

# RawTherapee 4.0.10 User Manual

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If you would like to help translate this manual, read this forum introductory thread:

<http://www.rawtherapee.com/forum/viewtopic.php?f=4&t=2943#p21647>

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# Introduction

## Welcome!

Welcome to RawTherapee 4.0.10, the powerful 64-bit open source raw converter for Windows, Mac OS X and Linux! The RawTherapee project was started in 2004 by the Hungarian programmer Gábor Horváth. In January 2010 Gábor decided to open his source code under the GNU General Public License, thanks to which talented developers from around the world joined the project. Based on their hard work, we are proud to present RawTherapee 4.0.10! We hope you will enjoy it.

# Features

## General Features

- All the standard features you would expect from a raw developer and much more,
- A processing queue to make tweaking a photo as fast as possible while leaving the CPU grunt work queued up for later,
- Floating point engine - the only raw developer on the market which does all calculations in precise floating point notation so nothing gets rounded off and lost,
- SSE optimisations for better performance on modern CPUs,
- Color management using the LCMS2 color management system for more precise color handling, providing control over working and output color space,
- File browser featuring colored tagging, searching (by text matched to the filename), metadata filtering (by file type, camera model, lens model, photo parameters),
- Support for DCP and ICC color profiles, for precise colors or for replicating the “camera look” to match out-of-camera JPEG images,
- A history panel to easily see what changes you made and jump back to a specific point,
- A snapshot panel to work with multiple versions of changes to a photo,
- A flexible UI where panels and some individual elements can be adapted or hidden,
- Easily pan around photos much larger than your screen thanks to pan rate amplification, eliminating the need for numerous and fidgety mouse movements,
- Scroll the tool panels using your mouse scroll wheel without worrying about accidentally misadjusting any tools, or hold the Shift key while using the mouse scroll wheel to manipulate the adjuster the cursor is hovering over,
- A Before|After view to compare your latest change to any previous one,
- Support for processing profiles (sidecar files), whole and partial,
- Show various channels in the preview: red, green, blue, luminosity and a focus mask,
- Show various channels in the histogram: red, green, blue, CIELAB luminance, chromaticity and raw,
- Clipping indicators in the preview,
- Export Panel with Fast Export Options,
- Keyboard shortcuts to speed up work,
- Command line support to automate RT using scripts or call it from other programs,
- Support for most cameras,
- Sound support to inform you when a CPU-intensive task completes e.g. when the queue is done being processed,

- Preserve IPTC and XMP of pre-tagged files,
- Adapt RT to use your system's interface color scheme and widgets or try the provided custom color schemes,
- Localization in almost 30 different languages.

## Exposure and Color Features

- The Auto Levels tool tweaks your photos to provide a good starting point,
- Various powerful methods of shadow and highlight recovery,
- Two RGB tone curves featuring four methods each, for unprecedented control of colors and exposure,
- Tone mapping based on edge-preserving decomposition for a natural look,
- Wealth of Lab adjustments for separate control of colors and luminance,
- Avoid color shift thanks to Munsell correction,
- Preservation of natural skin tones,
- Curve-based adjustment of chromaticity and luminance,
- White balance - automatic, manual or one of a wide variety of predefined sources,
- Channel Mixer,
- Hue, saturation and value (HSV) and red, green and blue (RGB) curve adjustments,
- Adaptation of the CIECAM02 color appearance model ratified by the International Commission on Illumination (CIE) to maintain accurate colors and to, given a set of initial viewing condition parameters, convert the image so that it will look the same under the target viewing conditions. Image processing using CIECAM02 is enabled via a number of methods, using curves and sliders. A multitude of tools is adapted to auto-switch to CIECAM02 mode, when in use, including tone mapper, sharpening, defringe, etc.

## Detail Features

- Sharpening via RL deconvolution, and unsharp mask sharpening featuring a unique and powerful threshold slider to bring out detail while avoiding halos,
- Control of sharpening around edges only,
- Microcontrast to bring out texture,
- Contrast by detail levels, which decomposes the image into four levels of detail, from pixel-sized to large radius, each of which can be individually tweaked,
- Very powerful wavelet-based noise reduction in the RGB and Lab color spaces,
- Impulse noise reduction to eliminate salt-and-pepper type noise,
- Defringe tool for elimination of purple fringing

## Transformation Features

- Perspective correction,
- Adobe Lens Correction Profile support for automatic correction of distortion, vignetting and chromatic aberration,
- Distortion correction,
- Chromatic aberration correction,
- Vignetting correction

## Raw Pre-Demosaicing Features

- Various demosaicing methods to start off by squeezing out the most detail possible from your raw photo,
- Line noise filter,
- White and black point adjustment to fine-tune some raw formats,
- Dark frame subtraction to eliminate some forms of noise,
- Flat field correction to easily correct vignetting, lens color cast and sensor dust,
- Manual and automatic chromatic aberration correction

## The Floating Point Engine

RawTherapee 4 is probably the only real time raw converter which does all calculations in precise 32-bit floating point notation (in contrast to 16-bit integer as used in most other converters like dcrw and also in RawTherapee up to version 3.0) so nothing gets rounded off and lost.

Classical converters work with 16-bit integer numbers. A pixel channel has values ranging from 0-65535 in 16-bit (to increase precision converters usually multiply the 12-14 bit camera values to fill the 16-bit range). The numbers have no fractions, so for example there is no value between 102 and 103. In contrast, floating point numbers store a value at a far wider range with a precision of 6-7 significant digits. This helps especially in the highlights, where higher ranges can be recovered. It allows intermediate results in the processing chain to over- or undershoot temporarily without losing information. The fraction values possible also help to smooth color transitions to prevent color banding.

The downside is the RAM space floating point numbers require, which is exactly twice that of 16-bit integer. To cope with these increased requirements, a 64-bit operating system is highly advised for stability. If you have problems running RT on a 32-bit system, try the following:

- As a general rule, you should avoid having folders with too many raw photos in them as each photo takes up memory when displayed in RawTherapee's File Browser tab. Try not to have more than 100 photos per folder.
- Use 4-Gigabyte Tuning in Windows. See the page in the Microsoft Library for an explanation of what 4-Gigabyte Tuning is: <http://msdn.microsoft.com/en-us/library/bb613473%28VS.85%29.aspx> and find out how to do it in Windows XP, Vista and 7 by reading this guide: <http://avatechsupport.blogspot.co.uk/2008/03/how-to-set-3gb-startup-switch-in.html>

- Close other programs while working in RawTherapee.
- Close the image editor tab when you're done editing to free up memory.
- Turn off "auto-start" in the batch queue. Only add photos to the batch queue once you are done editing all of them, and then start it. Use the batch queue, do not use the immediate save button.
- Change to a directory with few or no photos in it before starting the batch queue.
- The most memory-intensive tools are Tone Mapping, High Quality Shadows & Highlights and Contrast by Detail Levels, so you might need to avoid using them if your machine and operating system are not up to standard.

# Installation notes

Processing profiles (with a PP3 extension for version 3 processing profiles, or PP2 for the older version 2) can be stored in and retrieved from a cache or relative to the photo being developed. You can choose whether RT should use the cache, write the processing profile alongside the image, or both, from *Preferences > Image Processing*. It is advised to store these files alongside your input image files so that if you decide to move the image you can move the processing profile easily along with it.

Processing profiles can evolve from one version of RawTherapee to the next. We strive to ensure backward compatibility, but this is not always possible. Processing profiles can get new parameters or lose the ones that became obsolete. Tool behavior can also evolve, wherein default values change or in extreme cases the meaning of a value is interpreted differently; an example of this is the noise reduction tool, where a luminance noise reduction value of 10 in RT3 would lead to a different result in RT-4.0.10 where the whole noise reduction engine has been greatly improved.

Consolidating processing profiles into a cache allows one to store isolated copies of the processing profiles per specific version of RawTherapee. In such a case, the cache can be used to re-process photos in order to get the same output as originally intended (but e.g. with a new size or output color space) using the same version of RawTherapee in which the image was originally edited. Whether this is desirable is debatable. Consider that you want to squeeze the most out of your raw files possible. If a year later you want to go back to an old raw file, perhaps getting the same result as you did a year ago is not the best idea, because RT's capabilities would have greatly improved in that year, and your taste would also have developed. Nevertheless, by backing up whole cache directories when installing a new major of RawTherapee, you can be sure that you can reproduce the exact same result as you achieved years before when you originally developed the photos.

By default, the cache folder is named **RawTherapee4.x**, where **4** represents the major version number and **x** the minor version number.

Installation of each RawTherapee version creates a new cache folder to prevent the compatibility problem. However, if you don't mind re-tuning your photos because of backward-compatibility problems when upgrading RawTherapee and don't plan on editing your photos with the older version, the *Save processing profile next to the input file* option is the best choice.

Do note that if you process thousands of photos, this cache can grow quite large and possibly slow down RT loading times, so this is another argument for choosing *Save processing profile next to the input file* over *Save processing profile to the cache*. If you do use the cache, keep an eye on it every few months.

You can share the same cache folder (possibly over a network, through simultaneous access is not allowed, or at your own risk!) by creating an environment variable (see your operating system's documentation on how to create it):

```
RT_CACHE=full path to your cache folder
```

# Making a Portable Installation

RawTherapee and the cache folder can be stored “self-contained” on a USB flash drive or any other mass-storage device.

## For Windows

You can either download the zipped version of RawTherapee from the download page (if available) and just unzip it to a target folder, or download an installer version and unzip it from a command prompt using this command:

```
msiexec /a RawTherapee.msi TARGETDIR="C:\TargetDir" /qb
```

Replace the name of the MSI installer and the target directory as appropriate. Spaces in the TargetDir path are allowed, as the path is enclosed in quotes.

Let's assume that you've unzipped your archive into **E:\RawTherapee**, where **E:\** is the drive letter of your USB flash drive. Now open the **E:\RawTherapee\options** file, and set the **MultiUser** option to **false**. That way, the cache directory will be located in a subdirectory of the installation path.

## For Linux

Getting RawTherapee to run off a portable medium such as a USB flash drive on various Linux systems is not straightforward due to the nature of Linux systems. While the Windows version of RawTherapee comes bundled with all required libraries to run on any Windows version, Linux distributions differ significantly from each other and as a result a version of RawTherapee built for one distribution is unlikely to run under a different distribution. This should not be a problem though, as builds of RawTherapee are available for most distributions, so you should just install it the usual way - using the distribution's package manager.

The cache folder can be found in **~/.cache/RawTherapee** and you can simply copy it over to a portable medium and then copy it back to the same place on the destination system. You most likely only want to keep the processing profiles, so just copy the **~/.cache/RawTherapee/profiles** folder.

Note that on some distributions the RawTherapee cache folder name might have a version number appended, e.g. **~/.cache/RawTherapee4.0.10/profiles**

# Using RawTherapee

## First Run

The first time you start RawTherapee, you will most likely see an empty file browser tab. This is because you need to tell RawTherapee where your raw photos are stored. Use the directory tree browser on the left of the File Browser tab to navigate to your raw photo repository and double-click on it. Now RawTherapee will generate thumbnails of your photos in the central panel. The first time you open a folder full of raw photo files (you can refer to folders full of photos as *albums*), RawTherapee will read each file and extract the embedded JPEG thumbnail from it (every raw photo has an embedded JPEG thumbnail, sometimes even a few of various sizes). This can take some time on larger folders, but it only happens the first time you open it. The JPEG thumbnail embedded in each raw photo is identical to the out-of-camera JPEG image you would get if you shot in JPEG mode (or in raw+JPEG mode). This JPEG is not representative of the actual raw data in that photo, because your camera applies all kinds of tweaks to the JPEG image, such as saturation boost, contrast, sharpening, etc.

The moment you open a raw photo for editing, RawTherapee ignores the embedded JPEG image and reads the actual raw data. It processes this data according to the settings contained in the *default image processing parameters for raw photos* file as specified in *Preferences > Image Processing*. When you first install RawTherapee, the default processing profile chosen for raw photos is eponymously called “*Default*”. This profile contains mostly neutral settings and a few tweaks on top of that, which should result in a pleasant photo which you can either save straight away or continue tweaking to your taste. This photo will not look like your out-of-camera JPEG (or like the original thumbnail you saw for that photo, which is identical to the out-of-camera JPEG). From the moment you open that photo, its thumbnail in the File Browser tab is replaced with what you see in the preview in the Editor tab, and every tweak you make is reflected in the thumbnail. The thumbnails get stored in the cache for quick future access.

All subsequent times you open a previously edited folder, RawTherapee will read the thumbnails from the cache if they exist, and this will be much faster than the first time you opened that folder.

Use the zoom icons on top of the file browser to make the thumbnails smaller or bigger. Each thumbnail uses some memory (RAM), so it is advisable to keep the thumbnail size low (*Preferences > File Browser > Maximal Thumbnail Height*).

You can filter the photos visible by using the buttons in the top toolbar, as well as by using the *Find* box or the *Filter* tab. Possible uses:

- Show only unedited photos,

- Show only photos ranked as 5 star,
- Show only photos with a specific ISO range,
- Show only photos with a NEF extension.

## Editor Tab Modes

Double-click on one of the photos in the File Browser tab. It will open in a new tab, the *Editor* tab.

RawTherapee allows you to work on photos in two modes:

- *Single Editor Tab Mode*, where you work only on one photo at a time, and each photo is opened in the same Editor tab. There is a horizontal panel called the *filmstrip* at the top of the Editor tab showing the rest of the photos in that folder for easy access.
- *Multiple Editor Tabs Mode*, where each photo is opened in its own Editor tab. The filmstrip is hidden in this mode. Having multiple photos opened at the same time requires more RAM.

Try both modes and see which one suits you better. To do that, click on the *Preferences* icon  in the top-right corner of the RT window, and choose *General > Layout* and set *Editor Layout* to your preferred choice.

Use this *Preferences* window to select another language for the user interface, to choose another color theme, change the font size, etc.

It is also possible to start RawTherapee without the *File Browser* tab by specifying RawTherapee to open an image from your operating system's file browser, or by using the image filename as an argument when starting RawTherapee from the command line.

## The Image Editor Tab

Take a moment to explore the *Image Editor* tab. The central panel holds a preview of your photo. This preview is generated from the actual raw data by processing it according to the settings either you manually set, or those that are stored in the processing profile used to open that photo, as specified in *Preferences > Image Processing > Default Image Processing Parameters*. The preview will show you the effect of all the adjustments you make. Note that some adjustments, such as sharpening and noise reduction, are visible only when you are zoomed in at 100% (1:1) or more. On either side are panels which show information about the currently opened image and which contain tools with which you can squeeze out all the juice your photo has to offer.

### The Left Panel

To the left is a panel which shows the RGB, HSV and Lab values of the pixel your cursor is currently hovering over. This is called the *Navigator*. Under it is the *History*

panel. While editing a photo, all your actions are recorded in this history panel. By clicking on the different entries, you can step back and forth through the different stages of your work. Under the *History* panel is a panel called *Snapshots*. Its use is in that you can save a snapshot of the photo with all the adjustments up to that point in time, and then proceed to further modify your photo to give it a different appearance, saving new snapshots at every moment you feel you might have reached a version of your photo worth saving. Once you have two or more snapshots, you can just click on them to flip through the different versions and stick with whichever one you like best. In the future, all history items and all snapshots will be saved to the sidecar file. For now, the history and snapshots are lost when you load a new photo in the Image Editor or close RawTherapee.

## The Right Panel

To the right, at the top, is the histogram panel. It can show the histograms of the red (R), green (G), blue (B) and CIE Lab Luminance (L) channels of the photo as it would look if you saved it, or it can show you the histogram of the raw file before any transformations such as demosaicing are applied to it. Additionally, you can show or hide the RGB Indicator Bar, which is situated under the histogram and shows the exact place on the histogram of the enabled R, G, B or L values of the pixel your cursor is currently hovering over. The histogram can be moved to the left panel from *Preferences > Layout*.

Just under the histogram is a drop-down list called *Processing Profiles*. This is an important concept in RawTherapee. Every time you open an image, a profile is applied. A profile is a set of instructions regarding which demosaic algorithm to use to interpret the raw data, whether a sharpening filter is to be applied, if auto-exposure is enabled, etc. These profiles are simple text files and it's easy to make your own. For clarification: these processing profiles have nothing to do with camera profiles or color profiles. By default, RawTherapee opens raw files with the *Default* profile and non-raw files with the *Neutral* profile, but you can change them if needed by going to *Preferences > Image Processing > Default Image Processing Parameters*.

## Preview modes

In addition to the normal preview, RawTherapee supports a number of other preview modes to help you tweak your photos. Preview modes are controlled via buttons in the Editor toolbar or via shortcuts. Only one preview mode can be engaged at a time.

The following preview modes are currently supported:

- Red channel,
- Green channel,
- Blue channel,
- Luminosity, which is calculated as  $0.299*R + 0.587*G + 0.114*B$ ,
- Focus mask, to see which areas are in focus



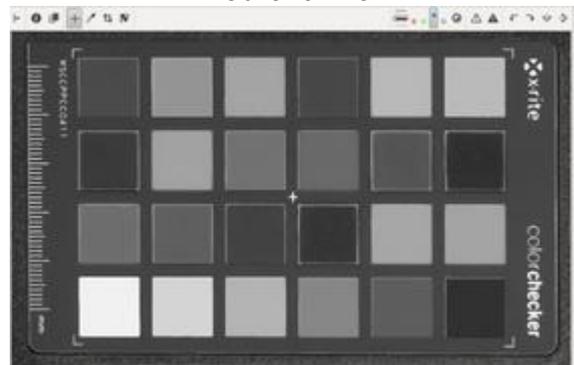
*Regular preview*



*Red channel*



*Green channel*



*Blue channel*



*Luminosity*



*Focus mask*

Preview Mode	Shortcut	Toolbar Buttons
Regular*		
Red channel	<b>r</b>	
Green channel	<b>g</b>	
Blue channel	<b>b</b>	
Luminosity	<b>v</b>	
Focus mask	<b>Shift-F</b>	

\*The preview is returned to normal by deselecting any other mode.

### RGBL preview modes

When clipping indicators are engaged in the RGBL preview modes, shadow clipped areas are indicated in a blue color and highlight clipping is indicated in red. As during normal preview, the lightness of the clipping highlight is indicative of the degree of clipping.

Preview of individual channels may be helpful when editing RGB curves, planning black/white conversion using the channel mixer, evaluating image noise, etc. Luminosity preview is helpful to instantly view the image in black and white without altering development parameters, to see which channel might be clipping or for aesthetic reasons.

### Focus Mask

The *focus mask* is designed to highlight areas of the image which are in focus. Naturally, focused areas are sharper, so the sharp areas are being highlighted. The focus mask is more accurate on images with a shallow depth of field, low noise and at higher zoom levels. To improve detection accuracy for noisy images evaluate at smaller zoom, around the 10-30% range. Note that the preview is rendered more slowly when the focus mask is enabled.



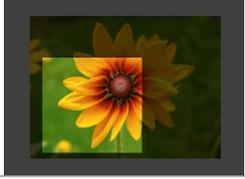
*Focus mask indicating the focusing plane.*

The current implementation analyzes the preview image which is rescaled from the original captured size. This process of rescaling reduces the noise and is helpful to identify truly sharper details rather than noise itself which may also contain micro texture. At the same time, rescaling of the original image to the preview size compresses larger scale details into a smaller size, and it may introduce aliasing artifacts, both of which could lead to false positives. You can increase your confidence by viewing the mask at various zoom levels. It is not always fault proof, but can be helpful in many cases.

*Warning: Be sure to double-check your images if you decide to delete them based on the focus mask.*

### **Background Color of the Editor Preview**

The background color of the preview panel surrounding the image area may be changed to ease image preview during editing and to better visualize image cropping. A vertical stack of three thin buttons in the preview modes toolbar above the image preview panel allows to set the background color of the area around the photo preview.

Background Color of Preview	Shortcut	Toolbar Buttons	Preview Behavior & Crop Visualization
Theme-based	8		Cropped area of the image is masked with theme-based color. Cropped area visibility is based on crop mask color & transparency as set in preferences. 
Black	9		Cropped area of the image is masked with black color 
White	0		Cropped area of the image is masked with white color 

## Saving

There are several ways of saving an image.

Click on the little hard disk icon  at the bottom-left of the preview image, or hit the Ctrl+S shortcut. This works as a *Save As* dialog, meaning you can select the name and location for the output file (RawTherapee will automatically add the extension based on the chosen format), choose a JPEG, TIFF or PNG (8-bit or 16-bit for the last two) format, set compression ratio, etc. You can also choose to save the processing parameters (your adjustments to the three sliders) in a sidecar file next to the output image. The last option lets you choose whether you want to *Save immediately* or *Put to the head/tail of the processing queue*.

### Save Immediately

If you chose *Save immediately*, RawTherapee will be busy saving your photo as soon as you click OK, so it will be less responsive to any adjustments you might try doing while it's busy saving, and it will also take longer to open other images as long as it's busy saving this one.

## Put to the Head / Tail of the Processing Queue

If you chose *Put to head* or *tail of the processing queue*, your image will be kept in a queue of files to be processed once activated, so RawTherapee can make the most of your CPU and be responsive while you tweak your photos. Once you're done tweaking and adding them to the queue, you can have RawTherapee start processing the queue while you go and enjoy some tea.

Whether you save the image immediately or put it to the queue using the *Save current image* button, you can use the proposed output name or set a new one. RawTherapee adds the extension automatically based on the chosen output format.

Note that there is a shortcut for adding an image to the tail of the processing queue: at the bottom-left of the preview image, next to the *Save current image* button, there is a *Put current image to processing queue* button . It does the same things as clicking on *Save current image* and then selecting *Put to the end of the processing queue* and clicking *OK*, except that it will use the file format settings as specified in the *Queue* tab (read about that in the next section).

