the New Features video in the Video Library (on the Help menu) or this web [link](#) at 1:35 seconds.



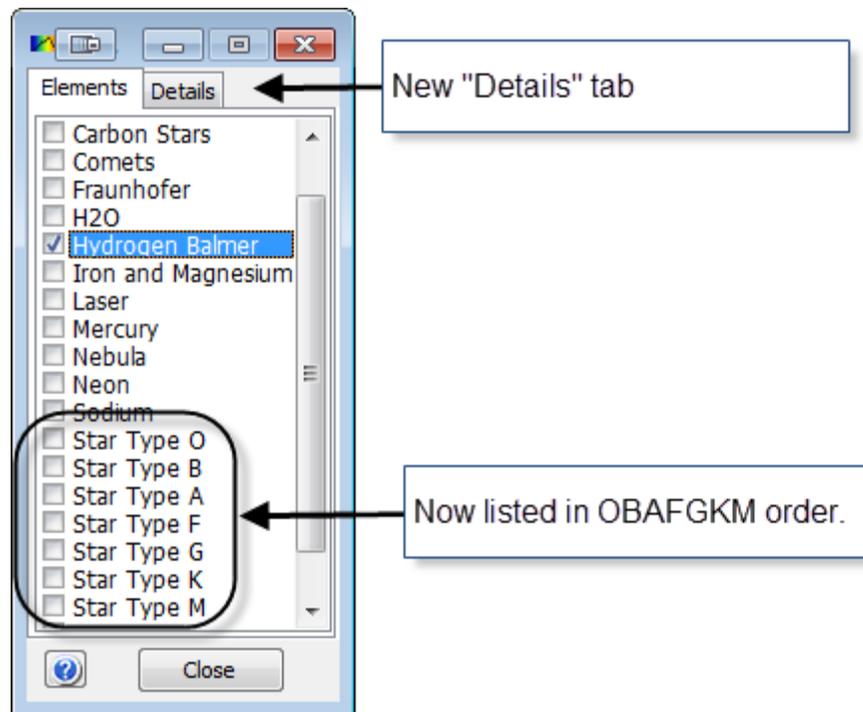
- The Subtract Background command now allows you to subtract a different number of rows above than below the spectrum. This can help you avoid subtracting a bright star:



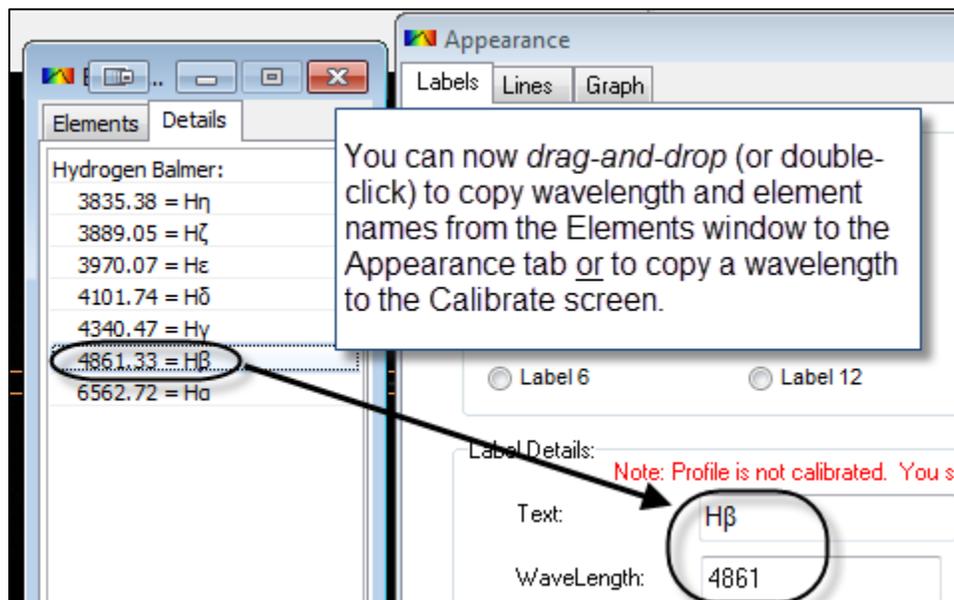
- You can now free up screen real estate for a wider profile graph by hiding the Legend. Use this checkbox on the Appearance screen, as shown below:



- The Element screen now lists the stars in OBAFGKM order and has a details tab that shows the contents of specific lines for the current element.



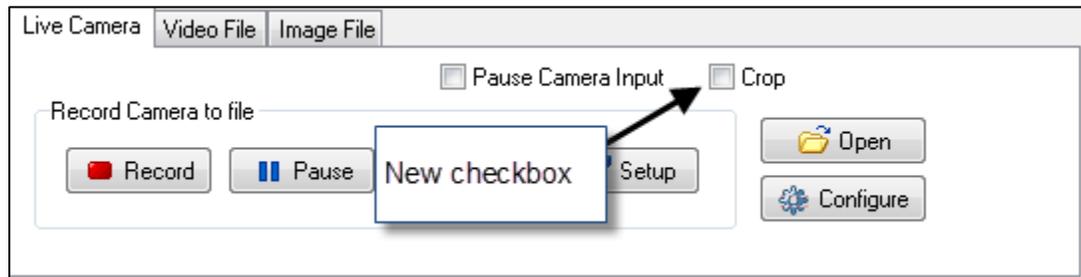
- You can now “drag-and-drop” or double-click to copy a specific line from the Detail-tab on the Elements screen to the Appearance screen. (You can also copy a wavelength to the Calibration screen.)