## The Batch Queue

Open a photo for editing, tweak it, click on *Save current image*, add it to the tail of the processing queue and click *OK*. Go to the *Queue* tab. You will see your photo there, waiting to be processed.

The *File format* panel resides in the top-right side of the *Queue* tab. You can save to JPG (8 bits per channel), TIFF (8 or 16 bits per channel) and to PNG (also 8 or 16 bits per channel). You can also select *Save processing parameters with image* - this options writes a sidecar file with all your adjustments made to that photo in a plain text file. This file will have the same filename as your photo, but it will have a ".pp3" extension.

You can set where you want the resulting JPG, PNG or TIFF image saved to by entering an appropriate template in the *Use template* field in the *Output Directory* panel. To find out how to create a template, hover your mouse over the *Use template* input box and a tooltip with an explanation will pop up:

You can use the following formatting strings:

`%f, %d1, %d2, ..., %p1, %p2, ..., %r`

These formatting strings refer to the different parts of the photo's pathname or some attributes of the photo. For example, if the photo being processed has the following pathname:

`/home/tom/photos/2010-10-31/dsc0042.nef`

the meaning of the formatting strings are:

`%d4 = home`

`%d3 = tom`

`%d2 = photos`

`%d1 = 2010-10-31`

`%f = dsc0042`

`%p1 = /home/tom/photos/2010-10-31/`

`%p2 = /home/tom/photos/`

`%p3 = /home/tom/`

`%p4 = /home/`

`%r` will be replaced by the rank of the photo. If the photo is unranked, `%r` will be replaced by '0'. If the photo is in the trash bin, `%r` will be replaced by 'x'

If you want to save the output image where the original is, write:

`%p1/%f`

If you want to save the output image in a directory named "converted" located in the directory of the opened image, write:

`%p1/converted/%f`

If you want to save the output image in a directory named "/home/tom/photos/converted/2010-10-31", write:

`%p2/converted/%d1/%f`

Alternatively, you can save directly to a specific directory, but in the long run it is much easier to use a template.

On the left you see a *Start/Stop processing* button, and an *Auto start* checkbox.

If *Auto start* is enabled, every time a raw is sent to the queue, processing will start immediately. Usually you will not want this, as this will use up your CPU on developing the photos in the queue, and as a result all adjustments you do while the queue is running will take much longer to get applied so that you can see their effect in the preview - RT will become sluggish.

If *Auto start* is unchecked, you will have to activate the queue manually by clicking the *Start processing* button once ready to do so.

You can pause the queue by pressing the *Stop processing* button, but RawTherapee will first finish processing the current photo.

You can delete the contents of the processing queue by right-clicking on a thumbnail and choosing *Select all*, then *Cancel job*.

You can exit the program and restart it later; the batch queue will still be there. The queue can even survive a crash of RawTherapee, as the batch queue info is written to disk each time you add a photo to it, each time a photo is done processing and each time you delete

a photo from it.

## 8-bit and 16-bit

“8-bit” when referring to image formats typically means that the program assigns 8 bits (8 digits, or a total of 255 possible decimal values) to each pixel’s color channel, and each pixel in the files RawTherapee saves has three color channels - red, green and blue.

Most, if not all, modern raw-capable DSLR cameras use 12- or 14-bit analog-to-digital converters to record the sensor data. This means that when choosing an 8-bit-per-channel output format in your camera, such as JPEG, one loses some information. Practically this is not a problem when the output file is the definitive one and will not be processed anymore, however a photo can be vastly improved when saved as raw data and processed using a state of the art raw processing program, such as your’s truly - RawTherapee.

Once you have processed a photo in RawTherapee, you are faced with the same choice - to save the image with a color resolution of 8 bits per channel, or 16 bits per channel (only TIFF and PNG, not JPEG). If you plan to post-process your photos after RawTherapee in a 16-bit-capable image editing program, it is better to save it in a lossless 16-bit format. Uncompressed TIFF is suggested as an intermediate format, as it is quick to save and stores all the metadata (Exif, IPTC, XMP) of the original file (PNG generally discards metadata!).

There is some confusion over the naming of 8, 16, 24 and 32 bit files. Here is a clarification, but it gets confusing, so put your tin foil hat on. You do not actually need to read this to use RawTherapee, it is just background knowledge.

Each of the red, green and blue channels stored in a JPEG, PNG or TIFF file is actually a colorless image, but when you combine these three colorless images together, you get a color image. This is how all digital representation of images works - color images are always decomposed into their components in one way or another. Of the file formats that RawTherapee can save to (JPG, PNG and TIFF), each pixel contains information for three color channels - red, green and blue. We say “8 bits per channel” to make it clear that these 8 bits apply to one color channel only. The reason is that you might encounter references to “8 bit images”, and here it gets confusing, because the person who wrote that may have been referring to a grayscale format which stores only one channel, or to a color format that stores three channels, with 8 bit precision each. Another notation for the very same “8-bit” images that RawTherapee saves is “24-bit”. Woo, confusing. Or is it? Each pixel is made of 3 channels, and each channel stores 8 bits of data, so we have a total of 24 bits of data per pixel. It gets worse. Image editing programs can also store a fourth channel, called alpha. To put it simply, alpha describes how transparent a pixel is. These alpha channels also have a ‘color resolution’ of 8 bits. Both PNG and TIFF files can also handle alpha, JPEG can’t. If you have an 8 bits per channel image with an alpha channel, it can also be described as a 32-bit image;  $R(8) + G(8) + B(8) + \text{alpha}(8) = 32$ . The ultimate problem is that you can also have an image that assigns as many as 32 bits per color channel. These images can be described as “32-bit” images as well as “96-bit images” (because  $R(32) + G(32) + B(32) = 96$ ). All real HDR files are stored in image formats that assign at least 16 bits floating point per color channel, such as the EXR format, or 32 bits, such as the RGBE format.

To summarize, an “8 bit per channel” image can also be called a “24 bit per pixel” image, and a “16 bit per channel” image can also be called a “48 bit per pixel” image. In both cases use the former (the full “x bit per channel” description, don’t just say “x bit!”), it’s more clear

what you mean.

## Naming

If your original raw file was called *DSC\_1000.raw*, the processed file name will be *DSC\_1000.jpg* (or *.tif* or *.png*). There's an option in the *Save current image* window: *Automatically add a suffix if the file already exists*. When checked, you can make different versions of one raw, which will be saved as *DSC\_1000.jpg*, *DSC\_1000-1.jpg*, *DSC\_1000-2.jpg*, etc. The same applies when you send different versions of the same raw to the batch queue. By the way, your original raw will never be altered by RawTherapee.

## Sidecar Files - Processing Profiles

If you enabled 'Save processing parameters with image', you will notice that there is a second file next to your output file. It has the same filename as the output file, but it has the *.PP3* file extension. This is a little text file that describes exactly what edits you made to your photo. Open it in a text editor and take a look. Whenever you re-open that raw in RawTherapee, this file will be read and all the settings from the last session will be restored (the profile displayed under Processing Profiles will change to 'Last saved'), so you'll never have to wonder what the sharpening settings were for a certain photo that you edited two weeks ago, because everything is recorded in this sidecar file (to be more precise: nearly everything, as ranking information and the history panel contents are not stored in this file yet). By default this information is also saved to a cache on your hard disk (here the ranking info is available). In 'Preferences > Image processing', you can disable the generating of these sidecar files. But why would you? They represent all the time-consuming work you did on a photo, so keep your work! PP3 files are written each time you close a photo or close RawTherapee. You can also very easily force saving the processing profile of the photo you are working on by hitting the *Ctrl+Shift+S* keyboard shortcut. This will overwrite the PP3 file of the image you're working on, found in the same folder next to the image file and/or in the cache, depending on your settings in "Preferences > Image Processing > Processing Profile Handling". You might even want to backup these files together with the processed photos. In case you want to start a new edit session from scratch, simply open the raw photo and select the processing profile you want to start from; 'Neutral' will show you the most basic version of your photo without any modifications.

See also installation notes

## Creating processing profiles for general use

In RawTherapee, we call the sidecar files 'processing profiles'. We supply a bunch of processing profiles with RT, so that you can start off with an existing look and modify it to your liking, saving you some time. One example of such a profile is Pop - it will make your photo vibrant and lively, lifting the shadows and bringing out detail.

You can see the whole list of processing profiles in the 'Image Editor' tab, if you expand the

'Processing Profiles' list. You can also see them if you right-click on a thumbnail in the 'File Browser' tab and move your mouse over to 'Processing Profile Operations > Apply Profile'.

You can create your own processing profiles for general use. Open a photo you want to create a good starting point profile for. Let's imagine this photo is a portrait of a baby. You could start off with the 'Neutral' profile, and work your way up from there. When you are done, just click on the 'Save Current Profile' icon  in the 'Processing Profiles' panel. Enter any name; you don't need to specify the extension - RT will add it for you. But sometimes, you'll want to save only a subset of the parameters available, e.g. to avoid storing geometric parameters like rotate, crop and resize. In this case, hold on the Control key while clicking on the 'Save' button. When you'll have selected the output file name, a window will let you choose which parameters to save. You can then share these profiles with your friends or in our forum.

Remember that in order for a profile to be universally applicable to all photos of the same scene and situation (baby profiles in this example), you need to think of all the variations in all of the baby portrait photos you might want to apply it to. Remember that exposure will vary between shots, even if you shot the baby in a studio, as the little bugger is likely to be crawling around, and even more so if you upload your profile on the internet for other baby photographers with different cameras and different lighting gear to use, so instead of setting a specific exposure, such as +0.60, you should rather turn on 'Auto Levels' with an appropriate 'Clip' value (more on this tool later on). This applies to all other settings - remember to set just the bare minimum number of options to achieve the effect you want. Leave the rest untouched, as it is very likely that if you had set those other options, they will not apply well to other photos. If your processing profile is meant to make baby face photos look soft and cuddly by a clever mixture of highlight recovery, auto exposure, Lab and RGB tone curves, then don't enable noise reduction, don't set custom white balance, don't rotate the photo, and so forth. All these superfluous parameters are likely to change between photos and not influence your soft baby look in any way, so turning them on will just litter your profile. Double-check these things before sharing your profiles.

## Closing RawTherapee

To close RawTherapee, click on the little close icon on top of the window. Its location depends on your window manager if this icon is located on the right or the left of your screen and if it's colored or just shows a 'x'. There's no 'official' exit button, so simply close the RawTherapee window.

## Edit Current Image in External Editor

You can use the *Edit current image in external editor* button  located at the bottom-left of the preview panel to process your raw in RawTherapee and send it straight to an image editor such as Gimp or Photoshop for further processing. Note that RawTherapee produces 16-bit temporary intermediate files when using this button, but Gimp cannot yet handle 16-

bit images, so it will down-sample them to 8-bit ones.

You can specify your external editor of choice in 'Preferences > General > External editor'.

# The Toolbox

The panel on the right side of the preview contains the controls for all the tools available in RawTherapee. They can do a lot, perhaps even more than you ever may want to! If you're new to RawTherapee or new to raw processing in general, don't feel overwhelmed, as there is no need to touch all those sliders to get decent results. In this section you'll find a brief description of what all those tools are for, tab after tab.

## Panels

A panel is a foldable element and is also frequently called a 'Tool', or 'Section'. Right-clicking over a panel's title opens it and closes all other panels of the same tab. You'll learn to love this shortcut when you'll consider the time you'll spend on folding sections manually...

## Sliders

Each slider has three values in memory:

- 1 the current value, when you move the slider to any position,
- 2 the 'default' value, the one that the programmer has set as default. It can be called back by clicking on the 'Reset' button,
- 3 the 'initial' value, which is the value of the profile used when the image was loaded in the editor. It can be called back by Control-clicking on the 'Reset' button.

## Curve Editors

Each curve editor has a button to select its type. It's a so-called 'Toggle' button, i.e. it will stay pressed or stay released after each click on it. Toggling on/off the curve's button will respectively display/hide its associated editor. This is very handy and saves a lot of space when handling groups of curves (e.g. see the Lab curve editor). The Reset button will reset the displayed (or pressed button) curve only.

For the Parametric curve type, clicking the right mouse button over the zone selector () will reset the handles' position to their default values (the global reset button will reset them too).

**Warning:** resetting the curve is considered as a curve modification, so if you've just modified the curve and mistakenly pressed the Reset button, there's no way to bring back your curve (Ctrl-Z will go one step before in the History list, not in the curve's

edition).

## **The Preview Area**

The preview is designed to show you the most realistic result possible, but it still has to deal with the quality/speed balance. That's why some tools will only be computed and previewed at the 1:1 (100%) scale. This applies to all tools in the Detail tab. For example it wouldn't really make sense to show the effects of the Sharpening tool when you are not at a 1:1 zoom level, as the effects would be indiscernible when zoomed out and would just waste a few seconds of CPU time, delaying the appearance of the effects of other tools which do make a big difference when zoomed out.

# **Exposure Tab**

## **Exposure panel**

### **Auto Levels**

The Auto Levels tool analyzes the image and then adjusts the sliders in the Exposure section to achieve a well-exposed image. Think of the adjustments Auto Levels comes up with as a good starting point. In many cases the result should be aesthetically pleasing, but as the program doesn't know your taste or expectations this will not always be the case. For example you might be going for a low-key look, in which case you should adjust the values yourself. There are also situations in which the algorithm will be fooled and end up setting Exposure Compensation to 10 which will make the whole image white - this seems to be the case with photos that consist of large dark areas with a bright area in the center, e.g. photos of the moon. In these cases just adjust the settings manually.

You can reset all of the sliders in the Exposure section by clicking on the Neutral button. The Tone Curves will not be touched.

### **Clip**

Auto levels uses the clip value to adjust the exposure. This number defines the amount of highlight pixels that may be clipped at the white point and the amount of shadow pixels that may be clipped at the black point. The minimum value is 0.0000, maximum value is 0.9999. Higher values increase the contrast.

### **Exposure Compensation**

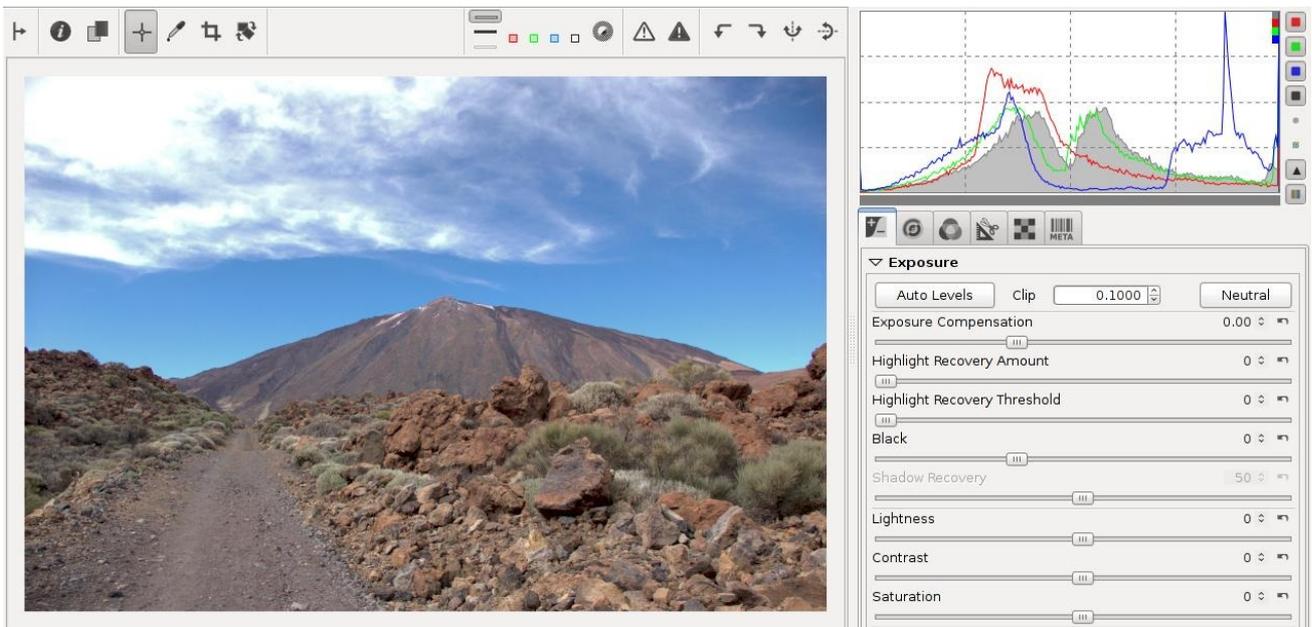
The values of the Exposure Compensation slider (EC) are ISO values. This means a value of +1 equals one stop of overexposure (+1 EV, exposure

value; also known as +1 LV, light value)). If you make two photos, one without correction (EV = 0) and one underexposed by one stop (EV = -1), you can make both photos match by setting exposure compensation for the overexposed photo to -1, or for the underexposed photo to +1.

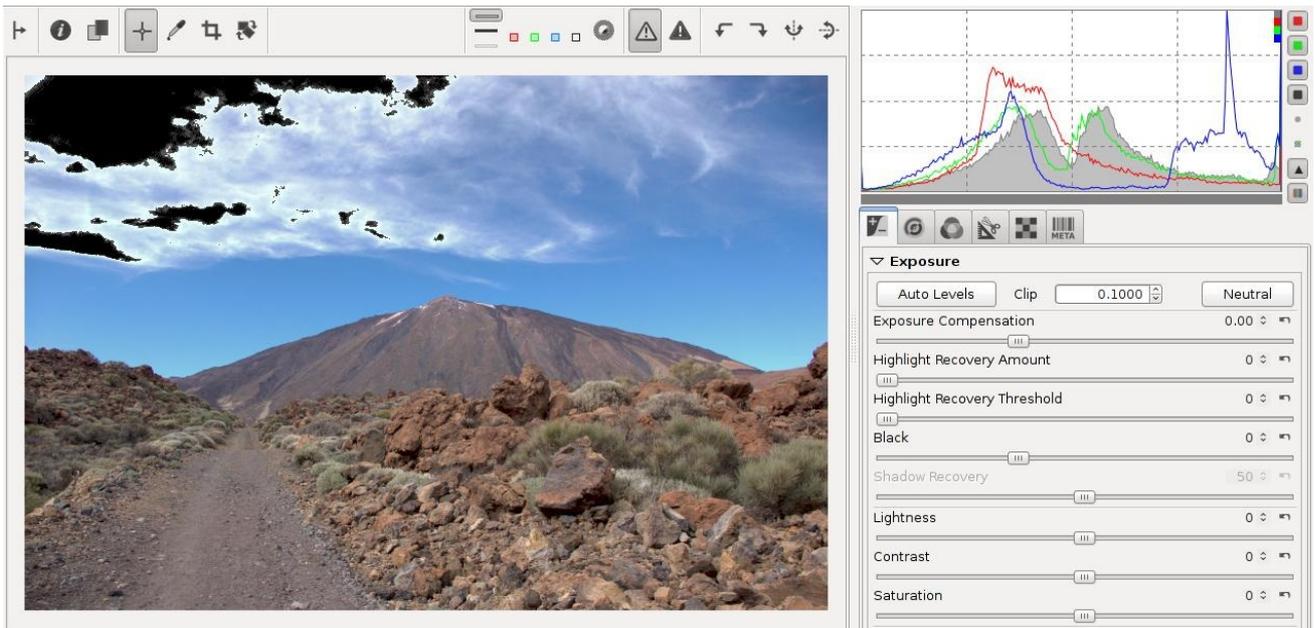
Take a look at the histogram while moving this slider. Moving it to the right shifts the whole histogram to the right. This means this slider changes the black point (on the very left of the histogram) and the white point (on the very right).

### Highlight Recovery Amount

The Highlight Recovery Amount slider (HRA) can be used to compress the highlights in a photo, useful for 'dimming' (or burning) slightly overexposed areas. To see if your photo contains overexposed areas, click on the clipped highlight indication icon  on the top right of the image window. Overexposed areas will show up in black.



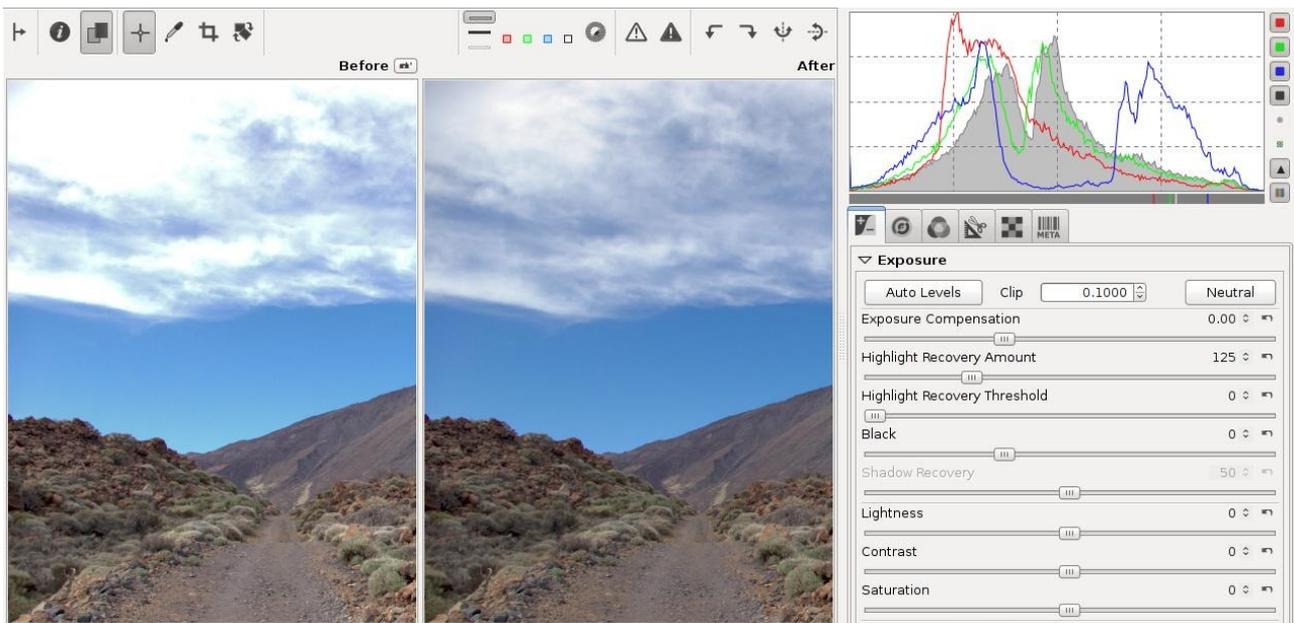
*An overexposed photo. No highlight recovery, the clouds are clipped.*



The Clipped highlight indicator has been turned on to make the clipped areas easier to see.