Changes in Version 1.2.0 Build 30

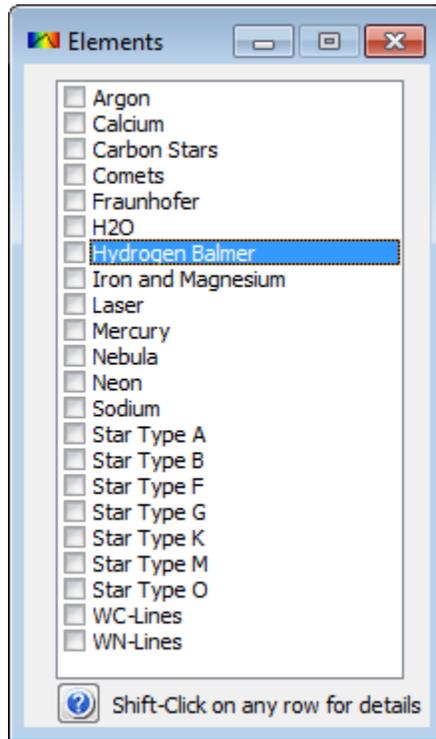
These features are demonstrated in the “New Features 7” video in the Video Library.

- The Live Camera tab now has a checkbox (shown below) labeled “Crop.” If you put a checkmark in this box, RSpec will discard the regions of the camera video that are *above* or *below* the orange binning boxes. If you are using a higher resolution camera, this will dramatically reduce the size of the files that RSpec records. Checking this box will also enable RSpec to process much faster frame rates, since the number of video rows is reduced. (You’ll find that you’ll probably want to have RSpec’s Rotation angle set to zero for the best use of this feature.)



- **Saving Profile Appearance:** When you save and then later re-open a profile graph (as a .dat file) RSpec now restores all of the labels, colors and other Appearance-screen items that were visible when the file was saved. This means, for example, that if you have placed labels (like Hydrogen- β) on the profile graph, they will re-appear. (RSpec saves the Appearance data in the same folder as the .dat file. The filename is the same, but with a .ini extension. You can turn this behavior off on the Options screen.)

- **Element Library:** Additional reference lines were added for OBAFGKM and other common objects. These are visible as new rows on the Elements screen, as shown below. This data is for informational purposes only. Not all of the lines will appear in your profiles.



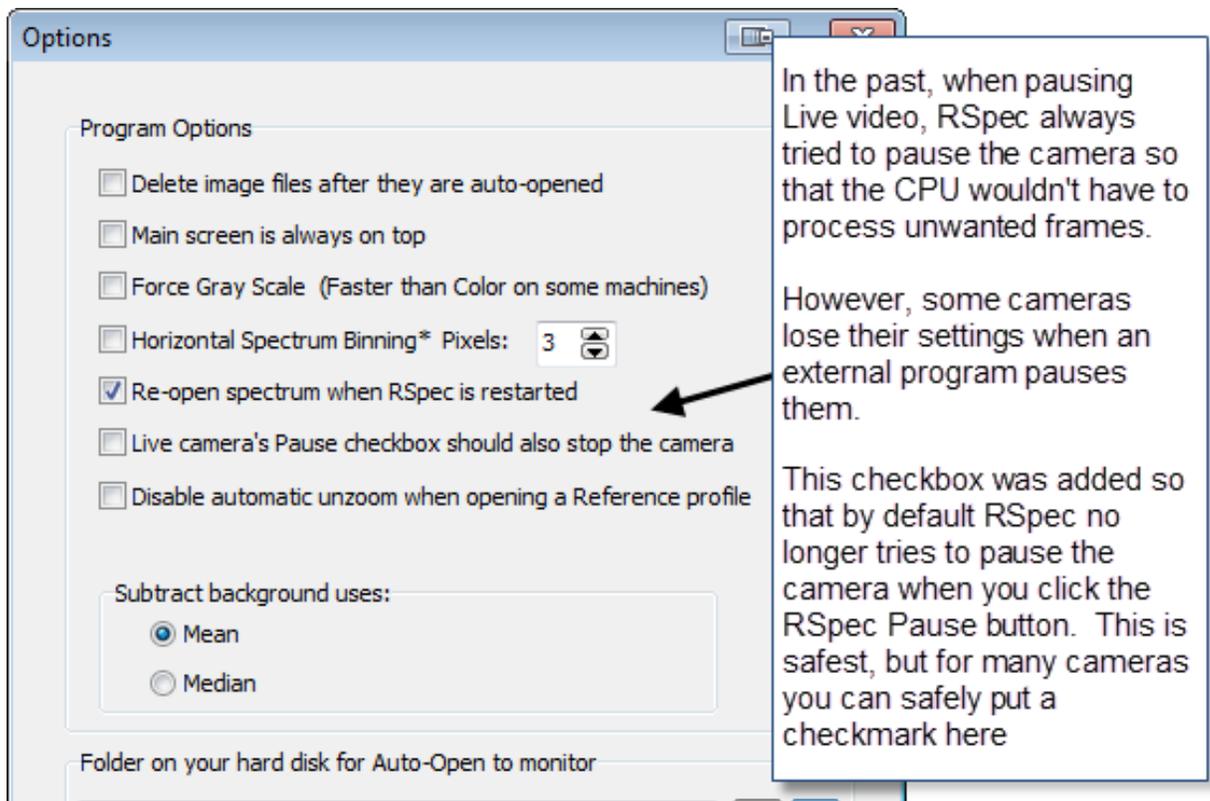
Also notice the new Help-button at the bottom of the above window. Clicking this button displays a document that explains the data and its sources.

Changes in Version 1.2.0 Build 22 –

- **Non-linear Calibration:** The Calibration Wizard now has a new tab for non-linear calibration using more than 2 points. Please see the Video Library for details of operation. Or view it on-line here: [link](#).

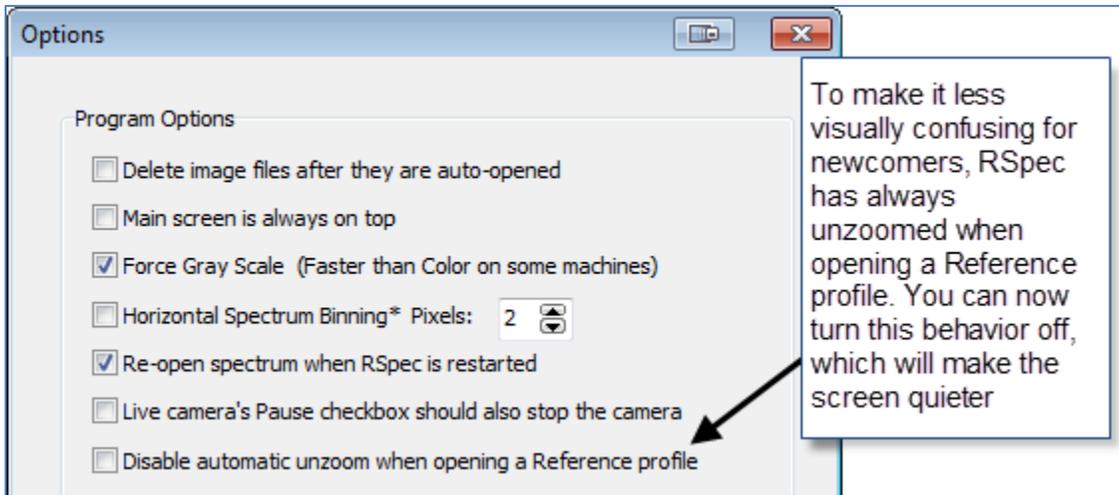
The features below are described in the video entitled “New Features 6” which can be found in the Video Library, or this [link](#) on-line.

- The Frame Rate control has been improved so it’s more effective.
- RSpec now optionally will allow the camera to continue running when you put a checkmark in the Pause checkbox:

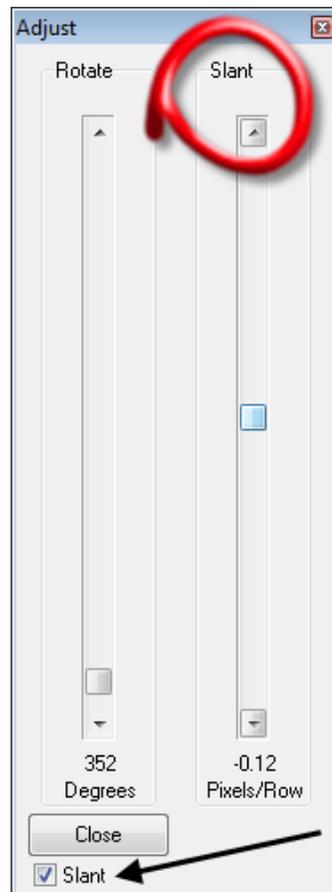


The screenshot shows the 'Options' dialog box for RSpec. Under the 'Program Options' section, there are several checkboxes. The checkbox 'Re-open spectrum when RSpec is restarted' is checked. A callout box with a blue border and white background points to this checkbox. The callout text reads: 'In the past, when pausing Live video, RSpec always tried to pause the camera so that the CPU wouldn't have to process unwanted frames. However, some cameras lose their settings when an external program pauses them. This checkbox was added so that by default RSpec no longer tries to pause the camera when you click the RSpec Pause button. This is safest, but for many cameras you can safely put a checkmark here'. Below the checkboxes, there is a section for 'Subtract background uses:' with radio buttons for 'Mean' (selected) and 'Median'. At the bottom, there is a text field for 'Folder on your hard disk for Auto-Open to monitor'.