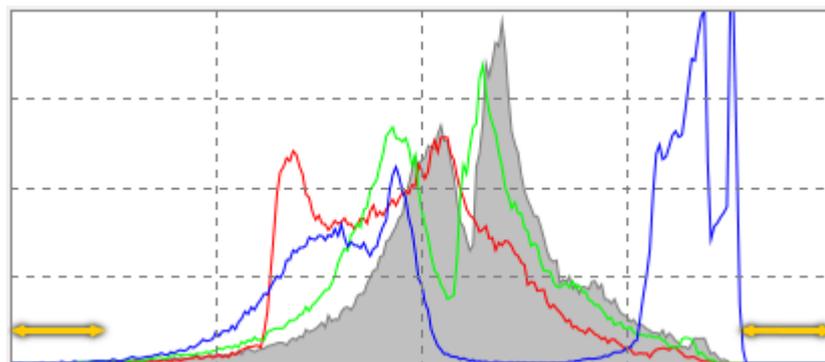
By dragging the HRA slider to the right, the intensity of the highlights will decrease. For highlight recovery to work best you must also enable Highlight Reconstruction. Each of the HR methods has its strong and weak points; read about them in the Highlight Reconstruction section. Color Propagation is the most likely method to produce good-looking results when the HRA slider is significantly over 100. For the other methods you will usually want to keep the HRA slider around or below 100 - watch the histogram and the preview!

To find out the optimal HRA value, you can make use of the histogram. In the screenshots above, what you see are overexposed clouds above the Teide volcano in Tenerife. When hovering the mouse cursor over the overexposed area, the pixel values indicator (in the Navigator panel, under the little preview) shows that lightness (L) is at 100, and the histogram shows that all channels are clipped (see the red, green and blue squares in the top-right corner of the histogram, they mean that there are so many pixels of maximum value that they are off-scale). Increase the HRA slider until the red, green and blue channels in the histogram no longer squash up against the right end of the histogram - you want them to touch it, but not to cram up against it. You can enable the *Clipped highlight indication* icon  before moving the HRA slider up. Once the indicator's black areas disappear from the white parts you want recovered, which is also when the lightness of those pixels drops from L=100 to L=99, you stop. Don't increase the HRA slider any more, because now the hopelessly-lost white areas would start turning gray. You don't want them to turn gray. That would make the photo look dull. In this example the indicator's black areas disappeared when I set HRA to 125.



*A correctly recovered photo - the histogram touches both ends.*

As a rule, the histogram of a correctly developed image should touch both ends - the black and the white end. Not doing so means the image was incorrectly developed. This is true for the vast majority of photos, the only exceptions being photos of scenes which lack dynamic range, such as misty scenes. If you increase the HRA slider too much, then whites turn gray as your histogram no longer touches the maximum end. Examples of photos that have been over-recovered can be easily found on the internet. They look horrible, don't do that! Recover what you can, but what's clipped beyond repair should stay white.



*The histogram of an incorrectly processed photo. It should touch both ends instead of having gaps.*

RawTherapee offers more ways to deal with blown highlights. The side-effect of all these methods is that they also take away some of the brilliance of the photos, as they get more 'flat' or 'dull' as a result. Highlight recovery is very useful when used with moderation, but remember that you cannot recover what is not there to begin with, so once you notice that the completely clipped white areas become gray you should reduce the recovery amount until these areas become white once more. To create the best possible output, feed RawTherapee with the best possible input - so expose well in the first place!

### **Highlight Recovery Threshold**

The Highlight Recovery Threshold slider sets the point where the HRA slider starts implementing compression. A value of 0 means the threshold is zero: data compression occurs over the whole range of tonalities. 100 sets the threshold at one stop below the white point, so all the compressed highlights are squeezed into the top stop. In practical terms, more highlights are recovered when this slider is set to 0.

### **Black**

Use this to set the black point. See the left side of the histogram move when you touch the slider. Values greater than 0 will make the image darker, negative values will lighten up the shadow parts of the photo.

### **Shadow Recovery**

The Shadow Recovery slider 'dampens' the effect of the Black slider, the maximum value of 100 gives a less dark image. This slider has only effect when the Black slider is set to another value than 0. Practical use of the Shadow Recovery slider is to fine-tune the shadow intensity of the image.

### **Lightness**

This slider applies a fixed tone curve to lift or lower the tonalities of the photo, resulting in a more or less bright image. The same tone curve is applied separately to each R, G and B channel. The black point and the white point keep their positions.

### **Contrast**

This slider increases or reduces the contrast of the photo. It applies a contrast curve centered at the average luminance level. Tonalities above the average are lifted (lowered), while tonalities below the average are lowered (lifted). The same contrast curve is applied separately to each R, G and B channel.

### **Saturation**

This slider makes the photo more or less saturated. In more technical terms, it adjusts the saturation of the image by applying a multiplier to the saturation level of pixels in the HSV color space. Set this slider to -100 to create a black and white image (or enable the *B&W toning* checkbox in the Lab Adjustments tool, explained later).

### **Tone Curves**

Here you can construct your own tone curves. They work on all three R, G and B channels at the same time (so you can't work on the R channel only).

There are two tone curves available, three curve types (*Custom*, *Parametric* and *Control Cage*; the *Linear* type simply disables the curve), and four modes (*Standard*, *Weighted Standard*, *Film-like* and *Saturation and Value Blending*; all explained later on). Clicking on the curve icon hides the curve from the

interface - it does not disable the curve.

While you can use only one tone curve to make your adjustments, you can gain much finer tonal control if you use two curves at once. The typical use of both curves is to lower values using the first curve, and to raise values using the second one. It is similar to creating an S curve in one of them, but you should be able to make finer adjustments by using both without entering too fast in the “danger zone” where your colors becomes unrealistic.

You can save a curve to disk. Click on the *Save current image* icon  next to the graph and give it a name. Use the *Load a curve from file* icon  to apply this curve later to another file. Use the *Reset curve to linear* button  to delete all the points you created and to reset the curve to neutral/linear. You can also *Copy*  and *Paste*  curves to/from RawTherapee’s own clipboard, which comes in very useful if you want to quickly apply an identical curve to a different tool.

You can use as many control points in a curve as you like.

You can set all three curve types if you like, but only the one that is selected in the dropdown menu will be applied to the photo.

### **Linear Curve**

This represents the unaltered (or linear) image, so without any tone curve applied. It disables the curve.

### **Custom Curve**

This is a classic type of curve, seen in many other programs as well. The left part of the graph represents the darker tones, the right part represents the brighter tones of the photo. Click on the curve to mark a point and drag it with the mouse to change tonalities. Dragging the point down makes the image darker, while pushing it up makes it brighter. The dotted diagonal line marks the linear or unaltered state of the photo. Press and hold the Control key to slow down the movement. Hold the Shift key to snap the point to key elements: maximum value, minimum value, middle value (i.e. snapped to the diagonal or horizontal dotted line), same value of the preceding point, same value of the next point, and for the Control Cage type, the line going through the previous and next points. Delete a point on the curve by dragging it out of the editor area.

The top-right point represents the brightest areas in the photo. Drag that point vertically down to make the highlights less bright; move it horizontally to the left to make bright areas brighter, perhaps at the cost of some overexposure.

The bottom-left point represents the darkest areas in the photo. Move that

point horizontally to the right to make the photo darker, perhaps at the cost of some underexposure. Move it vertically up to make the darks lighter.

Flip the diagonal line (from bottom-left and top-right to top-left and bottom-right) to produce a negative image.

### **S-Curve**

A typical usage of the custom curve is to construct a so-called S-curve. Mark three points at the 'coordinates' (1,1), (2,2) and (3,3) respectively. Drag the point at (1,1) somewhat lower and the point at (3,3) a bit higher. Your image will get more 'punch' this way. If your S-curve is symmetrical, ie. if you move the point you first placed at 1,1 by the same amount as the one you placed at 3,3 but in the opposite direction, then the effect will be identical to manipulating the Contrast slider.

### **Parametric Curve**

This curve presents four sliders and three control points. The sliders are used to control highlights, lights, darks and shadows respectively (shadows mean deep darks here). Move the mouse over the four sliders and a dark area under the curve tells you which slider alters what part of the curve. Move the Highlights slider to the left to make highlights less bright, move it to the right to make them brighter. The Lights slider moves the lights but not the highlights in the same way as above, as does the Darks slider: moving it to the right lightens the dark tones, moving it to the left darkens them. The Shadows slider works as the Darks slider, but only on the darkest parts of the photo. You can again construct the above mentioned stylized S-curve, although the parametric curve gives you less 'extreme' control over the form of the curve. This mode, however, has its own benefits, as curves be shaped in a well controlled manner. Note that using these sliders can have a profound influence on the overall contrast of the image.

Use, if needed, the three control points under the curve. They determine what point of the curve will be affected when moving the sliders. Moving the middle control point to the right makes the image darker (the form of the curve changes again, as does the dark area around the curve), moving it to the left makes the image brighter. Moving the left control point to the right darkens the dark areas somewhat, moving it to the left lightens them, again somewhat. Moving the right control point to the right makes the highlights brighter, moving it to the left darkens the highlights.

Use the *Reset to default* buttons  next to the sliders to reset individual sliders, use the same button at the top of the tone curve section to reset all four sliders and the control points to linear (zero).

### **Control Cage**

At first sight this curve type looks very much like the Custom curve, but there

are some differences though. With the Custom curve, the curve touches all the control points. This is not the case with the control cage curve. To see this, click somewhere on the line and move the black point to the left or to the right. Now the curve passes nearby the black point, but doesn't touch it. Another difference is that the control cage allows for a straight section of the curve, while you can't do this with the custom curve. The cage curve needs at least three points for that (so five in total). Holding down the Shift key while dragging a point will help you to easily create a straight line by snapping the point to the line made by the previous and next point (displayed in red by the 'snap to' tool). Now make a new point between the two most left ones and move it. As you can see, only the part on the left side moves, not the rest of the curve.

### **Curve Mode**

Next to each curve type, you'll find a Curve Mode combobox selector. This will let you choose the algorithm that will be used for the corresponding curve:

#### **Standard**

This is the most basic mode (and the one used in older versions of RawTherapee): the values of each channel are modified by the curve in a basic "correspondence" method.

The drawback of this mode is that e.g. considering an S-curve shape to get more contrast, an orange color with a high value of red and green and a low value of blue will tend to shift toward yellow, because the red and green component will be raised, while the blue one will be lowered.

#### **Weighted Standard**

You can use this method to limit the color shift, even if it won't suppress it totally. Keeping the previous example, this method will raise the first component (red), and will also linearly alter the green and blue component by raising them too. We end up with 3 values (R, g and b) while we have only processed the red component.

This process is then done for the green and blue component, so at the end of the process, we end up with 9 values (R,g,b / r,G,b / r,g,B). Each values of the same component are then mixed together, which will produce the resulting color with a smaller color shift.

#### **Film-Like**

Basically, it uses Adobe's method from their reference sample code. It is the same method that is used by the DCP's tone curve.

#### **Saturation and Value Blending**

This method is better suited for high-key shots. The average value of the three component is computed, and then the curve is applied to this value, giving a positive or negative gain.

The color is converted to its Hue, Saturation and Value representation, then if the gain is positive, the pixel is linearly targeting Value = 1 and Saturation = 0, the Hue is preserved. If the gain is negative, the pixel is

linearly targeting Value = 0, Saturation and Hue are preserved.

## Highlight Reconstruction

Use this tool to try to restore overexposed highlights. It attempts to restore clipped (blown-out) channels in the raw data using nearby data from unclipped channels, if present.

Please note that you need to set Highlight Recovery Amount in the Exposure section to see the effect of the reconstruction.

Four different methods are available:

### Luminance Recovery

When selecting Luminance Recovery, recovered details - if any - will be gray.

### Color Propagation

This is the most powerful recovery method. In addition to restoring luminosity, Color Propagation tries to restore color information by 'bleeding' the surrounding known color into the missing clipped area. This method works best on small overexposed areas, and can work wonders on overexposed skin. Its weakness is that it may sometimes "bleed" the incorrect colors, depending on the image elements surrounding the blown highlights. It is also computationally intensive and is therefore slower than the other methods.

This method has been much improved since version 3.0 and it will render differently than before.

### CIELab

CIELab reduces the luminance channel and tries to restore colors afterwards.

### Blend

This restoration mode attempts to guess clipped color channels by filling in their values from the closest match from unclipped highlight regions nearby.

Note, that the effectiveness of highlight reconstructions can be influenced by use of Flat Field Correction, if it in its own turn brightens the image - for example, when image periphery is brightened to compensate for vignetting.. In such case, disable flat field correction for better reconstruction of highlights.

## Shadows/Highlights

Use this tool to independently influence the highlights and the shadows of the image (yes, another one!). Take care with the *High quality* option, as this one is quite cpu-intensive.

### Highlights

The Highlights slider makes the brightest parts of the image less bright

without touching the darker tones. To make the effect stronger, use higher values. A slider value of 100 will turn the whites light gray.

### **Tonal Width for Highlights**

This slider controls the strength of the Highlights slider. Higher values give a stronger effect. A value of 100, combined with Highlights 100, turns the whites into middle gray (you probably won't want that...).

### **Shadows**

This slider lifts the shadows and applies an effect that is sometimes called 'fill-light' (or 'fill-flash') in other software. Higher values lighten the shadow areas more.

### **Tonal Width for Shadows**

This slider controls the strength of the Shadows slider. A maximum value of 100 gives the strongest 'lift shadows' effect.

### **Local Contrast**

Local Contrast is an adaptive contrast adjustment depending on contrast within a specified area. It increases contrast in small areas while keeping the global contrast (which can be set with the contrast sliders in Exposure or Lab). The resulting image will look more 'three-dimensional'. This feature is very useful when you have a foggy image or took your picture through a window. The effect is somewhat similar to an unsharp mask with a high radius and a small value. A setting between 5 and 20 works best for most shots.

### **Radius**

The value of the Radius slider influences the Highlights, Shadows and Local Contrast sliders. The larger the radius, the stronger the effect of local contrast. The effective area of the Highlights and Shadows sliders also increases.

If you are bored, set the first four sliders to 100 and play with Local Contrast to transform your favorite raw processor into a cheap effect machine!

## **Tone Mapping**

The Tone Mapping tool can be used to lift the dark areas of your photo in a way that prevents halos from appearing, and it can be used to bring out or suppress detail, to make the photo more crisp or more 'dreamy'. Tone mapping adjusts the global contrast of an image differently from the local contrast. Specifically, it's very useful for decreasing large scale contrasts while preserving (or boosting) small scale contrasts. The method used is taken from *Edge-Preserving Decompositions for Tone and Detail Manipulation* with some modifications. Note: tone mapping requires a lot of memory (RAM) and is CPU-intensive.

## Strength

This controls the strength of the overall effect.

## Edge Stopping

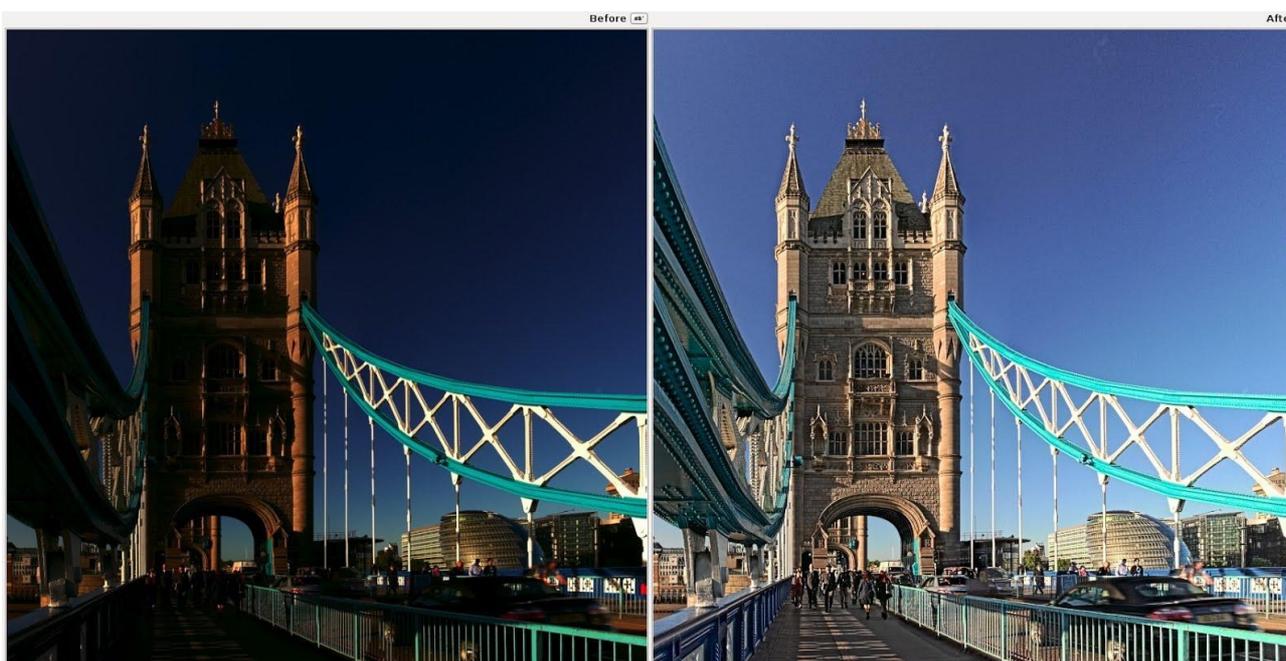
This parameter affects sensitivity to edges, the greater it is the more likely an illumination change is to be considered an “edge”, if set to zero tone mapping will have an effect similar to unsharp masking.

## Scale

This control gives meaning to the difference between “local” and “global” contrast; the greater it is the larger a detail needs to be in order to be boosted.

## Reweighting Iterates

In some cases tone mapping may result in a cartoonish appearance, and in some rare cases soft but wide halos may appear. Increasing the number of reweighting iterates will help fight some of these problems. When more than zero reweighting iterates are used, the best results will be had if the edge stopping parameter is set to one (technical detail: this results in a 1-norm approximation of the smoothness using iteratively reweighted least squares).



*Tone mapping was used on this high dynamic range (HDR) 32-bit TIFF image to make it look aesthetically pleasing and viewable on low dynamic range media, such as a computer screen or on paper.*

## Lab Adjustments

Technical details of RawTherapee’s Vibrance tool, in English:

<http://jacques.desmis.perso.neuf.fr/RT/vibrance2.html>

Additional detailed references, in French:

"*Lab adjustments*" and additives "*vibrance*", "*Colorimetry*"

[http://jacques.desmis.perso.neuf.fr/RT/Labadj\\_vibr.html](http://jacques.desmis.perso.neuf.fr/RT/Labadj_vibr.html)

[http://jacques.desmis.perso.neuf.fr/RT/ColorRT2\\_6.html](http://jacques.desmis.perso.neuf.fr/RT/ColorRT2_6.html)

Lab (also called CIELAB or L\*a\*b) is a three dimensional color space designed to approximate human vision, as opposed to the RGB color space which models the output of physical devices rather than human visual perception. It keeps the tone (also called lightness or value) separate from the color, so that you can adjust one without changing the other.

The L component closely matches human perception of lightness.

The a component defines how green/magenta the color is.

The b component defines how yellow/blue the color is.

### **Lightness**

When using the Lightness slider in the Lab section, a tone curve is applied to the L-channel of the Lab color space. As with the brightness slider in the Exposure section above, the black point and the white point do not move.

### **Contrast**

The contrast slider in Lab increases or decreases the contrast of the photo, again applied to the L-channel. In developer's terms: this slider applies a contrast curve centered at the average luminance level. Tonalities above the average are lifted (lowered), while tonalities below the average are lowered (lifted).

### **Chromaticity**

The Lab Chromaticity slider increases or decreases the chromaticity of the image, by applying a contrast curve to the a- and b-channels of Lab space. Setting this slider to -100 removes all color, making the image black and white.

### **B&W Toning**

When you enable this option the image will be made black and white, and you will be able to apply a color cast (e.g. sepia) by using the a and b curves. The Chromaticity slider and the CC, CH and LC curves will be disabled and not have any effect. More info in the "a" and "b" curve section below.

### **Avoid Color Shift**

Fits the colors of the image into the gamut of the working color space and applies Munsell correction to retain color purity.

### **Restrict LC to Red and Skin Tones**

When enabled, it restricts the effects of the Luminance According to Chromaticity (LC) curve, so that you can make skin fairer (by increase the luminance of the skin) without changing the model's clothing or background.