- You can now disable automatic un-zooming when opening a reference profile:

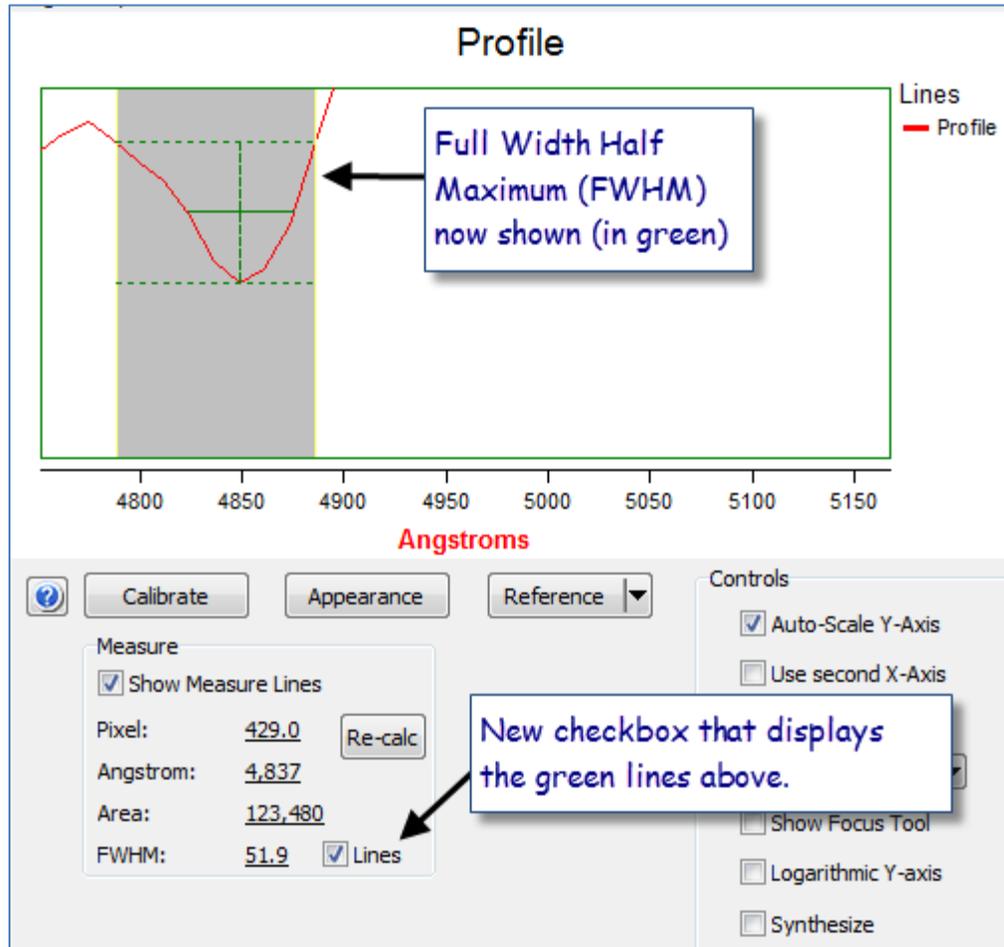


- The Rotate window has new slant command allows slanting a portion of an image. This is primarily used in the study of *meteor* or other moving spectra (including *drift scans*) where the movement was not perpendicular to the dispersion.

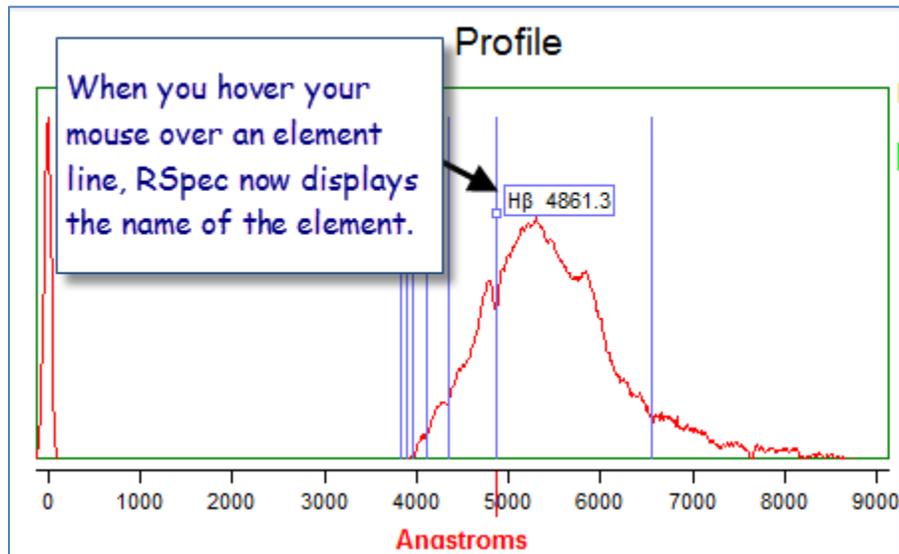


- **Full Width Maximum Height (FWMH)** is now calculated using standard geometry rather than the former Gaussian curve fit. The geometry that RSpec uses can be displayed by putting a checkmark in the checkbox as shown below. The FWMH calculation is only updated when you drag the Measure Lines to a new position or you click the “Re-calc” button.