## Red and Skin Tones Protection

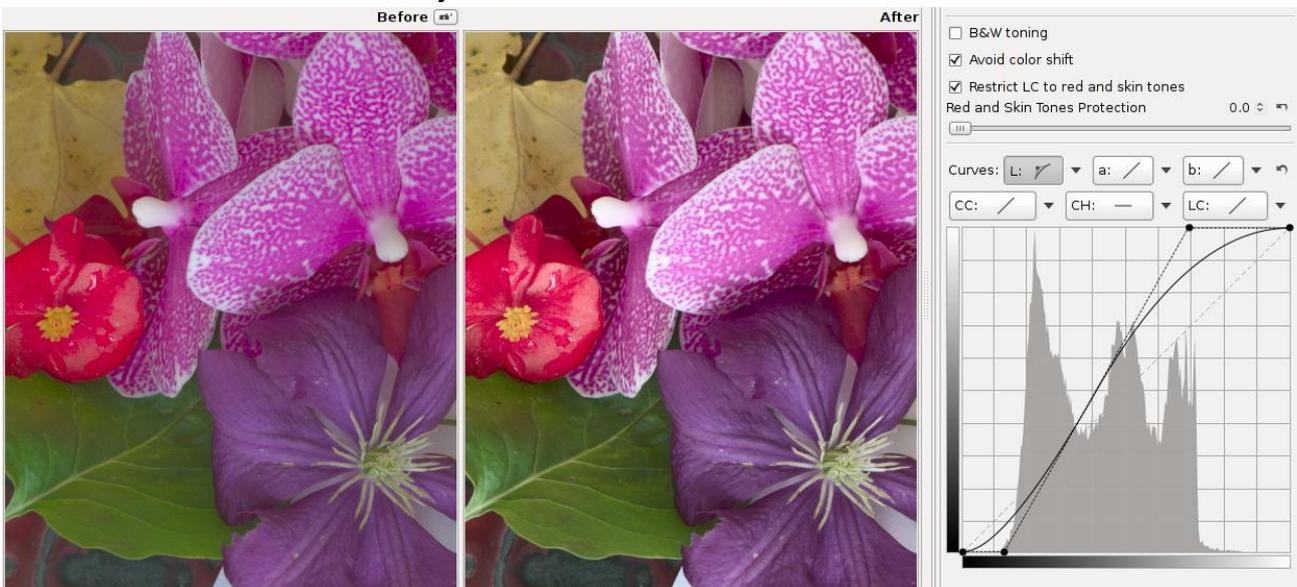
When enabled, the effects of the Chromaticity slider and the CC curve will not be applied to skin colors, so that you can increase the chromaticity of your photo without causing skin to appear oversaturated.

## Curves

Lab Adjustments provides a wealth of curves to alter the look of the image. Below are illustrated explanations of each curve.

### L Curve

The L curve allows to control output lightness based on the input lightness,  $L=f(L)$ . The histogram on the L curve reflects lightness prior the Lab adjustments.



*The L curve was used to lighten the image while preserving the shadows.*

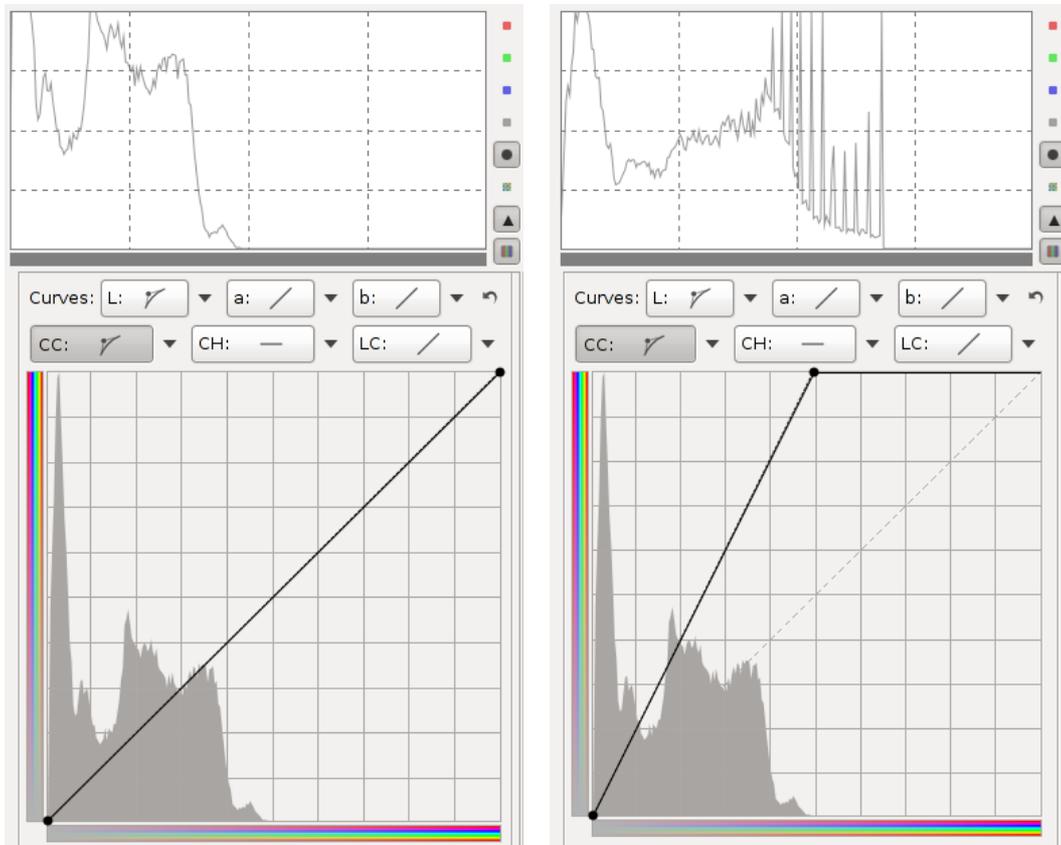
An S-shaped curve applied to the L channel increases image contrast. At the same time this leads to a perceptually desaturated look. Chromaticity adjustments can be used to compensate for this effect .

### CC Curve

The CC curve (chromaticity according to chromaticity) allows to control output chromaticity based on the input chromaticity,  $C=f(C)$ . The histogram on the CC curve reflects chromaticity before the adjustment.

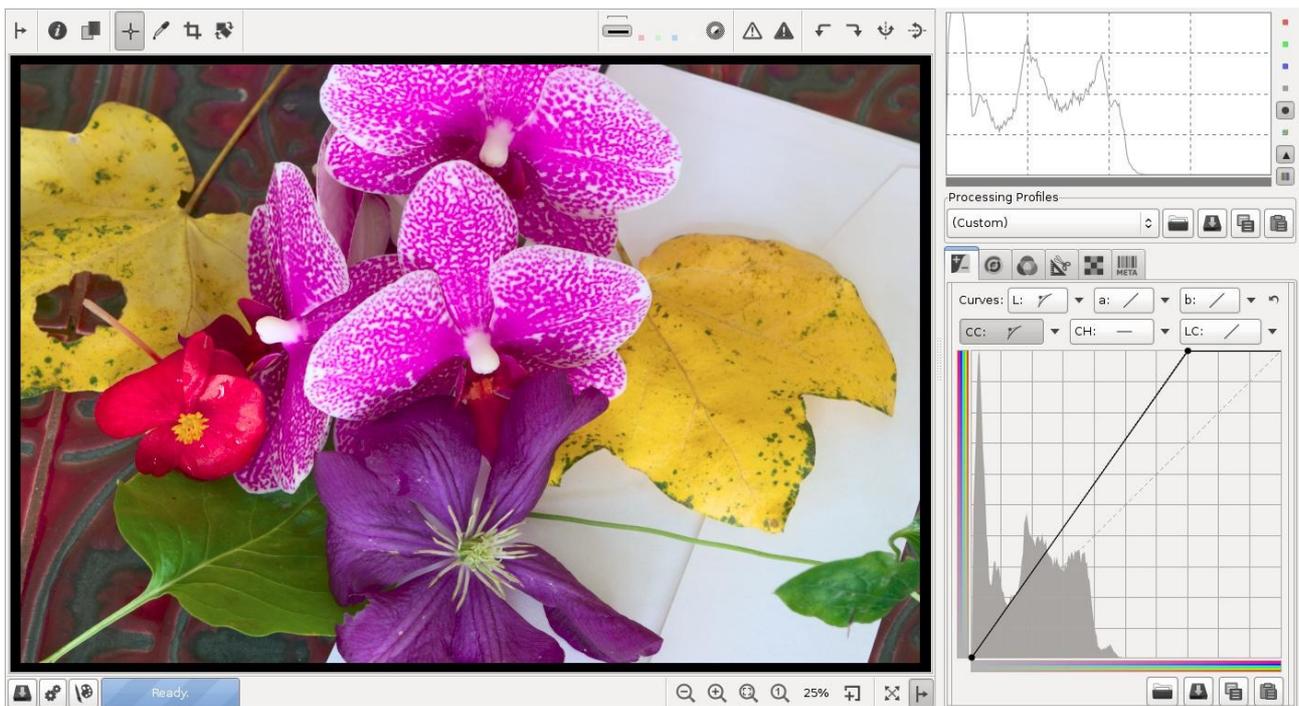
You can use the *Show/Hide chromaticity histogram* button  besides the histogram to help you see the effects of your CC curve tweaks on the histogram, and to help you find the maximum value before you start clipping colors. The screenshots show what the chromaticity histogram looks like for the untouched image, and then what happens when you increase chromaticity too much (you can do this using the Chromaticity slider, or, as in the screenshot, by sliding the top-right

point of the CC curve to the left. Holding the Shift key while you slide the point will help you keep the point at the top).



*The CC curve was increased too much, resulting in spikes in the histogram and an effect similar to posterization in the image.*

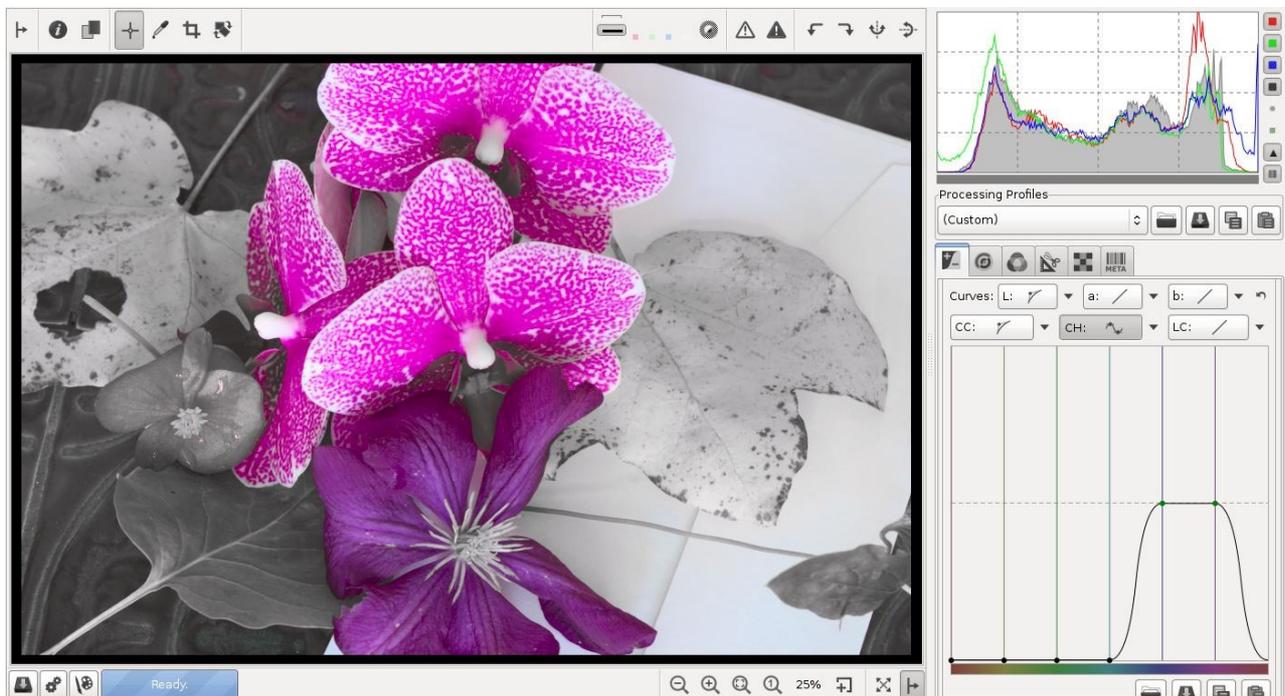
To find the maximum chromaticity boost you can apply without causing nasty spikes, which will appear as sudden flat regions of color in the image, similar to posterization, all you need to do is click *Show/Hide chromaticity histogram* if you haven't done so already, and then slowly boost chromaticity until you notice the histogram begins to spike. The curve does not have to be linear of course.



*The CC curve was used to boost chromaticity within a safe limit.*

### CH Curve

The CH curve (chromaticity according to hue) allows to control output chromaticity based on the input hue,  $C=f(H)$ . Using it you can very easily boost or mute only a selected range of colors.



*The CH curve was used to mute all colors except for purple and violet*

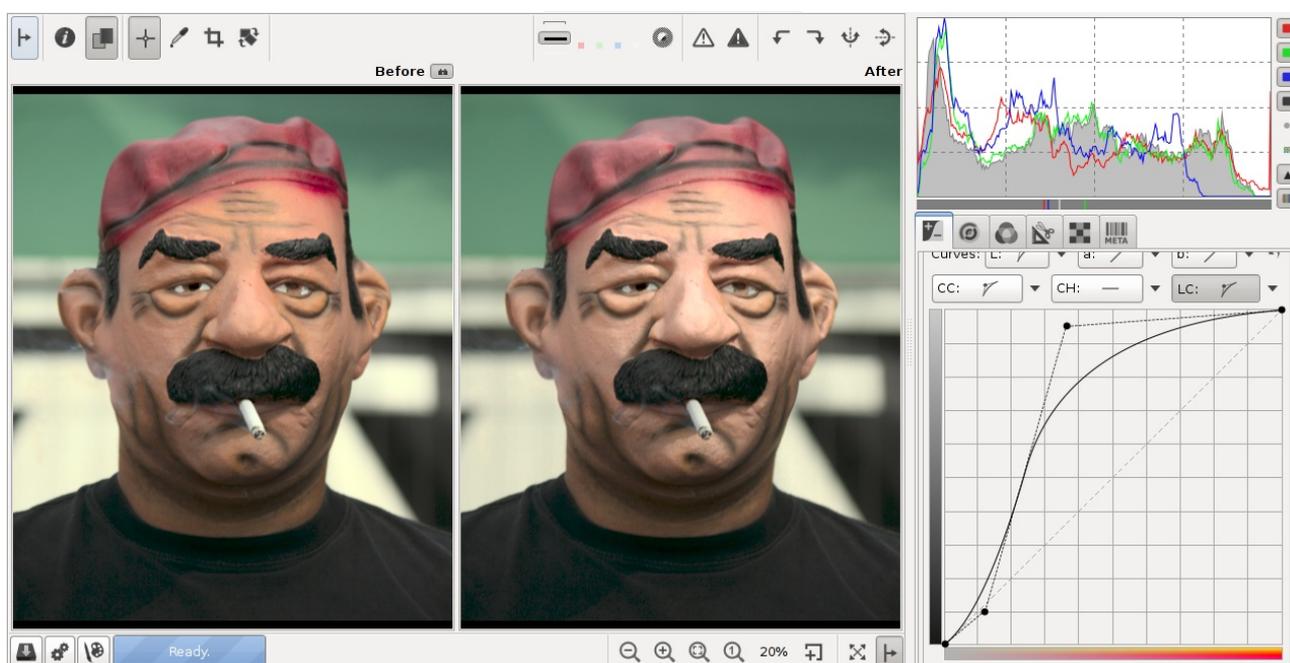
### LC Curve

The LC curve (lightness according to chromaticity) allows to control the output lightness based on the input chromaticity,  $L=f(C)$ . This type of image control is uncommon in imaging software, but is provided in

RawTherapee and is very powerful.

The LC curve's action is modulated by the *Restrict LC to red and skin tones* checkbox. Thus the LC curve provides a complex image control, altering lightness based on image chromaticity and also targeting a specified range of hues. With this option enabled, the luminosity of only red and skin tones is affected, for example allowing you to make skin fairer and conceal wrinkles and blemishes while preserving the color of the model's clothes and background. When it is disabled, the LC curve acts on other colors as well.

The coloring of the bar on the horizontal LC curve axis changes to reflect which colors the curve applies to, as chosen by the state of the *Restrict LC to red and skin tones* checkbox.



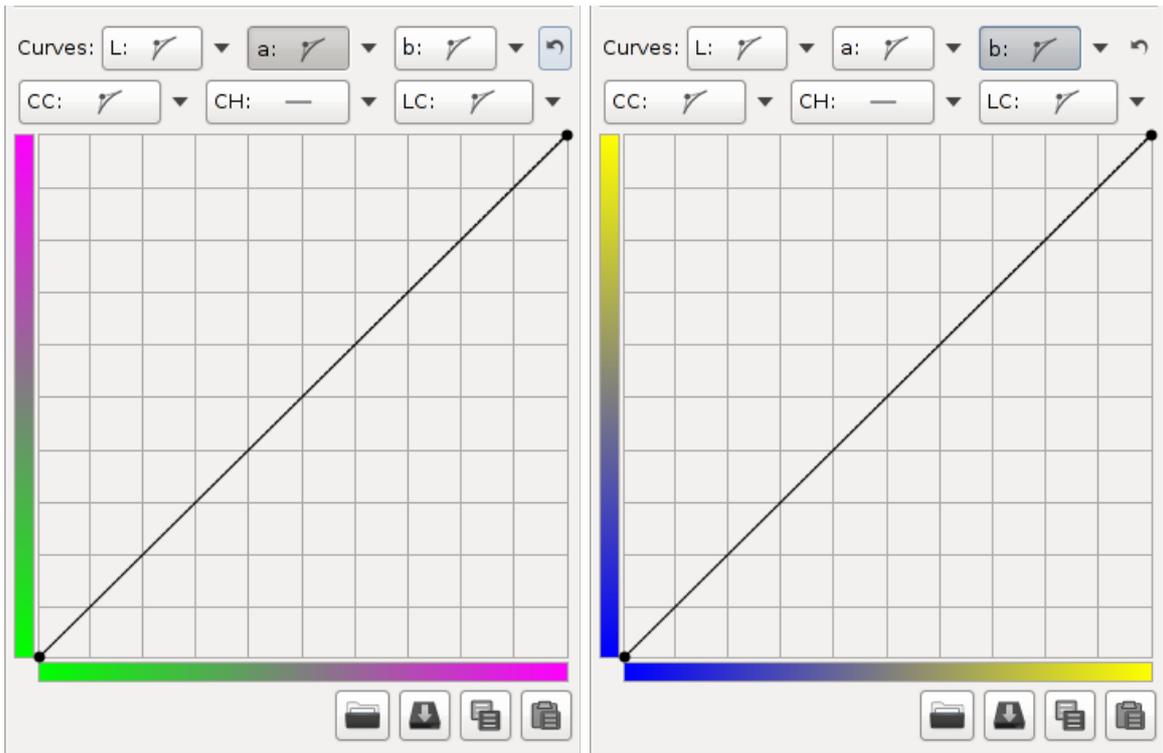
*The LC curve was used to make the skin tones lighter, concealing wrinkles and reducing age.*

*The model was satisfied with the result.*

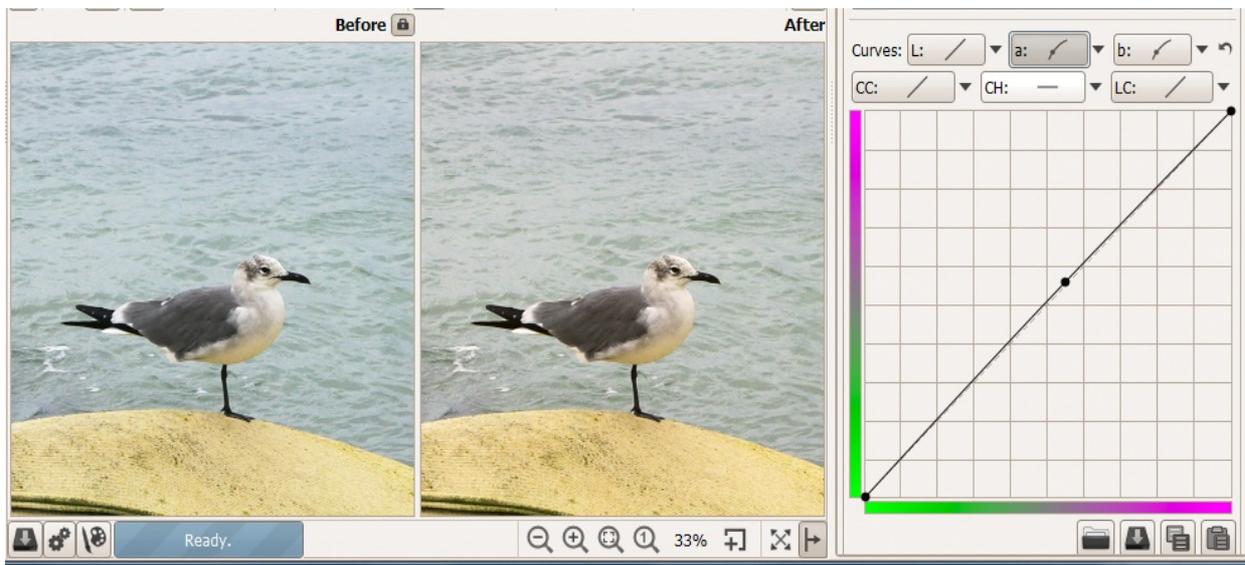
### **a and b Curves**

The *a* and *b* curves allow to control output *a* and *b* channels based on the input *a* and *b* channels respectively,  $a=f(a)$  and  $b=f(b)$ .

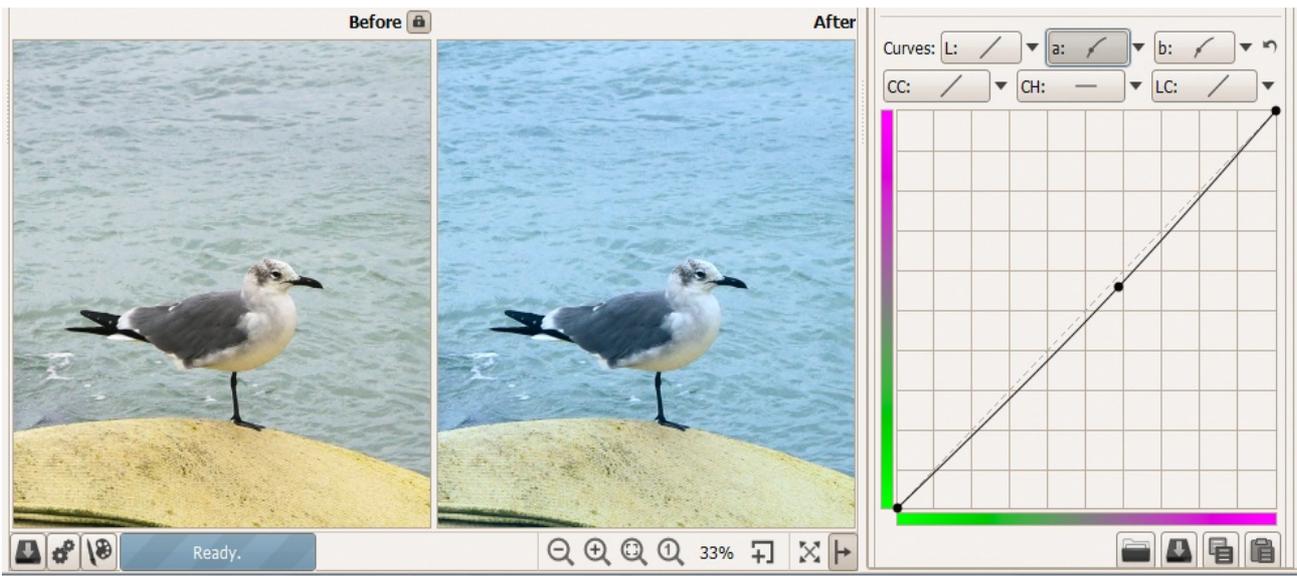
As indicated by the color bars, the *a* curve allows one to shift colors between green and magenta, and the *b* curve to shift between blue and yellow. This can be used to apply color toning effects.



*The a and b curves, and the colors they correspond to.*



*Similar a and b curves were used to warm the image.*

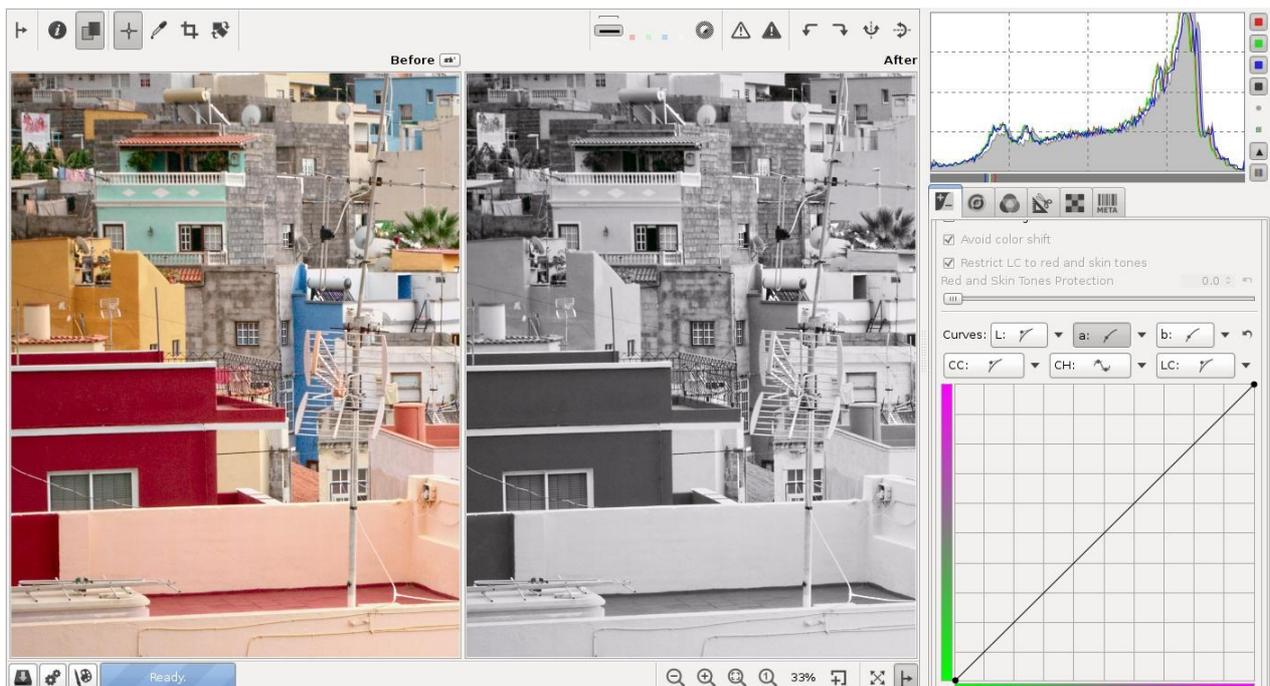


Similar a and b curves were used to cool the image.

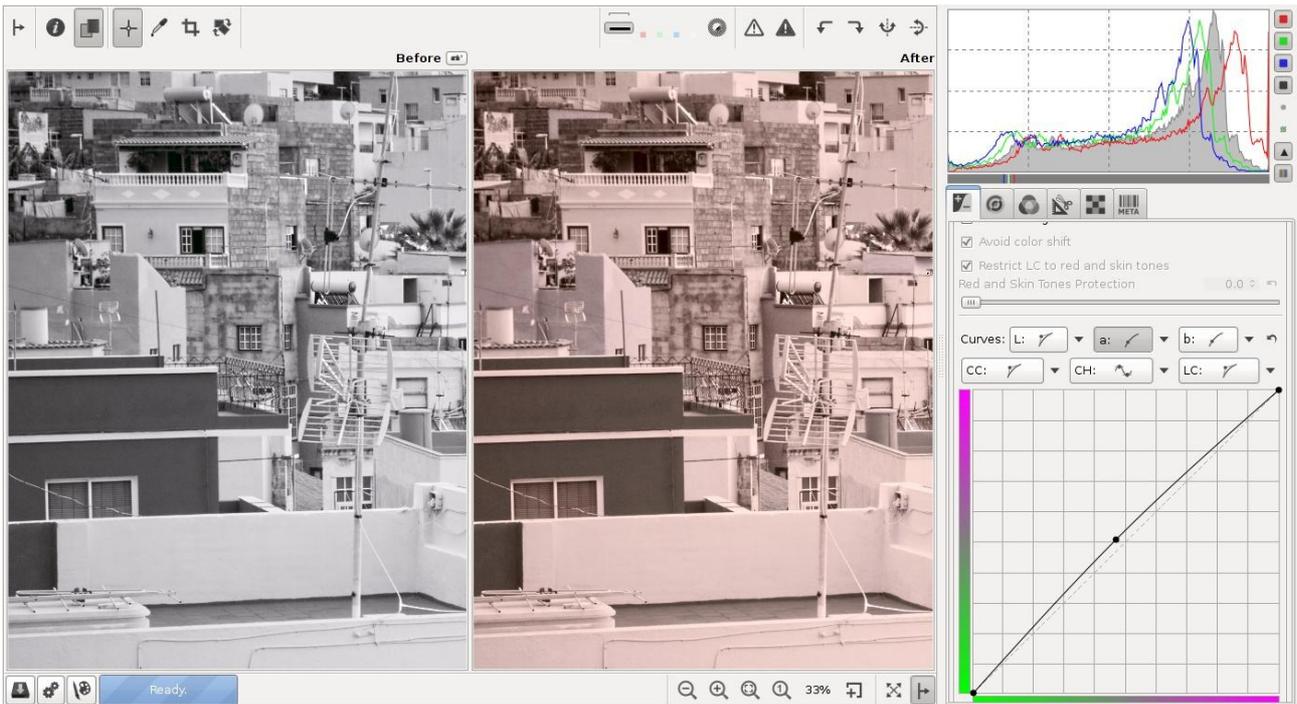
### B&W Toning

When the *B&W toning* checkbox is selected, the image's lightness is used for converting it to black and white (the effect is the same as setting the Lab Lightness slider to -100, however toning the image using the *a* and *b* curves is only possible when this checkbox is enabled). Consequently the effect of the following tools gets *disabled*:

- Chromaticity slider
- CC Curve
- LH Curve
- LC Curve



With the *B&W toning* checkbox enabled, you can tone the image by tweaking the *a* and *b* curves, e.g. to introduce a sepia color cast.



To copy color toning from one image to another, *copy the current processing profile to clipboard* , then partial-paste it either by right-clicking on a photo in the File Browser and selecting “Processing Profile Operations > Paste - partial”, or from the Image Editor tab by Ctrl+clicking on *paste profile from clipboard*  to paste only the Lab Adjustments section of the profile. Please note that other adjustments in the Lab Adjustments sections will be pasted as well. Alternatively, the *a* and *b* curves can be copied and pasted individually.

### Controlling Conversion to B&W

The interpretation of the image lightness according to color can also be controlled via the Saturation slider in the Exposure section. Use of this slider alters brightness of colors at various degree. Since the saturation adjustment is applied prior the Lab adjustments, this leads to a color-dependent change of lightness.



*The B&W toned image on the left had the Saturation slider set to -100; the one on the right +100.*

Another method of controlling conversion of color to BW is to use BW toning checkbox and then tweak the RGB Curves or a Channel Mixer, to adjust contribution of each of the color channels independently. This provides the greatest control for BW conversion.

## RGB versus Lab

Many people wonder what the differences are between adjusting lightness, contrast and saturation in RGB, or lightness, contrast and chromaticity in Lab. RGB operates in the three channels; red, green and blue.  $L^*a^*b$  is a conversion of the same information to a lightness component  $L$ , and two color components -  $a$  and  $b$ . The lightness is kept separate from the color, so that you can adjust one without changing the other. "Lightness" is designed to approximate human vision, which is very sensitive to green but less to blue. If you brighten in Lab space it will often look more correct to the eye, color-wise. In general we can say that when using positive values for the saturation slider in Lab space, the colors come out more 'fresh', while using the same amount of saturation in RGB makes colors look 'warmer'.

The difference between the Lightness slider in the Exposure section (in RGB space) and the Lightness slider in the Lab section is subtle. A RGB Lightness setting of +30 produces an image that is overall a bit brighter than when using a +30 Lab Lightness setting. The colors in Lab Lightness are somewhat more saturated. The contrary is true for the Contrast sliders; when using a RGB Contrast of +45 the colors will be clearly warmer than when using a Lab Contrast of +45. The contrast itself is about the same with the two settings. Do not hesitate to use both sliders to adjust saturation and/or contrast. As for the saturation/chromaticity sliders, setting -100 in

the RGB Saturation slider renders a black and white image which appears to have a red filter applied, while the Lab Chromaticity slider renders a more neutral black and white image. Positive RGB Saturation values will lead to hue shifts (the larger the value, the more visible the shift), while positive Lab Chromaticity values will boost colors while keeping their hues correct, rendering a crisp and clean result. Lab Chromaticity is the recommended method for boosting colors.

## CIE Color Appearance Model 2002

A detailed description of CIECAM02 principles and how it has been implemented in RawTherapee by Jacques Desmis:

[http://code.google.com/p/rawtherapee/downloads/detail?name=CIECAM02-RT\\_en.odt](http://code.google.com/p/rawtherapee/downloads/detail?name=CIECAM02-RT_en.odt)

### Histograms in Tone Curves

The tone curve histograms in the CIECAM02 section can show values before or after CIECAM02 is applied. To view the values after CIECAM02 adjustments, enable the *Show CIECAM02 output histograms in curves* option. If disabled, the histograms show values before CIECAM02.

### Histograms in the Color Curve

The histogram in the Color curve shows the distribution of chroma (saturation/colorfulness) according to the intensity of the chroma (saturation/colorfulness) or chromaticity in Lab mode. The more the histogram is shifted to the right, the more saturated colors are close to the limits of the gamut. The more the histogram is shifted to the left, the more the colors are dull.

The abscissa represents the value of the chroma (saturation/colorfulness) or chromaticity (in Lab mode). The abscissa scale is "open".

As usual, the ordinate represents the number of pixels involved.

## Detail Tab

Here you find the sharpening and noise reduction tools. Please note that the effects of some of the filters here are only visible at 100%. Use a detail window (click on the  icon under the preview) to inspect a part of the raw, or zoom to 100% (also called 1:1) by clicking on .

### Sharpening

A big warning to start with! The Sharpening tool is computed **before** the Resize tool, so if you set a resize value and were planning to adjust a post-resize sharpness, it will not be possible at the moment. But if you resize your image by a factor of 0.5 for example, you might want to double your sharpening radius value. Unfortunately,

sharpening cannot be previewed at scales lower than 1:1.

Sharpening in RawTherapee can be done with two methods: using the Unsharp Mask (USM) or using RL Deconvolution.

## **Unsharp Mask**

### **Radius**

The Radius determines the size of the details being amplified and, consequently, relates to the width of the sharpening halo. In general the quality of sharpening is best if the sharpening radius is smaller. For low ISO images that are in focus and without motion blur a value of 0.5-0.7 is satisfactory.

### **Amount**

The Amount parameter controls the strength of the sharpening.

### **Threshold**

The Threshold tool helps to suppress noise amplification and to confine sharpening to a desired tonal range. The Threshold tool allows one to create a curve via which the sharpening is applied. The vertical axis corresponds to opacity: 0% at the bottom (transparent, sharpening not visible), 100% at the top (opaque, sharpening visible). The horizontal axis corresponds to luminosity: select the tonal range that will get sharpened - the darkest tones at on the left, progressing to white tones on the right. As mentioned in the tooltip, to move each of the points in the threshold tool individually, hold the Shift key before clicking on a point with your mouse. Holding the Ctrl key while moving a point with the mouse allows for very fine movements.

When moving the right pair of sliders to the left side, sharpening is reduced in the highlights. When moving the left pair of sliders to the right side, sharpening is reduced in the shadows and minimizes amplification of dark noise.

The default threshold values will protect from over-sharpening in most cases and limit the sharpening effect to midtones.

### **Sharpen Only Edges**

If you activate *Sharpen only edges* then uniform areas will not be sharpened. This is useful when sharpening noisy photos.

Two new sliders appear as well:

### **Radius**

The Radius is used for the noise detection. If the noise is low, a lower radius can be used, and vice versa.

A higher radius slows down the image processing.

### **Edge Tolerance**

Edge Tolerance determines how much a pixel has to differ from its neighbor to be considered as an edge and not as noise. It's very similar to the USM threshold parameter and has a high impact on the visual quality. For low ISO (low noise) images use 1000 or less, for high ISO images use 2500-3000 or even more.

### **Halo Control**

Halo Control is used to avoid halo effects around light objects when sharpening too aggressively. When activated, a new slider appears:

#### **Amount**

At 100 it works at maximum, reducing the visual impact of the USM filter.

### **RL Deconvolution**

The second sharpening method is RL Deconvolution, named after the makers of this algorithm, Richardson and Lucy. Here it is assumed that the image suffers from a Gaussian blur (like when applying a Gaussian filter) which might be produced by the lens, motion, etc. In reality the blur might come close to a Gaussian blur, but not exactly. Therefore some artifacts like halos might occur when you try to remove the Gaussian blur.

#### **Radius and Amount**

You can define the Radius of the gaussian blur you want to remove. When you set the Amount to 100 the gaussian blur will be removed completely, but as this gives a harsh result a lower setting is recommended.

#### **Damping and Iterations**

The Damping is used to avoid sharpening of noise on smooth areas. As deconvolution cannot be done perfectly at the first time several iterations are necessary. How much is changed between each iteration is defined by the Richardson-Lucy algorithm. The more iterations are used the more perfectly the gaussian blur is removed, but with each iteration the speed decreases and the danger of halo artifacts rises. Normally you don't want to remove the gaussian blur perfectly due to personal visual taste and speed. The default settings should be fine most of the time.

## **Edges**

Most sharpening algorithms work by making use of a trick our brain plays on us, whereby an image with a high acutance (edge contrast) appears sharper than one of the same resolution with a lower acutance. At these high contrast edges, the brain fools us into thinking the edge is sharper than it really is - an optical illusion known as "Mach bands". This is the phenomenon on which *Unsharp Masking* is based. This is not how *Edges* works.

Edges is a true sharpening algorithm. It does not introduce halos, it can be used to some degree on noisy images, and it works in the Lab space. Zoom in to 100% and enable it, you will see how it sharpens edges (and only edges).

More information here: <http://www.rawness.es/sharpening/?lang=en>

Note, that excessive application of this tool may lead to posterization of the image.

## Microcontrast

This tool complements the *Edges* tool. Where *Edges* sharpens just the edges, *Microcontrast* can be used to enhance texture. 3x3 matrix is better suitable for noisier images.

## Impulse Noise Reduction

Suppresses 'salt and pepper' noise - usually white single-pixel noise, similar (but not occurring for the same reason as) hot or dead pixels. The slider adjusts the threshold that must be exceeded for the suppression to be applied.

## Noise Reduction

RawTherapee's powerful Noise Reduction tool lets you eliminate noise while retaining detail. It uses wavelets and a Fourier transform to work its magic. As with all tools in the Details tab, to see the effects you must zoom in to 100% (1:1) or more.

To find the best set of Noise Reduction values for your image:

- 1 Check the sharpening tools to make sure that you're not sharpening any fine detail, because your noisy photo has no fine detail! All they would do is amplify the noise. If you're using Contrast by Detail Levels to give the image more depth, make sure that the first *0 (Finest)* slider is turned off.
- 2 Zoom into the photo to 100% and find an area that has both sharp in-focus parts as well as large plain out-of-focus ones, so that you can prevent noise reduction from destroying details as you tweak it.
- 3 Start by setting the *Luminance Detail* slider to 0,
- 4 Increase the *Luminance* slider until the luminance noise has been smoothed away.
- 5 Because luminance noise is all gone now (though we haven't recovered any detail yet), this is a good time to denoise the color channels. Increase *Chrominance (Master)* to a level where chrominance noise is gone but color detail in small objects hasn't been lost. You can reduce or boost the effects of noise reduction on the red and blue channels by respectively lowering or raising the *Delta Chrominance Red/Blue* sliders. In most cases 0 should be fine.
- 6 Now increase the *Luminance Detail* slider to recover detail until you are happy with the noise:detail trade-off.

## Luminance

This slider lets you control coarse smoothing of luminance.

### **Luminance Detail**

This slider is for detail recovery after application of the Luminance noise reduction.

### **Chrominance (Master)**

Applies noise reduction to color channels. If this slider is at 10, the *Delta* sliders have no effect.

### **Delta Chrominance Red**

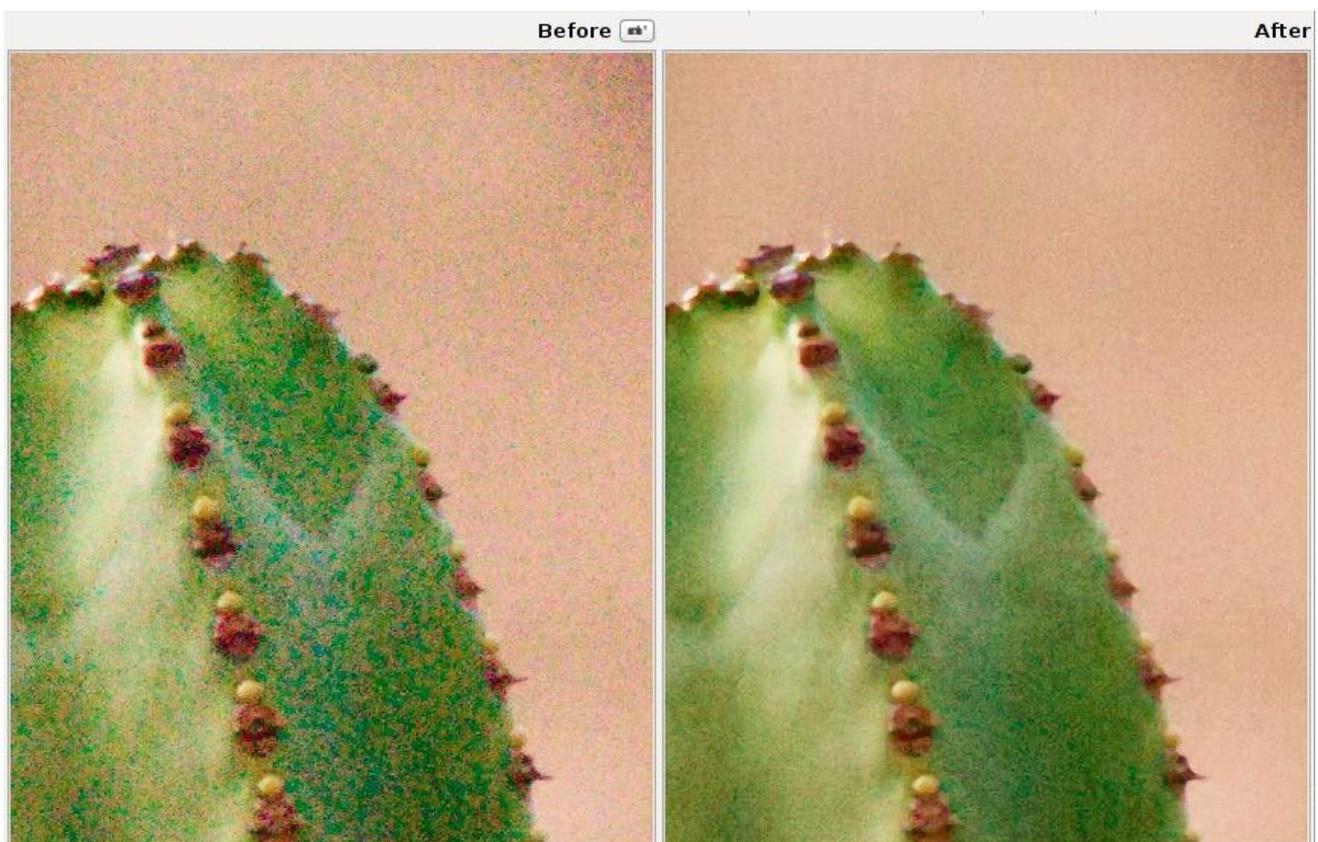
Reduce or boost the effect of color noise reduction in the red channel.