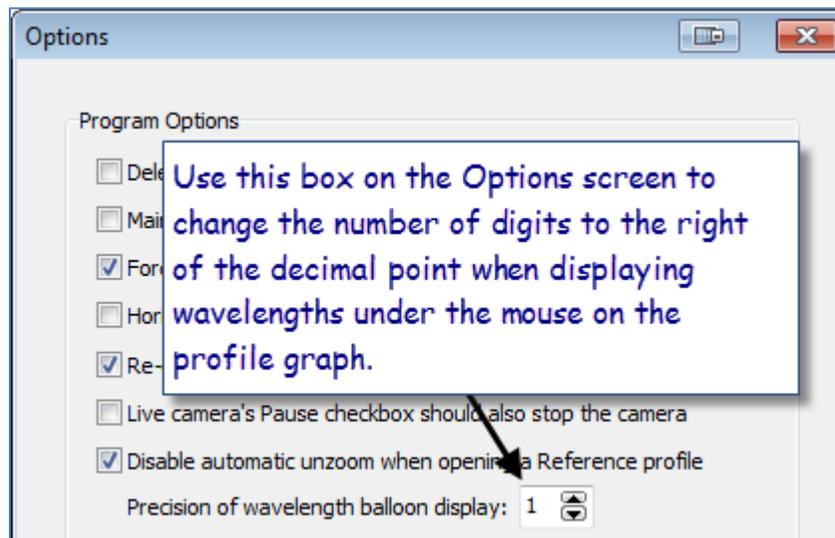
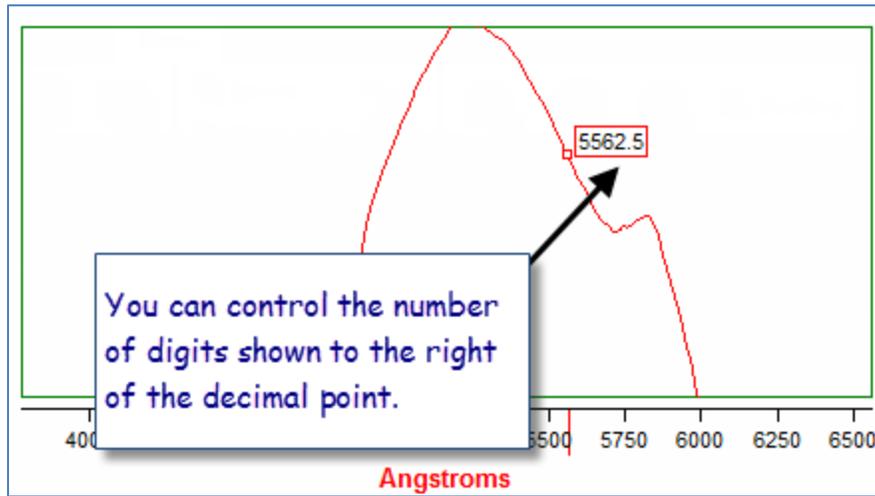
The FWHM, for example, can be used as aid to focusing.



- The **Element library** (vertical lines used in calibration) has been enhanced to allow more than one library to be displayed at a time. Also, when you hover your mouse over an element line, RSpec now shows the name of the feature. To add additional element lines to RSpec, look in Readme.txt found in Documents\RSpec\ElementsCustom for instructions.



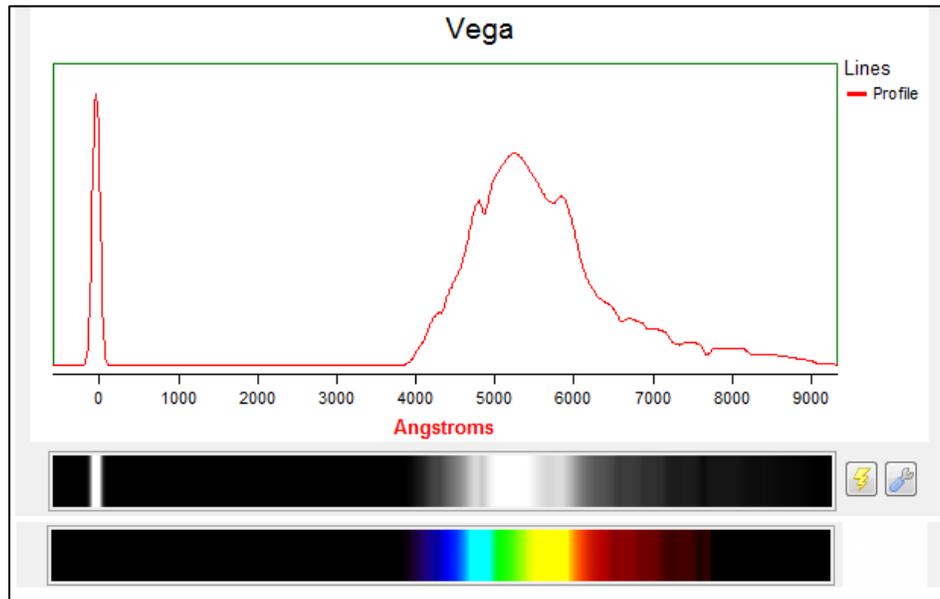
- **Precision of wavelength display:** You can now change the number of decimal points that RSpec will display when you hover your mouse over the profile graph.



Changes in Version 1.0.0 Build 354 –

These changes are documented in a video named “*New Features 5*” which you can find inside of RSpec on the Help, Video Library menu, or at this [link](#) on-line.

- RSpec now has real-time black and white or color spectrum synthesis!

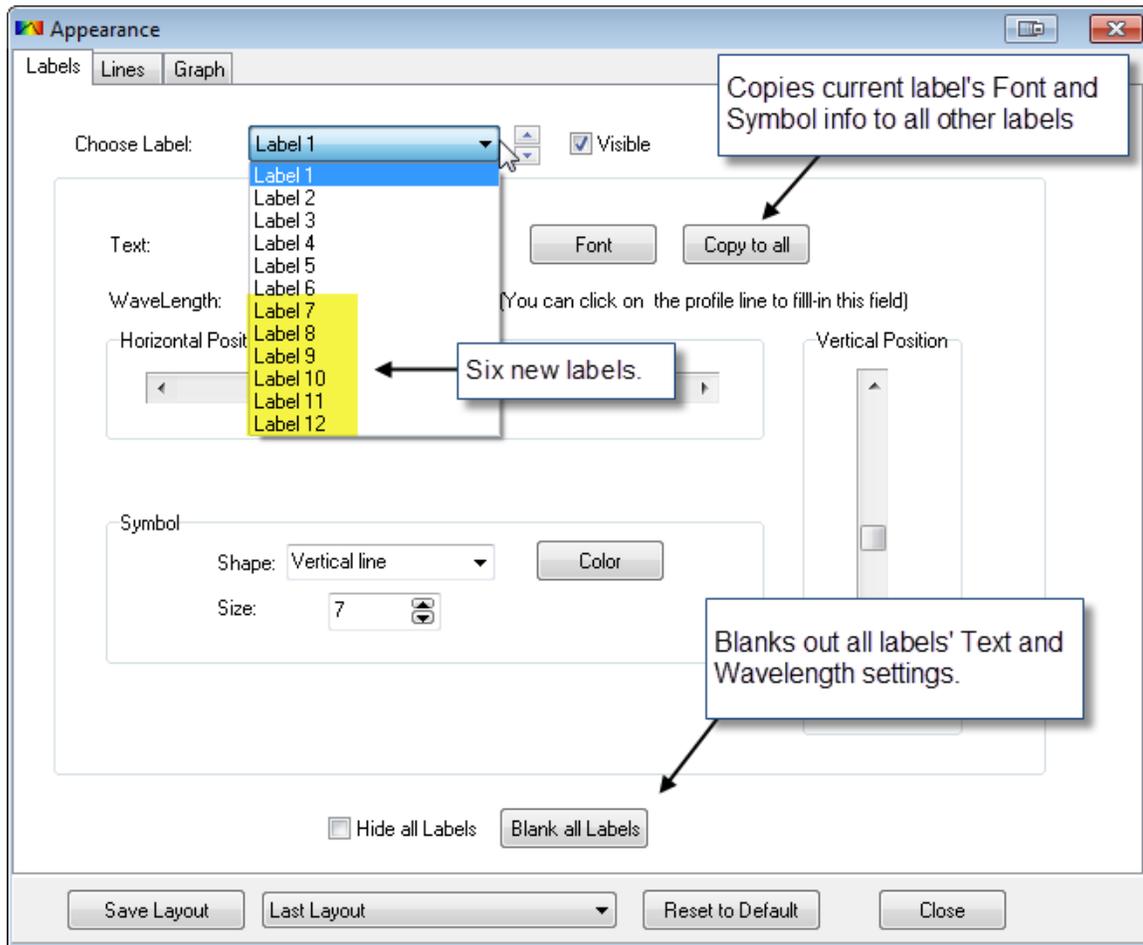


On the Options screen, you can now disable the automatic re-load at program start-up of the image/video file that was open the last time RSpec was run.

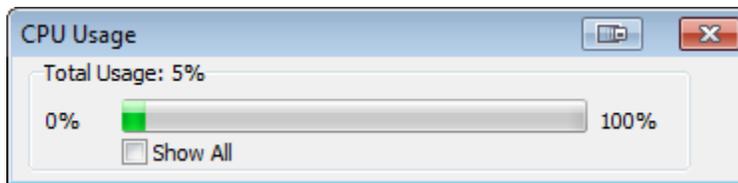
- You can now associate any file type (.jpg, .bmp, .FITS, .avi) with RSpec so you can load the file into RSpec by double-clicking on it in the Windows Explorer. Associate the file with the program RSpecOpen.exe, which can be found in the Program Files folder where you installed RSpec.