### **Delta Chrominance Blue**

Reduce or boost the effect of color noise reduction in the red channel.

### **Gamma**

Gamma varies noise reduction strength across the range of tones. Smaller gamma values let noise reduction affect all tones emphasizing the action on shadows, while higher gamma values limit the effect to brighter tones only.



### **Defringe**

Purple fringes are a form of axial (or longitudinal) chromatic aberration, and appear along dark edges adjacent to bright areas due to incorrect focus, lens imperfections, or simply (but more technically) due to the nature of lenses not focusing all colors on the same plane.



As lenses are optimized to focus visible light of longer wavelengths on the same plane, those shorter wavelengths farther away from the ones the lens was optimized for (i.e. purple, violet - wavelengths on the shorter side of the visible spectrum) can visibly tint dark regions when the bright areas are of sufficient intensity. This tool should be able to effectively remove most of them.

#### **Radius**

Strong chromatic edges are suppressed by averaging over a neighborhood of the specified radius.

#### **Threshold**

Sets a threshold for the application of defringing.

### **Contrast by Detail Levels**

This filter decreases or increases the local contrast and thus works in two directions: either it reduces noise by blurring the image somewhat, or it enhances the sharpness impression. It uses four sliders. Slider 0 (Finest) has a pixel radius of 1, sliders 1 to 3 have a pixel radius of approximately 2, 4 and 8 pixels.

#### **Contrast +/- and Neutral**

Use the Contrast- button to move all four sliders by preset amounts to the left (noise reduction). Use the Contrast+ button to move all four sliders by preset amounts to the right (sharpening). Use the Neutral button to reset all sliders to 0. Feel free to move individual sliders as well, and inspect the results in the detail window; you may want to zoom in to 200% or more to see better what this filter does. For high iso shots (1600+), try for example this. Click twice on the Contrast- button and use USM sharpening with an amount of 80.

#### **Threshold**

The Threshold parameter is used to prevent the sharpening of noise: if a pixel luminance differs only a bit from its neighbors (the difference is less than the threshold), then it is not sharpened. You can set the threshold also to 0 but then everything will be sharpened (even the noise).

# Color Tab

## White Balance

### Method

White balance can be set in different ways: Camera, Auto, Custom, or a host of presets for different light sources.

#### Camera

Takes the white balance used by the camera . If you shoot only in raw (so no raw+jpg), put the white balance settings of your camera on Auto. This should generally give good results.

#### Auto

Automatically corrects the white balance.

#### Custom

Set your own color temperature and green tint by moving the two sliders and/or using the Spot WB tool.

### Light source presets

-  Daylight (Sunny)  
These temperatures correspond to the “daylight” setting temperature used in these camera manufacturers’ cameras (they will be referred to as “camera-specific” temperatures in this manual), not to the actual daylight temperatures as calculated from the ICC or DCP profiles (these will be referred to as “ICC/DCP-specific”). When available, use the more precise ICC/DCP-specific daylight temperature and tint values.
  - Canon: 5200K
  - Leica: 5400K
  - Minolta: 5100K
  - Nikon: 5200K
  - Olympus: 5300K
  - Panasonic: 5500K
-  Cloudy  
Camera-specific.
  - Canon: 6000K
  - Leica: 6400K
  - Minolta: 6500K
  - Nikon: 6000K
  - Olympus: 6000K
  - Panasonic: 6200K
-  Shade  
Camera-specific.
  - Canon: 7000K
  - Leica: 7500K

- Minolta: 7500K
- Nikon: 8000K
- Olympus: 7500K
- Panasonic: 7500K
-  Tungsten 2856K
-  Fluorescent
  - F1 Daylight: 6430K
  - F2 Cool White: 4230K
  - F3 White: 3450K
  - F4 Warm White: 2940K
  - F5 Daylight: 6350K
  - F6 Lite White: 4150K
  - F7 D65 Daylight simulator: 6500K
  - F8 D50 simulator
  - Sylvania F40 Design: 5020K
  - F9 Cool White Deluxe: 4150K
  - F10 Philips TL85: 5000K
  - F11 Philips TL84: 4150K
  - F12 Philips TL83: 3000K
-  Lamp
  - HMI lamp studio Osram (for film, spectacles, studio, etc.): 4800K
  - GTI lamp Graphiclite & ColorMatch for Photography: 5000K
  - Judgell lamp D50: 5100K
  - Solux lamp: 3500K
  - Solux lamp: 4100K
  - Solux lamp near daylight (e.g. in “Musee d’Orsay”): 4700K
  - Solux lamp near daylight (e.g. in the “National Gallery”): 4400K
-  LED
  - LSI Lumelex 2040 (e.g. in the “National Gallery”): 3000K
  - CRS SP12 WWMR16 (e.g. in the “National Gallery”): 3050K
-  Flash
  - Daylight (Leica): 5500K
  - Daylight (Canon, Olympus, Pentax, standard) 6000K
  - Daylight (Minolta, Nikon, Panasonic, Sony): 6500K

### ICC/DCP Specific Daylight White Balance Values

The daylight white balance temperature values used by your camera and commonly referred to in literature and on the internet are averages. The precise temperature and tint combination you should use for daylight photos is specific to the ICC or DCP input profile auto-matched to your camera by RawTherapee. This will give you a technically color-accurate image where whites are white, though aesthetically it may not be what you want.

MAKE	MODEL	TEMP	TINT
Canon	EOS-1D MKIII	4871	1.113
Canon	EOS 20D	4733	0.969
Canon	EOS 40D	5156	1.049
Canon	EOS 400D	4862	1.030
Canon	EOS 450D	4950	1.050
Canon	EOS 5D	4993	0.998
Canon	EOS 550D	4915	0.916
Canon	EOS 7D	5770	0.971
Canon	EOS D60	4723	1.237
Canon	G12	5821	0.994
Nikon	D200	4936	1.064
Nikon	D300	5277	1.070
Nikon	D3000	5302	1.109
Nikon	D3100	5087	0.955
Nikon	D3S	5100	0.970
Nikon	D50	5321	1.180
Nikon	D5100	5621	0.989
Nikon	D700	5000	1.100
Nikon	D7000	5398	0.986
Nikon	G10	4885	1.078
Olympus	E-1	5118	1.154
Olympus	E-P2	5000	1.060
Panasonic	DMC-G1	5550	1.000
Panasonic	DMC-G3	5800	1.050
Panasonic	DMC-GH1	6280	1.036
Panasonic	DMC-GH2	5680	1.043
Panasonic	DMC-FZ150	5950	1.020
Panasonic	DMC-FZ35/38	4840	1.100
Pentax	K10D	5420	1.094
Pentax	K200D	4465	1.129
Sony	A700	5280	1.076
Sony	A900	5258	1.042
Sony	NEX-5N	5832	0.890
Sony	A55 SLT-A55V	5254	1.081

## Spot WB

When you click on the Spot WB button  (shortcut: W), the cursor changes into a pipette (when it is on the photo). Click on a gray or white area to determine the correct white balance. You may do this several times on different places in the photo. Use the Size drop-down box to change the size of the pipette. This tool can be used as well inside a detail window. Right-click to cancel the tool and to get the regular cursor back.

## **Temperature and Tint**

Moving the Temperature slider to the left makes the image cooler (bluish), moving it to the right makes it warmer (yellowish). Moving the Tint slider to the left makes the image purplish, moving it to the right greenish.

## **Vibrance**

Vibrance is an intelligent saturation adjustment tuned to correlate with the color sensitivity of human vision. The vibrance effect is applied with higher accuracy on a correctly white balanced image when RGB saturation and Lab saturation sliders are set to 0.

### **Enabled**

Vibrance effect can be enabled and disabled without altering other settings of the control

### **Pastel Tones**

Saturation control over the pastel tones in the image

### **Saturated Tones**

Saturation control over the saturated tones in the image

### **Pastel/Saturated Tones Threshold**

This threshold setting value is used differentiate between pastel and saturation tones to control the area of influence of the saturation sliders for pastel and saturation tones.

### **Protect Skin Tones**

When enabled, colors closely resembling natural skin tones are not being affected by the vibrance adjustments

### **Avoid Color Shift**

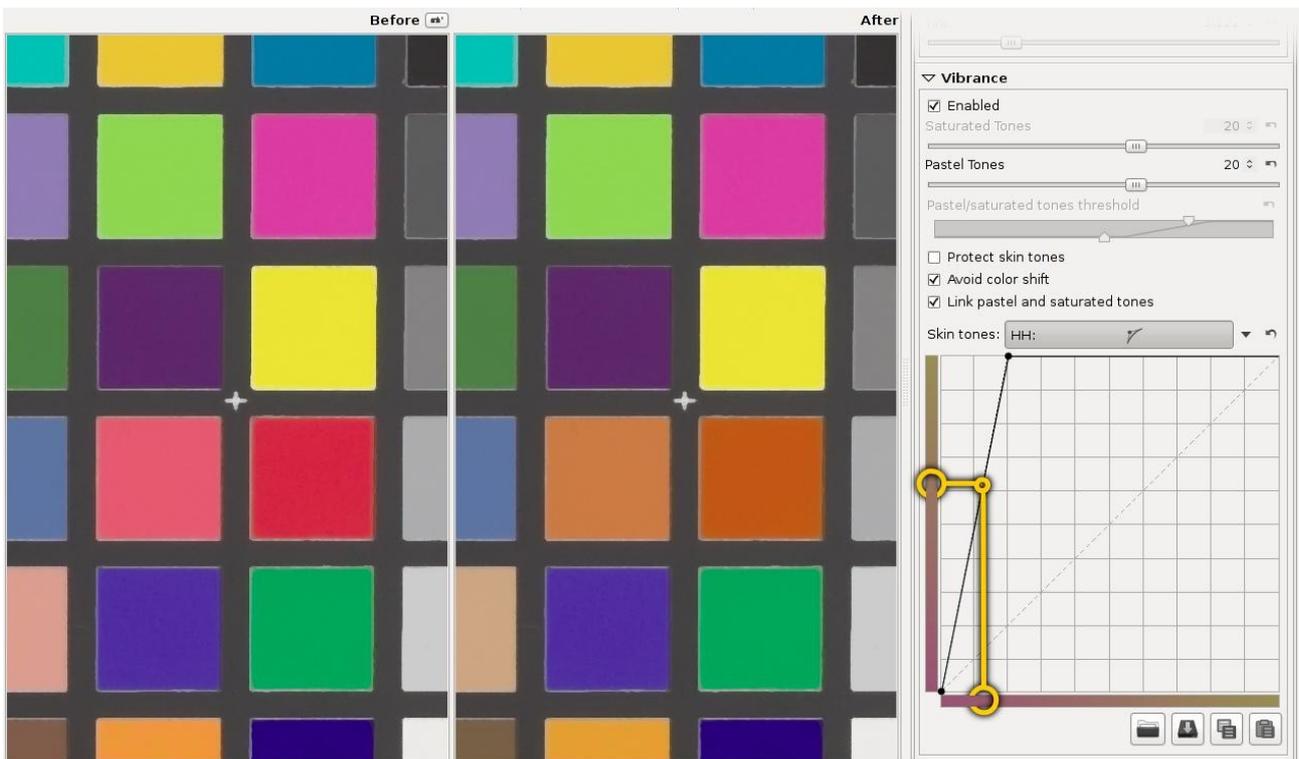
When enabled exercises extra control to avoid hue shifting

### **Link Pastel and Saturated Tones**

When enabled Vibrance level is adjusted with a single slider equally controlling saturation for both pastel and saturated colors.

### **Skin Tones - Hue According to Hue**

This  $H=f(H)$  curve lets you change the hue of skin tones. It behaves just like the tone curve you know from any image editing program, but instead of working on a whole color channel it just works on a range of common skin tones. The x axis represents the input hue, and the y axis the output hue. Decide on the specific skin tone hue you want to change (the one your subject has in the photo), find it on the x axis, and then change the curve to map it to a nicer tone on the y axis. In practical terms, you can use this tool to map a British-pink suntan skin color to a nice Maldives-brown one.



*Using the HH curve, a pinkish skin hue was changed to a tanned-brown one.*

## Channel Mixer

This function is used for special effects, for color and black and white alike. The Channel Mixer is divided into three sections: Red, Green and Blue. Those sections represent the three available color output channels in a RGB image. All values shown here are percentages. The mixer makes a new R channel from the specified percentages of the existing R, G, and B channels; similarly for the other channels.

Among the uses of the channel mixer:

- a IR and black & white photography, using the mixer to achieve desired tonal values for different parts of the scene.
- b Extending the range of White Balance beyond the 1200-12000 range of the WB tool.

In the channel mixer, for the values that have a starting value of 100, enter values other than 100 and you are in effect changing the white balance (ie. only changing the R slider on the R channel, only the G slider on the G channel, and only the B slider on the B channel). Get the image into the right ballpark, then use the temp/tint sliders of the usual WB tool to fine tune. In principle this allows an arbitrary range for WB.

## HSV Equalizer

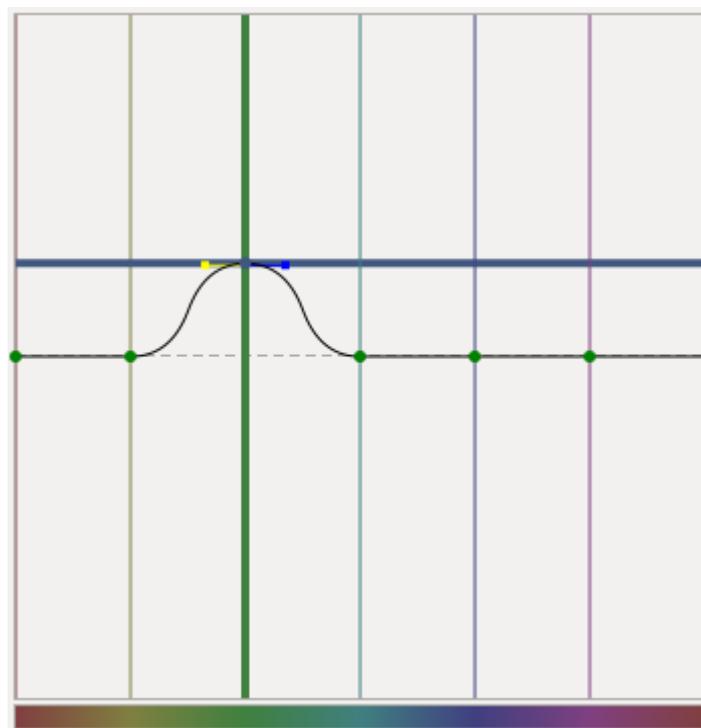
Use the HSV Equalizer (Hue, Saturation and Value) to selectively change colors, e.g. make the sky more dramatic by making it somewhat darker or more saturated

without touching other colors. It can be very useful for correcting skin tones as well. 'Incorrect' use may produce effects resembling the analogue cross-processing technique. When used for black and white, be sure that the raw is desaturated by setting the Lab Saturation slider on the Exposure tab to -100, or by enabling the *B&W toning checkbox* also in Lab Adjustments. The HSV Equalizer does not work when the raw file is desaturated by setting Exposure Saturation on the Exposure tab to -100.

The HSV Equalizer is of a so-called flat curve type, which needs some explanation.

Open a raw file, click on the drop-down icon  next to the H(ue) button and choose *Minima/Maxima control points*. You'll see six dots on the horizontal line in the middle and six vertical lines that cross these dots. If you look (very) well, you'll notice that those lines are colored; from left to right: red, yellow, green, aqua, blue and magenta. Now click on the very left dot (the cursor changes into a little hand) and move it slightly upward and downward. Result: red colors quickly change to green, blue and magenta as the cursor is moved up, and to pink, blue and green when moved down.

Notice that a new horizontal line appears when you start dragging a color point, and see how its color changes. The vertical axis represents input colors, and the horizontal axis output colors.

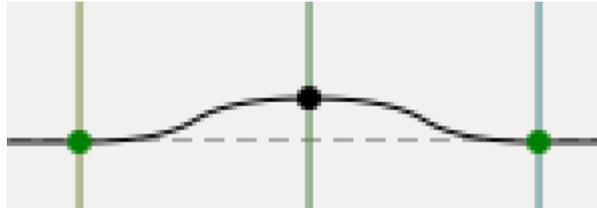


*The input color green (vertical line) was changed to the output color blue (horizontal line).*

When you click and drag a vertical line (the line, not the point!), the very first movement will determine the kind of move: vertical or horizontal (so take care with

this first movement if you want to have a predictable result). If you want to move the point in both directions at the same time, then click and drag the point itself. To move the point only in one direction (only horizontally or only vertically) you can use the 'snap to' function by holding down the Shift key while moving the point.

It's easy to see if a point is on its neutral value (i.e. on the middle line) because the color of the point will be green. As soon as you move a point off its neutral value, it changes color to black.



*A neutral point is green, a modified one is black.*

The HSV Equalizer wraps around on the horizontal axis, so the very right vertical line of the HSV Equalizer equals the very left line. You can see this by dragging the red line on the left a bit to the left. Now the left point of the graph is at the same position as the very right point.

You can delete points by dragging them out of the editor field. You can add points by clicking somewhere on the curve. When you place the mouse on one of the points, you see a yellow and blue indicator. Place the mouse on the yellow one and the cursor changes into a left arrow. Now you can drag this point to the left, to change the slope of the curve. Ditto for the blue indicator.

To get an idea how this editor works, delete all but two colors (e.g. red and yellow) and move the graph around, change its slope and see what happens to your photo.

Dragging all the color points to their maximal values (completely up) gives an image that is about the same as when no points have been changed (ie. Linear). Same when all sliders are set to their minimum positions (down).

Reset the Hue curve to linear (no changes) by clicking on the reset icon  next to the Value button. To compare the effects of the Hue curve with linear: switch between *Linear* and *Minima/Maxima control points* in the drop-down menu next to this button, or use the history list on the left side of your screen.

You can save a curve for later use by clicking on the disk button. Note that only the actual (shown) H, S or V curve is saved, not all three at once. So don't give your curve a name like `my_hsv` because it doesn't describe whether the curve inside it is H, S or V, but instead name your saved curve files something like `my_hue`, `my_sat` and `my_val`. The extension will be added automatically, ".rtc".

## RGB Curves

RGB curves allow to apply a curve adjustment individually to each of the RGB channels. This provides a fine control over image color balance when curves applied to each of the RGB channels are different. Using RGB curves one could make warmer highlights or colder shadows, simulate film cross-processing effect, etc.

### Luminosity Mode

The purpose of Luminosity Mode in the RGB Curves tool is to alter image luminosity by changing the contribution of the RGB channels to it, while keeping image color the same.

The effect is somewhat similar to V changes in the HSV Equalizer, but is smoother and broader across hues, not as selective. When working on black and white images, similar adjustments could be made via the Channel Mixer, but RGB Curves allows a finer control.

## Color Management

### Profile types

RawTherapee supports the following types of color profiles:

Type	Color fidelity, speed
Adobe DCP (below version 4), RawTherapee auto matched profile	Best color fidelity, not restrictions. Fast.
Adobe DCP (version 4)	Not supported, too bright (and not needed, RT does not have the problems which v4 aimed to solve).
ICC - LUT based	Highlights clipped (default) or inaccurate (using Blend with Matri option). Blend with Matrix only usable if profile rendering is similar to RawTherapee internal default matrix (so e.g. not with indoor profiles). Slow.
ICC - CaptureOne	Supported like ICC LUT based, however colors are not guaranteed to be exactly like CaptureOne. Slow.
ICC - Nikon NX2 (hacked from temporary directory)	Highlights clipped and not recoverable. Colors are not guaranteed to be like NX2, but very near. Slow. See chapter titled <i>How to Obtain Nikon Profiles from NX2</i> .
ICC - Matrix based, RawTherapee Camera Default	Color fidelity reduced in comparison to the other types, but no highlight restrictions. Fast.

### Input Profile

#### No Profile

Bypasses camera input color profile. Colors are closer to camera raw data. Useful in exceptional cases where camera records colors far

outside conventional color gamuts.

### **Camera Standard**

Uses a simple color matrix by dcrow, enhanced RawTherapee version (whichever is available based on camera model) or embedded in DNG.

### **Auto-Matched Camera-Specific Profile**

Uses RawTherapee's camera-specific DCP input profile that is more precise than a simpler matrix (and fall back to lesser powerful ICC profiles if no DCP is available). Available for some cameras, these profiles are stored in /dcpprofiles (or fallback /iccprofiles/input) directory and are automatically retrieved based on file name matching the exact model name of the camera as it appears in the info section in the Editor. E.g. "Canon EOS 5D Mark III.dcp"

In other words, if Auto-matching is selected, RawTherapee will try to do the following, in this sequence:

1. locate a DCP profile in /dcpprofiles
2. if DCP is not found, locate an ICC profile in /iccprofiles
3. if DCP and ICC are not found, revert to the hard-coded camera matrix.

Camera matrix values are generally from dcrow, but in some cases have more accurate custom overrides based on measurements with ColorChecker-24.

Please note that when ICC profile is used the Highlight Reconstruction is not as efficient. As an mitigation, enable the option "Blend highlights with matrix". DCP profiles are faster and more precise (esp. in the highlights), so they don't have this restriction.