Note: rather than associating a file-type with RSpec, you can also use RSpec’s “Create Video/Preview Images” tool bar button to step through image files. (Turn on its “Preview the Images” checkbox.)

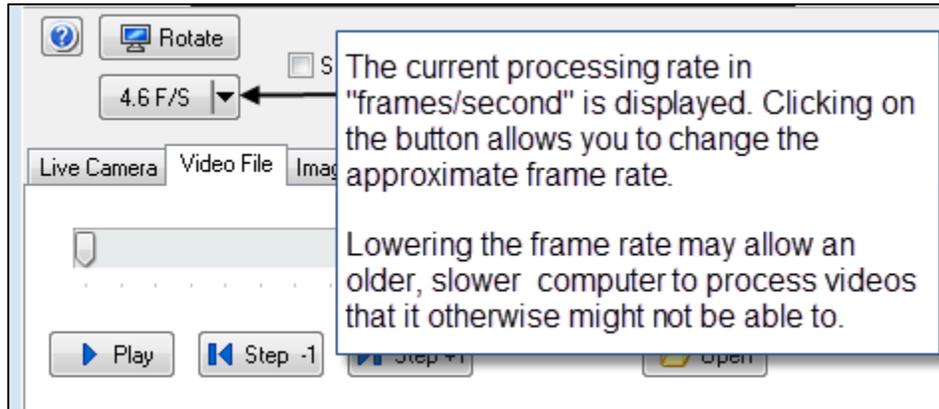
- The Setup installer no longer contains any videos. The Update installer now contains just the most recent video. Users can download the entire video library from the web via an option that appears when they try to play a video that isn’t on their machine. The Update installer is now only 15 megabytes, which should be small enough for you to download quickly. If downloading the video is still taking too long, please let us know how long it’s taking and where you’re located. We can set up a mirror site for your continent.
- The following changes have been made to the appearance screen:



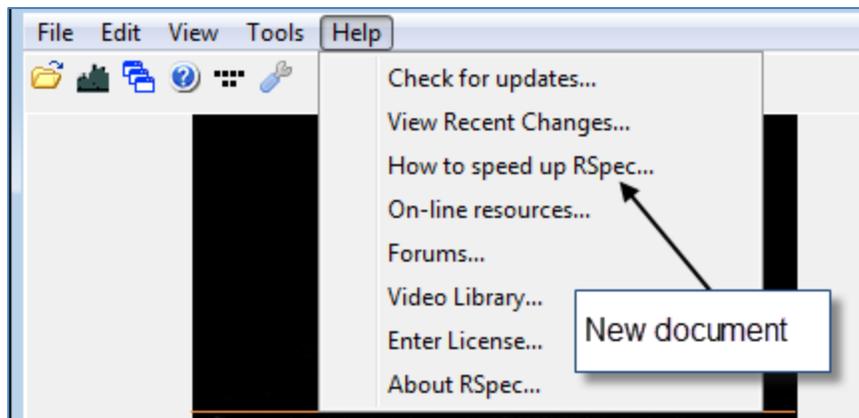
- The CPU meter by default only shows *total* CPU usage, making more room on the screen for other windows:



- There is a new “Frames/Second” button that shows how many frames per second RSpec is currently actually processing. This button also allows you to change the approximate frame rate that RSpec uses to read a video file or video camera.



- The Help menu contain a link to a new document that explains some steps you can take to speed up RSpec real-time video on slower computers.



Changes in Version 1.0.0 Build 336 – These changes are documented in a video named “New Features 4”

- A new feature named “Library” has been added. As you scroll through the Pickels’ reference library, the library profile graphs are now displayed in real-time as a reference curve. This makes it considerably easier to find the reference profile that most closely matches your spectrum. This update installs a video that shows how to use this feature.
- If you right-click on the spectrum (on the left side of the screen), you can paste a bitmap from your clipboard. This makes it easy for you quickly view a spectrum profile that you copy from a web page or other document.
- A new option on the Appearance screen enables the display of the current filename at the top of the profile graph.
- Right-clicking on any text field on the Appearance screen allows you to easily enter Greek letters. So, labels like this are now possible: “Hydrogen α ” or “ δ Scorpii”. These letters only display properly on labels if the label’s font supports Greek symbols. The default Arial font is fine.
- To make organizing your reference files easier, the Pickels’ Reference Library that comes with RSpec is now installed in its own folder: \Documents\RSpec\ReferenceLibrary. To reduce clutter, we suggest that you put any reference files that you create into a different folder. The \Documents\RSpec\Reference folder remains available for that use.
- When switching tabs or opening a new file, RSpec empties the averaging stack. This eliminates the counter-intuitive operation that occurred when changing to a new spectrum.
- The dialog box that appears when opening a new video now remembers the folder last used.
- When opening .dat files, their x-axis label is now properly displayed as “Angstroms” rather than “Pixels” if appropriate.
- In some circumstances, it was not possible to apply a label to a profile that had been corrected for instrument response. This bug has been fixed.