### **Custom**

Specify a custom DCP or ICC camera input profile stored on your computer.

RT also parses ICC profiles by CaptureOne and Nikon (extracted from Nikon NX2 temporary directory).

### **Preferred DCP Profile**

While RawTherapees own profiles are all single illuminant (standard daylight), some other DCP profiles contain calibrations for two light sources (e.g. Adobes ones, which come with tungsten and daylight).

With preferred profile you can select which one you'd want to be taken if available. If the profile just contains one illuminant, this option has no effect. If the preferred profile type could not be found, the most daylight like profile is taken.

### **Use DCP Tone Curve**

Some DCP profiles contain tone curves, which are not part of the color calibration, but may be used to add contrast and brightness to simulate a special image look. This is mainly used for profiles simulating camera

maker settings. It is always disabled for RawTherapee's own profiles.

### **Blend ICC Highlights with Matrix**

This setting is not needed for DCP profiles.

Enable to recover blown highlights when using LUT based ICC profiles.

This function merges the imprecise, but recoverable highlights from the dcrw standard matrix profile into the precise ICC picture. So the color precision is reduced there, but the highlights are available.

Note that this only works correctly with RTs default profile, since the (RT dcrw embedded) matrix must match the ICC profile.

### **Save Reference Image for Profiling**

Clicking this button saves the linear TIFF image before the input profile is applied. This file can be used for profiling i.e. creating a new camera profile.

However since this file does not contain metadata needed for correct profiling (e.g. white level), you must transfer this info manually. It's generally more advisable to profile the raw file directly.

### **Working Profile**

Specify the working color space; this color space will be used for internal calculations, for instance for calculating saturation, RGB brightness/contrast and tone curve adjustments, chrominance, etc.

Wide gamut profiles such as ProPhoto and WideGamut are suitable only for source files of a high bit depth (at least 16-bit), such as raw files or 16-bit TIFF files, but **not** JPEG images.

For JPEG files sRGB and AdobeRGB are the best profiles.

If you are unsure, use sRGB.

### **Output Profile**

Specify the output RGB color profile; this color space will be used for image output and embedded in metadata.

RawTherapee comes bundled with a number of custom-made high quality output profiles:

- RT\_sRGB similar to sRGB with gamma close to sRGB:  $g=2.40$ ,  $slope=12.92$
- RT\_sRGB\_gBT709 similar to sRGB with gamma BT709:  $g=2.22$ ,  $slope=4.5$
- RT\_sRGB\_g10 similar to sRGB with linear gamma  $g=1.0$ ,  $slope=0$
- RT\_Middle\_gsRGB similar to AdobeRGB1998 with gamma close to sRGB:  $g=2.40$ ,  $slope=12.92$
- RT\_Large\_gsRGB similar to ProPhoto with gamma close to sRGB  $g=2.40$ ,  $slope=12.92$  (close to "Melissa" used by Lightroom)
- RT\_Large\_gBT709 similar to ProPhoto with gamma BT709:  $g=2.22$ ,  $slop=4.5$
- RT\_Large\_g10 similar to ProPhoto with linear gammma  $g=1.0$ ,  $slope=0$

The recommended output profile in most cases is RT\_sRGB.

RT\_sRGB is a higher quality version of the standard sRGB profile, which surprisingly is not consistent between implementations. RT\_sRGB was custom-made for RawTherapee by Jacques Desmis and has 4096 LUT points, as opposed to the lower quality 1024 point sRGB profiles. Applications that aren't color managed and won't take advantage of RT\_sRGB will fall back on sRGB.

## Transform tab

### Crop

Quite self-explanatory. Use the Select crop button to drag a crop with your mouse. Use the Shift key to move the crop over the image. Resize a crop by placing the mouse on one of the sides, cursor changes into a double arrow. Click inside of the crop to show (temporarily) the whole image. Go to the Preferences window, tab General, and click on Cut overlay brush to change the color and/or transparency of the area around the crop. Use Fix ratio to set the crop to a fixed size like 3:2, 16:9, etc. 1:1 is for square crops. DIN means paper sizes like A4 and A5, those have fixed width/height proportions. You must tell RawTherapee if you want to have a horizontal (landscape) or vertical (portrait) crop. Use Guide types if you like. The PPI value does not change any physical property of the image, but sets metadata which describes the intended print size of the current crop (or the whole photo if there is no crop). For prints up to 13x18cm (5x7 inch), 300PPI is a good choice; bigger prints can have less pixels per inch.

### Resize

Can be applied to the cropped area or to the whole image.

Choose your preferred resizing algorithm:

- Nearest
- Bilinear
- Bicubic
- Bicubic (Softer)
- Bicubic (Sharper)
- Lanczos

Lanczos results in the highest quality sampling and is therefore the recommended and default option.

You can resize according to:

- Scale, e.g. have the resulting image 0.5 times the size of the full one,
- Width, by specifying the desired width so that the height is automatically and proportionally scaled,
- Height, by specifying the desired height so that the width is automatically and proportionally scaled,
- Bounding Box, by specifying the maximum width and height you want your image to have, and leave it up to RawTherapee to figure out how to proportionally fit your image into this box.

Warning: the effects of the Resize tool will not be shown in the preview. This is a

limitation of RawTherapee's current engine. Resizing is done at the end of the processing pipeline. The output image will of course be resized.

## **Lens / Geometry**

### **Auto Fill**

This option will upscale or downscale the photo to the extent that the whole image fits within the image boundaries with no black borders visible.

When correcting images that suffer from barrel distortion, Auto Fill will perform downscaling to fit as much of the reprojected image as possible into the image boundaries, so that you don't unnecessarily lose any parts of the image. Conversely if the image suffers from pincushion distortion, Auto Fill will upscale the corrected image to fill the frame without black borders around the periphery.

### **Rotate**

Rotate the image between -45 and +45 degrees. Use the Select Straight Line button to tell RawTherapee what line has to be straight. Use the mouse to draw this line.

### **Perspective**

#### **Horizontal**

When your picture was taken while you were slightly off-center of the object, you can correct this (within certain limits) with the horizontal slider.

#### **Vertical**

Very useful to correct 'falling lines', eg. when photographing architecture.

Higher values for both sliders produce heavily distortion, so use with care. Or don't care at all and have fun!

### **Lens Correction Profile**

Select an Adobe LCP file here to automatically correct geometric distortion, vignetting and lateral chromatic aberrations. It uses its own, more precise correction model and is not linked to the other controls. However you can still use the other controls in addition to the LCP profile e.g. for artistic reasons or if the LCP fails to correct a parameter (which happens on some extreme distortion occasions, like with some heavily distorting compact cameras).

The following restrictions apply:

- LCPs are only supported for raw files (JPGs will only correct distortion and CA, but not vignetting).
- While distortion is visible in the full image preview, CA and distortion are not reflected in the detail crop windows, only in the fully processed result image. Auto filling is also not supported.
- CA correction is only supported if the Exif information contains the focus distance (e.g. in DNGs from Nikon files).

## Getting LCP Profiles in Linux

- 1 Install wine
- 2 Install Adobe DNG Converter  
<http://www.adobe.com/support/downloads/product.jsp?product=106&platform=Windows>
- 3 Find profiles for your camera under  
~/.wine/drive\_c/users/Public/Application\ Data/Adobe/CameraRaw/LensProfiles/1.0/
- 4 Copy the relevant profiles to a different folder for easy access.

## Distortion

Corrects lens distortion. A negative number corrects barrel distortion, a positive value will correct pincushion distortion. You can place a grid over the image by activating Crop (without cropping) and using Guide Type 'Grid'. This may serve as a guide to correct lens distortion.

## Chromatic Aberration

The chromatic aberration can be corrected by using the two sliders Red and Blue. Normally you won't see any C/A in the preview therefore it is highly recommended to use the Image Details (I even suggest to magnify to 200%) when you apply this kind of correction. As in other software tools, this algorithm eliminates moderate chromatic aberration quite well. Do not expect miracles with images having extremely high chromatic aberration.

## Vignetting Correction

The difference between a cheap telefocus lens and an expensive one is, among others, that the first one likely will produce vignetting, while the expensive lens will not or less. Vignetting means light fall-off in the corners of the image, making them darker than the center. This can easily be corrected with this tool.

### Amount

Setting the Amount slider to a positive value brightens the four edges of the images to correct the classical vignetting. Setting it to a negative value darkens them.

### Radius

Influences how much of the image beginning from the edges will be brightened or darkened. Lower values: area of darkening is bigger; higher values: area of darkening is smaller.

### Strength

Amplifies the settings of the Amount and Radius sliders, to the level of an effect filter. Set Amount to -100, Radius to 50 and move Strength from 1 to 100 to see how this works.

### Center X

Moves the 'circle of correction' to the left or the right of the image. Use this to apply vignetting correcting to a cropped photo or to darken an

area on the left or the right that is a bit overexposed (think flash).

**Center Y**

Moves the 'circle of correction' up or down over the image. Useful to 'burn' skies or lighten the foreground.

# Raw Tab

## Demosaicing

### Method

To display a raw file - any raw file made by any camera - its data has to be 'demosaiced'. That's why opening a raw file always takes a bit longer than opening a JPEG or TIFF file, where the data is already 'display-ready'. RawTherapee offers several demosaic algorithms, each with its own characteristics. The differences between them are often very subtle - one might need to zoom in to 200-400% to discern them - but since the program works on a pixel-by-pixel basis and demosaicing is the basis upon which all other tools work, the choice of demosaicing algorithm can have a visually significant effect when combined with other tools, such as the sharpening ones. The choice of a certain algorithm influences among other things the quality of very fine details in the image, whether false maze patterns will appear, and decides how well colored edges are rendered.

RawTherapee uses the Fast algorithm to initially open the image for editing. After this the selected demosaic method is applied when the image is zoomed to 100% magnification or when the detail window is opened. The selected method is also used for batch processing. It is not recommended to select the Fast method for the final conversion, as it is a low-quality algorithm for display purposes.

AMaZE (Aliasing Minimization and Zipper Elimination) is the default demosaic method of RawTherapee, as it yields the best results in most cases. VNG-4 used to be (in version 2.4) the preferred algorithm for Olympus cameras, as it eliminates certain maze pattern artifacts that might be created by the other methods. Since version 3.0 of RawTherapee, Olympus users might prefer the AMaZE method though. DCB is similar to AMaZE, it also removes maze artifacts.

Zoom in to at least 100% (1:1) and try all the demosaicing algorithms, see which works best for you. Try them on sharp photos with fine detail and tiny patterns, such as the wavy and repetitive fabric of a sweater (watch for maze pattern artifacts), a distant brick wall, a distant round road sign (watch for aliasing along the round edges), and test with both low and high ISO shots. Use photos from your own camera; what's best for Nikon raws is not what's best for Olympus raws.

### False Color Suppression Steps

Sets the number of median filter passes applied to suppress demosaic

artifacts when applying the demosaicing algorithm. False colors (speckles) could be introduced during the demosaicing phase where very fine detail is resolved. False color suppression is similar to color smoothing. The luminance channel is not affected by this suppression.



*A good image to test the demosaicing algorithms on. Zoomed in to 800%, you can clearly see that VNG4 is not a good choice for this Pentax K10D raw file, as there are dots where there should be none, and the detail of the wall's brickwork (the orange part on the right) is all washed out.*

## Preprocessing

### Line Noise Filter

This filters pattern noise. The slider sets the strength of the effect.

### Green Equilibration

Some cameras (for example Olympus, Panasonic, Canon 7D) use slightly different green filters in the two green channels of the color filter array on the camera sensor. Green equilibration suppresses interpolation artifacts that can result from using demosaic algorithms which assume identical filter properties in the two green channels. The threshold sets the percentage difference below which neighboring green values are equilibrated.

### Apply Hot/Dead Pixel Filter

Suppresses hot and dead pixels by replacing them by a neighborhood average.

## Raw White & Black Points

### White Point: Linear Correction Factor

Applies a linear exposure correction on the raw file before the demosaic algorithm is used. This can be useful to deal with difficult lighting situations that resulted in overexposed areas in the raw. The value of this slider represents the multiplier of the RGB channels. The correction factor is independent of color space.

Be careful when using it, since it shifts the input before the color management system translates them, so you might see color shifts. On the other hand reducing the raw white point can recover highlights which would be lost when going through the color management system with ICC profiles.

### **White Point: Highlight Preserving Correction (EV)**

Use this slider to preserve the highlights. The value here represents an EV value, so the equivalent of a f-stop. When the correction factor (the first slider) is positive, a high value for the second slider makes highlights somewhat darker, thus preserve them. On the contrary, when the first slider is negative, a high value of the second slider makes the highlights lighter. This slider only works when the Linear correction factor slider has a value other than 1.0.

### **Black Levels**

These allow you to add offsets to the channels still in raw (that's why there are two greens, because a bayer sensor has two green sensors). It helps to fine tune color tints in shadow areas.

## **Dark Frame**

In long exposure shots (more than 1 sec) the non homogeneous thermal noise becomes evident, mainly due to unevenness of the sensor and surrounding electronics. A method to mitigate this effect is to subtract one (or more) shots taken in the same conditions, but with the lens cap on. Only raw images for the same camera model can be used as "dark frame".

Attention, this method is not effective with high ISO noise because of its different random nature.

In the Dark Frame panel, you can specify a single shot to subtract from the image, or check "Auto Selection" and let RT choose the best match from one directory specified in Preferences. To select the directory go in "Preferences...", tab "Image processing" and select "Dark Frame Directory"; you may wait a little after selection because RT scans all files in that dir. Under the widget, RT shows how many shots are found and how many groups of shots are found and averaged into a template. From now on, put your darkframe shots there if not already done. You could also move a shot that you find to be a dark frame with right click menu in thumbnails browser "Move to dark frame directory". RT chooses the best match looking for same camera model shots with minimal difference in ISO, exposure duration and date. If more than one shot with exactly the same properties is found, then an average of them is used: this produces by far less noise, so it's better to have 4-6 frames taken in the same conditions of the actual photo.

When selecting a dark frame (or with autoselection), RT extracts from it all the positions of hot pixels and then always corrects them in the final image. This

correction is better than applying only the "Hot/dead pixel filter", but works only for hot (=white) pixels not for dead (black) ones.

## Bad Pixels

RT can correct a list of bad pixels (pixels that are always black or white or stuck to one color) for your particular camera model. To do this you need to write a text file with the absolute raw coordinates of these pixels: each line specifies a pixel with x<space>y<return> positions. (If you look at the coordinates of pixels in RT, beware of the offset introduced by cut border: you must add +4 to each coordinate).

The file has to be named exactly as your camera: "**maker model.badpixels**" (maker must be short name) es: PENTAX K200D.badpixels; if you have two cameras with same model you can specify also the serial numbers (look at Exif data): "**maker model serial.badpixels**". The file has to be located in the "dark frames" directory specified in preferences.

Pixels in the bad pixels list will **always** be corrected in processed photos.

### Bad pixel detection software

There exist programs to aid in detecting such pixels:

- Dead Pixel Test  
<http://www.starzen.com/imaging/deadpixeltest.htm>
- Pixel Fixer  
<http://www.pixelfixer.org/>

## Flat Field



Original image



AFTER Auto Flat Field correction



Flat field image at similar aperture



The same flat field image shown with exaggerated contrast and saturation to visibly demonstrate color and luminance non-uniformity due to the lens cast effect

Flat field corrections are used to compensate for the non-uniformity characteristics of the camera and lens combination. A well known example of such non uniformity is vignetting – a peripheral darkening of the image, more pronounced in the corner areas. Another example, more familiar to the users of digital medium format cameras, is the lens cast effect – both color and luminance non-uniformity of the image field. Both of these examples of non uniform image capture can be further complicated by a possible misalignment of the lens mount or by the usage of the tilt-shift lenses. Another set of examples of capture non-uniformity is due to light leakage in the camera, thermal non uniformity of the sensor or defects/irregularities in the sensor readout electronics.

Manual corrections for these effects in post production are quite difficult; especially when to be reproduced on series of images captured under various conditions, and would rarely lead to perfect corrections.

Flat field correction tools in RawTherapee allow both automated and user-guided

modes. Flat field correction is performed only on linear raw data in the beginning of the imaging pipeline and does not introduce gamma-induced shifts. Thus *in RawTherapee flat field correction can be applied to raw files only.*

Due to performance considerations thumbnail images do not reflect flat field corrections. At present time only preview in the Editor and the output image can be flat field corrected.

Accuracy of the flat field correction is largely based on use of the appropriate flat field image file. Flat Field raw image is usually a de-focused photograph of a uniformly lit uniformly colored and toned subject, such as a piece of white matte paper. Another method of capturing flat field reference image is to use a uniform piece of white Plexiglas® in front of the lens (at full contact with the lens/filter barrel) and photograph it against a preferably uniform illumination (e.g. point camera towards the clear sky). The idea is to provide a uniform entrance illumination into the lens. As a result, all non-uniformities of the lens/camera combination can be recognized in the captured raw image as deviations from the ideal spatially uniform (*flat field*) response.

### **Algorithm Specifics & Concise Summary**

The user or auto-selected raw flat field image need not have the same white balance as the image to which it is applied. The flat field is blurred according to any of several user-selectable blur types and choice of blur radius. The blurred flat field serves as a template for vignetting, lens cast, etc and used to correct the corresponding issues in the image file. Area blur uses a box blur of the flat field file and is the normal use of the correction. Use a large blur radius to smooth the flat field image in order to mitigate any imperfections such as flat field image noise, dust spots, etc. Use of a small radius will leave these effects in the flat field image, and will leave their imprint on the corrected image file. This can be used to advantage, for instance if the flat field has the same dust spots as the image file, use of a blur radius of 0-1 pixels will subtract out the darkening caused by the dust. Use the vertical, horizontal, or vertical+horizontal blur options if the camera generates repeatable line pattern noise. For instance, consistently repeatable vertical line patterns can be subtracted off by using vertical blur on the flat field file.

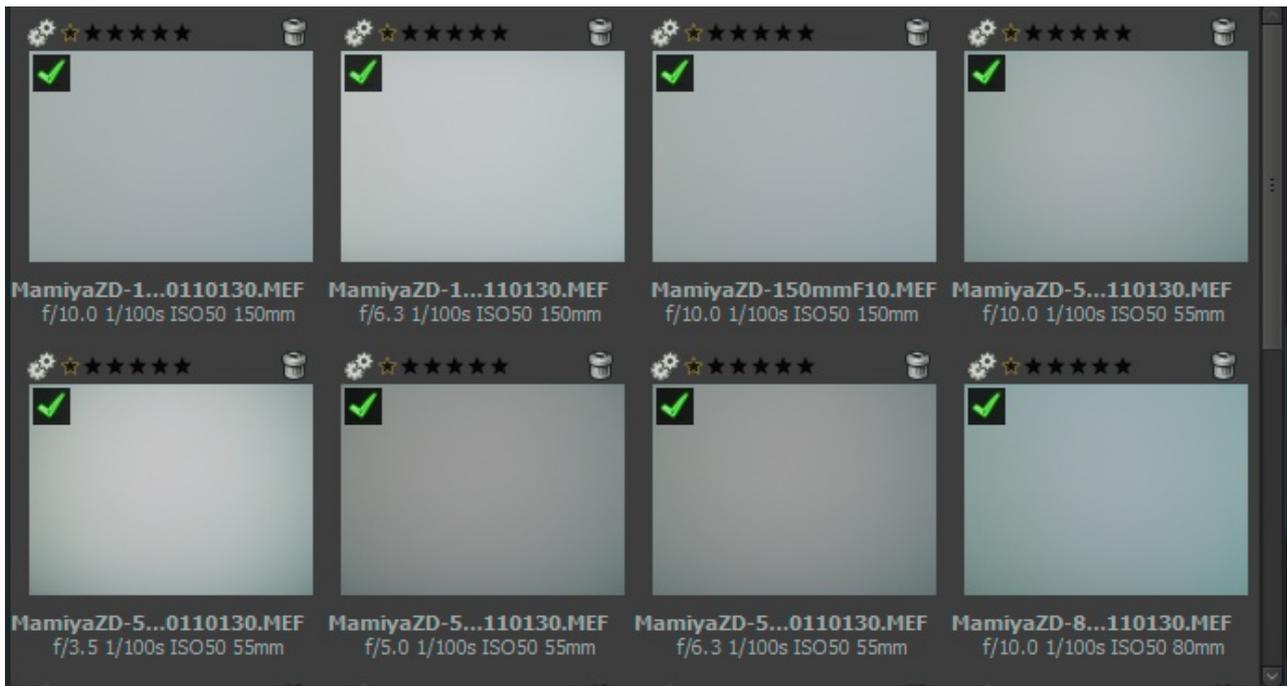
### **Organising Flat Fields**

Non-uniformity of the captured field depends on the following parameters:

- Camera (camera & sensor combination in case when digital back is used),
- Lens,
- Focal distance,
- Aperture,
- Lens tilt/shift

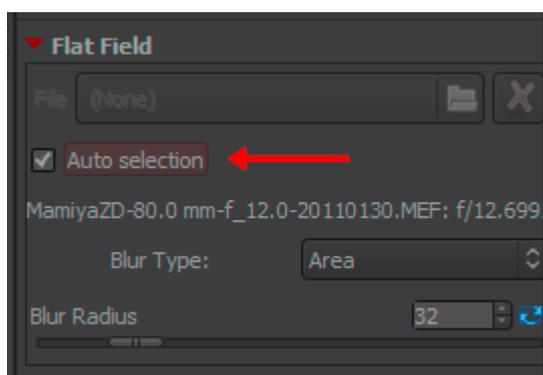
It is recommended to assemble a library of flat fields for camera/lens

combination, taken at various (expected to be used for real image capture) aperture settings. It is advisable to name flat fields descriptively, so that files can be recognised easier by the user, preferably, incorporating all parameters listed above. During flat field correction process these parameters are being read from Exif data only and contents of the file name is irrelevant from this perspective. The flat fields should be stored in a dedicated directory. RawTherapee allows to point to it via “*Preferences > Image Processing > Flat Field > Flat fields directory*”. Setting that directory initiates an analysis of its content. A counts of qualifying files and templates is reported in the UI.