Changes in Version 1.0.0 Build 329

- A major new feature allows you to adjust your profiles by a response curve for your CCD camera.
- RSpec now contains an element library that will show reference lines for specific elements. This makes it easy to locate common elements in a profile.
- The Auto-Open command has been enhanced. It's faster and a bug that caused lock-ups on certain machines has been eliminated. You can also now specify a file extension (e.g. *.fits) of the files to be automatically opened. This is helpful because some cameras that produce (non-image) data files in the same folder as image files.
- When doing a one-point Calibration, you can now enter the dispersion in Angstroms/Pixel. Once you know the dispersion of your setup, you can now easily calibrate any profile by manually entering it as well as the wavelength of a single feature.
- RSpec now can save profiles in .png format.
- Both German and French have been added to the languages that are available. On personal note, I wanted to thank all of the RSpec users who have been so helpful in reviewing features, making suggestions, and testing upgrades. I couldn't do it without you. Tom
- When opening a Reference Profile, RSpec now adds a second Y-axis to the graph. You can turn this axis off with a new check box.

Changes in Version 1.0.0 Build 305

- The "Subtract Background" command now allows you to subtract using the background both from above and from below simultaneously.
- The "Subtract Background" command now can use the mean (as previously) or median for calculations. (Select this on the Tools | Options screen.) The Calibration Wizard has a new checkbox that enables you to horizontally align a profile graph with a previous calibration.

Major Changes in Version 1.0.0 Build 285

- To view a "New Features" video on the web that shows these changes, click on this [link](#). After you've installed this update, this video is also available on the Help | Video Library menu.

- RSpec can now optionally show the Full Width Half Maximum (FWHM) of any profile feature.
- Binning of the input spectrum is now supported.
- After a profile is calibrated, RSpec now properly displays the dispersion (in Angstroms/Pixel) above the graph.
- When measuring a spectral feature with the vertical measure lines, a new feature (named "Measure Snap") can position the lines so that they best bracket the feature. In the past, measuring a profile feature required careful tweaking of the measure lines to get the symmetrical around the feature. With Measure snap, you can set the measure lines accurately with one click.
- When hovering your mouse over a profile graph, if the Measure Lines are turned on, the "floating" window now shows the Y value as well as the Angstroms/pixels.
- On the Help | Video Library menu, the "Previewing & Creating Videos" video now plays properly. We encourage you to watch this video because the feature is a valuable one.
- On the Help | Video Library menu, the link at the end of the Focusing video to Dr. Doug West's helpful article now works. You can go to the article with this link rather than re-watching the entire video.
- Bug fixed: on rare occasions, at program startup, the orange "capture box" lines would not be visible.
- Bug fixed: in some circumstances, toggling the "Show Second Axis" checkbox off would result in the profile's x-axis values being those of the reference.

Major Changes in Version 1.0.0 Build 275

- When selecting to play the "Previewing and Creating Videos" video, the video now starts properly.
- The link to Doug West's on-line article (at the end of the Focusing video) will now launch your browser and take you to the article.
- Browsing for the capture folder (on the Tools | Option screen) has been changed in appearance to allow DSLR devices to be seen.

Changes in earlier releases

- A new option on the Tools | Option screen lets you enable color display if your video or image are in color rather than mono. This may be slower on some machines.
- When switching from the Live Video tab, RSpec now closes any live camera that is open. RSpec was not releasing cameras, which prevented other applications from accessing them.
- There is a new feature that will allow you to create a video from a series of FITS or other still images. (See the Video Library for details.)
- The video screen has a new "Subtract Background" checkbox that can dramatically reduce noise from sky or camera glow. (See the Video Library for details.)
- The Tools | Options screen has a new option where you can specify the folder which "Auto-Open" should monitor.
- The Tools | Options screen has a new option to delete files after they are Auto-Opened.
- The Tools | Options screen has a new option to force the RSpec window to always be on top. This can be helpful if you're running several different program simultaneously.
- The Setup button on the Live Video tab allows you to restrict the maximum size of a captured file, and to specify that the name of the captured file should contain the current time and date.
- A new histogram screen can be opened from a tool bar button or from the View menu. This screen allows you to view and adjust the spectrum image brightness.
- The loading of FITS files has been sped up by a factor of ten.
- The Help menu has a new "Online Resources" option that will take you to the RSpec website page with resource links.
- The Video file screen has a new "Loop" option. If this option is checked, when the end of a video is reached, RSpec will rewind it and play it again. This is helpful if you have a short avi file that you want to work with.
- The right-hand profile screen has a new "Logarithmic" checkbox. This can be useful when viewing the spectra of planetary nebula, making it a lot easier to see weak spectral lines that are normally overpowered by the strong emission lines:

NGC 7009 - The Saturn Nebula