*Thumbnails of sample Flat Fields displayed in RawTherapee file browser.*

## Auto Selection



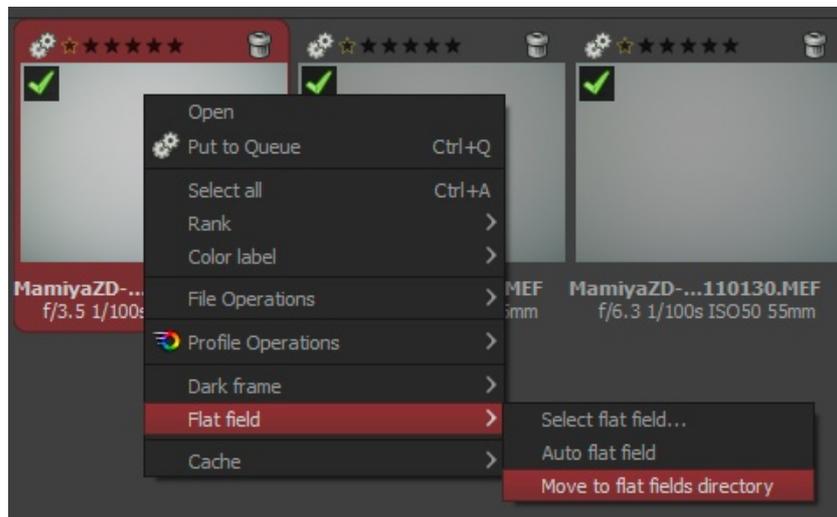
Flat field Auto Selection capability can be engaged simply by checking the “Auto Selection” checkbox. RawTherapee will search through the files in the Flat Fields directory specified in preferences and select the exact or, if not available, the closest match to the image being corrected based on Camera Make, Camera Model, Lens, Focal distance, Aperture and the date of the flat field file. If match is found, the file name of the selected flat field image will be displayed along with its aperture setting. If match is not found, flat field correction will not be applied and message will be displayed to the user. If more than one exactly matching flat fields are found, their data will be averaged and then used for flat field correction.

Auto selection does not account for the tilt-shift settings used on the lens, therefore such flat fields should not be stored in the main flat fields directory, but rather in a descriptively named subdirectory. Such unusual flat field files should be applied manually.

### Flat Field File Browser Context Menu Options

You can apply and manage flat field images from within the File Browser tab, by right-clicking on a thumbnail and selecting the *Flat Field* option. You will be presented with three sub-options:

- i *Select flat field* brings up the file selection dialog to select a flat field file to be applied to the selected images.
- ii *Auto Flat Field* allows to run the *Auto Select* option on the currently selected images.
- iii *Move to flat fields directory* moves the selected image into the directory specified in the preferences.



### Blur Type

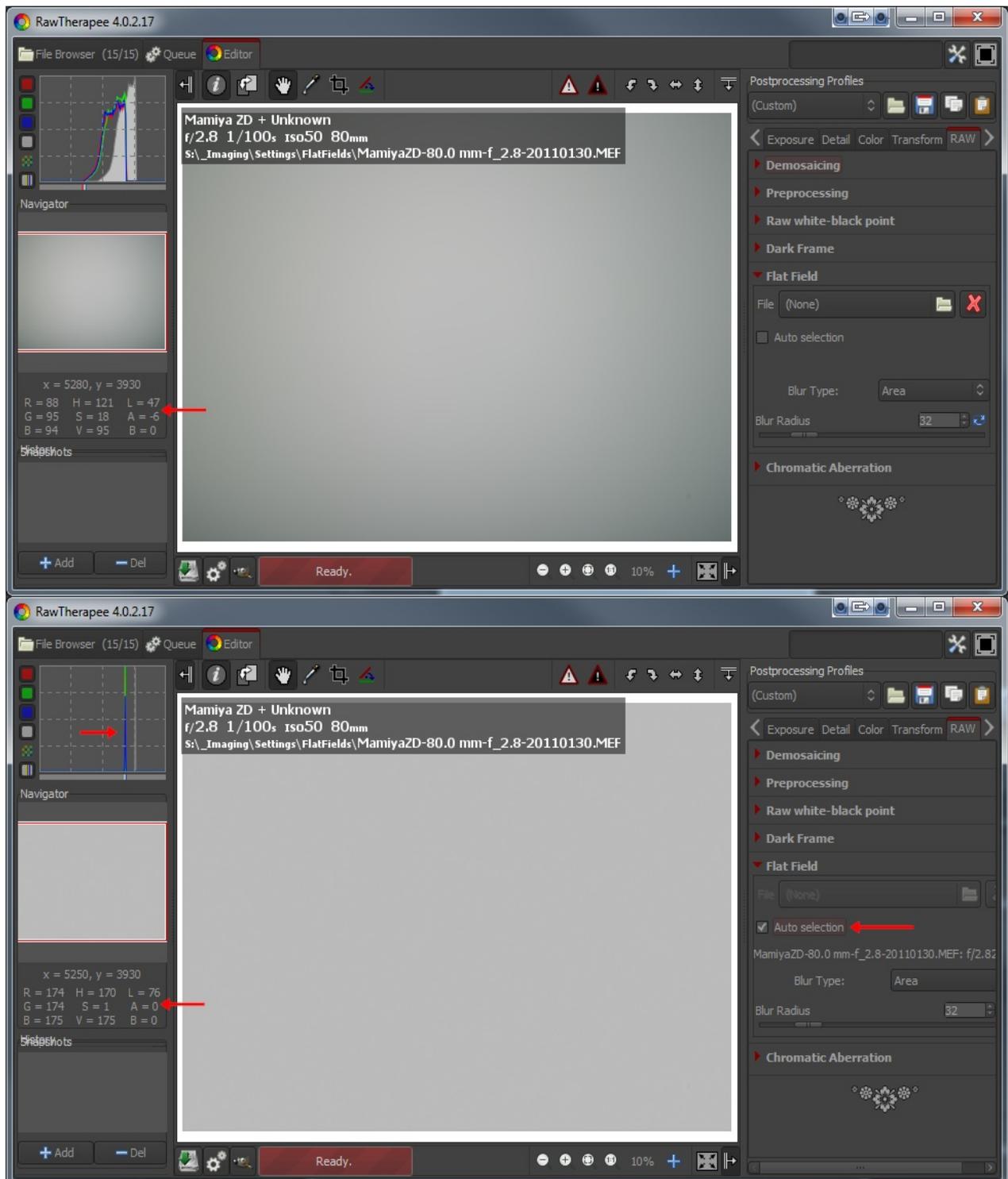
Blur Type	Purpose
Area	A default and generally most useful setting to apply blur action equally in all directions. Works well for correcting vignetting and lens cast.
Vertical	Blurs flat field in vertical direction to compensate for vertical non uniformities.  This is useful if vertical sensor readout has variation between the columns.
Horizontal	Blurs flat field in horizontal direction to compensate for horizontal non uniformities.  This is useful if horizontal sensor readout has variation between the rows.

Vertical + Horizontal	Blurs flat field sequentially in horizontal and then vertical directions to compensate for both vertical and horizontal non uniformities.
--------------------------	---

### **Blur Radius**

Blur radius controls the degree of blurring of the flat field data. Default value of 32 is usually sufficient to get rid of localised variations of raw data due to noise. Setting the Blur Radius to 0 skips blurring process and allows to correct for dust and other debris on the sensor (as long as their position has not changed) at the expense of carrying noise from the flat field file into the corrected image. If such correction is desired, it is advisable to create flat field files with minimum amount of noise at the lowest ISO setting and optimal light exposure.

All parameters in the flat field panel are saved into the development profile of the image being edited. These settings can be copied and pasted to other images just as all other development settings. This includes flat field auto selection option. Pasting it to different images will result in independent auto selection of the appropriate flat field for each of them.



*Demonstration of the effects of flat field removal from the flat field photo itself*

The figure above illustrates the application of a flat field file onto itself. There is a noticeable asymmetry shown in “before” image on top in the light falloff as well as in the green color cast. Flat field correction removes both color and luminance non uniformities and results in a perfectly uniform image. Histogram on the bottom (after) image indicates that corrected image does not have any variation in the tones, exactly what one would expect from a uniform (flat) field. The same level of correction is applied to the “real” image when it is flat field corrected.

## **Chromatic Aberration**

This tool corrects bluish-green and magenta fringes due to lens lateral chromatic aberration that shows mainly in the borders of the image. This correction is performed before actual demosaicing and can sometimes improve the quality of demosaicing step, but it is rather slow, so its results are shown only when zooming 100% or more.

### **Auto Correction**

If auto correction is checked the Red/Blue sliders are disabled and an automated detection and correction of chromatic aberration is attempted.

### **Red and Blue**

If the Red/Blue sliders are non-zero the given values are used to correct chromatic aberration.

## Metadata tab

### Exif tab

Here you can control which Exif metadata will be contained in the saved (developed) image file. The Exif metadata is usually created by the camera itself and implemented into the raw image file. Basic Exif informations are directly visible. Extended Exif information and so-called makernotes are organized into a tree. Click on the arrow at the very left of the desired subtree and you'll see its contents. Makernotes are informations varying between camera manufacturers and even between camera models.

You can Remove, Keep, or Add/Edit Exif metadata. Manipulating metadata does not change the source file in any way! If you want to restore a value you have changed or removed by accident, simply press Reset. Reset All works similar but is used for trees and works recursive, which means that all values changed/removed in this subtree are restored.

You can Add/Edit the following Exif information: Artist, Copyright, ImageDescription and Exif.UserComment. Only the English names of the Exif fields are displayed for easy reference. They are not translated when you choose a different GUI language.

Tip. If you want to add a specific tag to every processed photo, such as the Artist tag so that your name will appear, Artist field for, then do this. Open a raw (it will be opened with the profile you use by default), go to the Exif tab, click Add/Edit, choose Author, fill in your name and save this profile with a new name, like *default-exif.pp3*. Now open "*Preferences > Image Processing*" and set *default-exif.pp3* as your default profile for raw (or non-raw) photos.

### IPTC tab

IPTC values belong also to the group of metadata, as they are integrated into the image files but do not add any picture details (additional or different pixels) to the image. Basically the metadata summarized as IPTC contains additional information about your image. As this information is saved within the image file it cannot get lost. This eases the the workflow a lot as you don't have to care about another file when e.g. backing up or sorting your images.

IPTC is usually used to describe the image in detail. There are a lot image database softwares that use the (IPTC) information saved in images to e.g. fill their descriptive fields. For example you can also use IPTC fields when you try to sell your images. Most online companies willing to sell your images support IPTC tags when you upload your images to their databases, thus you have less work. Adding e.g.

keywords on your computer at home is much more comfortable than doing it through the web browser. Multiple Keywords and Suppl. Categories can be added/removed using the plus and minus signs next to it.

The button Reset (under) resets the IPTC values to those saved in your current profile. There are two more buttons, one copies your current IPTC setting to the clipboard. This is especially useful when you you want to apply the same IPTC values to multiple images. The other one pastes the formerly copied IPTC settings from the clipboard to your current image.

# Preferences Window

## General Tab

### Workflow

Choose here between single editor tab and multiple editor tabs mode. If you own a second monitor, you can use that one as well. With 'Histogram in left pane' and 'show profile selector' you can control what and where the tools are shown in the edit panels. It helps you to save GUI space.

A restart is required for these options to take effect.

### Default Language

Select the language for the GUI out of a list of thirty languages. English (US) is the default ('mother') language, translations are based on that one. On Win Vista/7 64bit you can have the language automatically read from the operation system.

Again, a restart is required to change the language of the GUI.

### Default Theme

Choose between several themes for the GUI, from light to dark. The effects are visible after a few seconds, so no need to restart here. Checking 'Use System Theme' might change the appearance of RawTherapee, although this depends on the platform and the window manager in use. Just see if it works for you.

Cut overlay brush: this is the color of the area outside of a crop. By clicking on the colored button, a new window appears where you can also set transparency. If set to 75, the cropped area is still somewhat visible. Useful to move the crop around and to find the best composition (hold the Shift key and move the crop with the mouse).

Choose the font of your liking here. With smaller fonts more tools can be displayed on the screen.

### Clipping Indication

When checked, the raw photo blinks at underexposed and overexposed areas. The both threshold sliders determine at which values blinking begins (0..255). In RawTherapee 4.0 the clipping indicators are calculated on the final image in the output space selected for the image. The clipping indicator takes the distance to the maximum/minimum and renders these as grayscale values. Mention the clipping is only calculated at the end of the processing chain. However, since RawTherapee 4.0 has a floating point engine, there are fewer positions within the processing chain where clipping can occur at all.

## **Date Format**

Determines the date format of the thumbnails in the file browser window.

## **External Editor**

When you send a raw from within RawTherapee to an external editor for further processing, RawTherapee needs to know which program you want to use. If that's not the Gimp, you can specify the path to your favorite photo editor here.

## **Custom Profile Builder**

Executable (or script) file called when a new initial profile should be generated. The executable receives command line parameters to allow a rule based PP3 generation:

[Path raw/JPEG] [Path default profile] [f-no] [exposure in secs] [focal length in mm] [ISO] [Lens] [Camera]

In the 'samples' folder you can find the RTPProfileBuilderSample.cs / cs.config file which can serve as a basis for your own custom profile program. It is heavily documented in the files.

This feature is very powerful to automatically set e.g. lens correction parameters or noise reduction base on image properties. It is called just once on first edit of the picture.

## **About**

Shows information about the original author of RawTherapee and the current version, details of the build, names of developers and other contributors and the licence under which RawTherapee is published: GPL 3.

# **Image Processing Tab**

## **Default Image Processing Parameters**

Specify which profile RawTherapee has to use when opening a raw and when opening a non-raw photo. When you have made your own default profile, you can tell RawTherapee to always use that one.

The profile for non-raw files like jpg or tif can probably best set to neutral. The neutral profile just loads the photo as it is, without applying for example Auto exposure or sharpening.

## **Processing Profile Handling**

Save processing parameters next to the input file: When checked, RawTherapee writes a PP3 file with all the edits you made to your photo next to the input (raw) file. This represents your work (e.g. sharpening settings used) and can be reloaded later.

Save processing parameters to the cache: Instead of creating a PP3 file next to the raw, this option - when checked - writes the PP3 to the cache. When you check the last option only, chances are that you lose your work (the edits) when installing RawTherapee on a new pc for example.

It's usually a good idea to only save the processing parameters next to the input file, since you can e.g. back them up along with the your raws.

### **Dark Frame**

Specify the directory on your hard disk for searching for the dark frame shots for long exposure noise subtraction. File with coordinates listing of the bad pixels must be placed in the same directory for auto correction.

### **Flat Field**

Specify the directory on your hard disk for searching for the flat field reference images.

### **Metadata**

The option "Copy IPTC/XMP unchanged" changes RTs metadata behavior. Usually RT will remove all IPTC/XMP data from the input image and write only its own tags in IPTC section. This may become a problem when you tag your input files using other programs, raw usually contain XMP data. This would be lost. By checking this option RT will not touch IPTC and XMP data at all, just passing them through. On the downside all your tagging within RT will not be saved though.

## **File Browser Tab**

### **Image Directory at Startup**

At the top you can define the Image directory at startup. It could be the RawTherapee Installation directory, the Last visited directory, the Home directory, or you define another directory.

Next you can set some File Browser / Thumbnail Options. This option defines whether you can see date and time or Exif information below the images in the file browser.

The Menu Options determine the grouping of the right-click context menu in the file browsers.

You can also define a list of parsed extensions, i.e. which files are recognized as images. Some extensions are defined by default. Those can be deactivated by removing the checkmark in front of it. If a desired extension is missing you can easily

add it by using the plus button.

At the bottom of that page there are several Cache options that influence the speed of loading/generating the thumbnails. These options are quite self-explaining. The JPG option is usually the fastest and uses the least disk space, however the thumbnail quality is the least.

## Color Management Tab

Here you can define the directory where ICC profiles could be found. You should also define the ICC profile of your monitor when you've done a calibration. If you don't do it, the image will be displayed with wrong colors.

The option "Automatically use operation systems main monitor profile" is currently only supported on Windows. Please mention that RT only knows about one monitor. So if you have multiple monitors connected, it will always take the main monitors profile (the one with the task bar).

You can also set the colorimetric intent which defines how the ICC profiles are used for translation between gamuts or color spaces

### Perceptual

If the color gamut of your image is higher than that one your device (monitor or printer) is able of then it is compressed a bit to fit the gamut of your device as far as possible. This might result in an image with reduced saturation, the hue is still kept. It might look a bit dull. But this is not really that much visible as the color relations stay the same. This method is activated by default (recommended)

### Relative Colorimetric

The colors existing in the color gamuts of both your image and your device are kept and displayed 100% perfect. If the color does not exist within the color gamut of your device the nearest possible value is taken. This might lead to some banding effects, especially visible in blue sky. The white point will be corrected.

### Saturation

Very similar to Perceptual, but here it is tried to keep the saturation and change the hue instead. This is very useful for e.g. screenshots or similar. It could also be used when you do not care of some possible color shift as long the image does not look dull.

### Absolute Colorimetric

Similar to Relative Colorimetric. It tries to reproduce the exact colors recorded in the original scene. The white point will not be corrected. It is normally used, when the gamuts of your image and your device are nearly the same. For example for reproduction of specific colors like reproductions of fabric or logo colors.

## Batch Processing Tab

The Batch processing is the capability of editing several images at the same time in the 'File Browser' tab. That's why there's a tool editor on the right of it.

This is done by selecting more than one file by using the Shift or Control key in the File Browser, then you can edit those images with the so-called 'Batch tool panel editor'. The way the sliders' value is used to modify the image depends on the options set in this 'Batch Processing' tab.

When you select a single image, the sliders get the values of the processing parameters of that specific image. These can be the values of the default profile or the values from your last edit session of this photo. If your image is currently being edited in an Editor tab, the editors' values will be reflected in real time in the Batch tool panel editor, and vice versa, so take care of what you're doing.

But if you select several images, the behavior of each sliders can be used in two different ways.

### The 'Add' Mode

The slider set to work in this mode will change its range and default value right after the image selection, in order to add the value of the slider to the value of the according parameter of each image.

For example, if you select two images by holding the Ctrl modifier key, one image that has an 'Exposure compensation' of -0,5 EV, and another one which has an Exposure compensation of +1,0 EV, moving the slider up to 0,3 will result in setting a value of -0,2 EV for the first image and +1,3 EV for the second one! This mode may also be understood as 'Relative mode'.

Using the 'Reset' button will move the slider to its default (zero) position and will then bring back the initial value of each images for this parameter.

### The 'Set' Mode

In this mode, the value of the slider will set 'as is' the value of the corresponding parameter.

If we use the same example as before, moving the slider up to 0,3 will result in setting a value of 0,3 EV for both images (one value for all images). This mode may also be understood as 'Absolute mode'.

Using the 'Reset' button will move the slider to its default position (different for each slider), and will then reset this parameter for each image.

You can select the desired behavior for each slider in this tab. Please note that all

sliders are not listed, because they are supposed to work in SET mode only.

The option “Overwrite existing output file” sets RT to overwrite an existing e.g. output jpg if it exists. If this is unchecked and you e.g. send an image a second time for conversion to the batch queue, RawTherapee will add a numeric index to the file name (e.g. myoutput\_1.jpg).

## Performance Tab

The Performance tab is only for people who know what they’re doing. It lets you poke under the hood and tweak the parameters of some tools. These parameters take part in the balance between speed and stability.

### Maximum Number of Threads for Noise Reduction

The Noise Reduction algorithm in RawTherapee is very powerful. It is also quite CPU and memory intensive. People with weak hardware who experience crashes caused by running out of RAM may find that tweaking this parameter prevents those crashes, at the cost of taking longer to process the image.

Noise Reduction a baseline 128MB of RAM for a 10 megapixel raw photo, or 512MB of RAM for a 40 megapixel one, and additionally 128MB RAM per thread. The more threads run in parallel, the quicker the computation, but higher the memory requirement.

Most modern CPUs run two threads per physical core. Find out what CPU you have and how many cores it has, multiply that by two, and you get the maximum number of threads it would make sense to run simultaneously. Let’s call this number  $T_{max}$ . You would not benefit from running more threads than this - in fact you would likely suffer a small speed penalty.

Setting this parameter to “0” will let your CPU figure out what  $T_{max}$  is, and use that. If you experience crashes due to insufficient RAM, then you can calculate  $T_{max}$  yourself and use a number lower than that.

## Sounds Tab

Here you can get notified with a sound when a lengthy operation has ended. It is currently only supported on Windows and Linux.

The *Queue processing done* sound is played after the last queue entry finished processing. The *Editor processing done* sound is played after a lengthy in-editor operation that took longer than the specified number of seconds is complete.

Sounds can be muted either by enabling the mute option or by setting fields with sound file references to blank values.

The Queue and *Editor processing done* text boxes can either point to wave (.wav) files, or can specify one of the following values:

- Windows:
  - *SystemAsterisk*
  - *SystemDefault*
  - *SystemExclamation*
  - *SystemExit*
  - *SystemHand*
  - *SystemQuestion*
  - *SystemStart*
  - *SystemWelcome*
- Linux
  - bell
  - camera-shutter
  - complete
  - dialog-warning
  - dialog-information
  - message
  - service-login
  - service-logout
  - suspend-error
  - trash-empty
  - possibly the name of any file in  
`/usr/share/sounds/freedesktop/stereo/`

# How to Obtain Nikon Profiles from NX2

Capture NX 2 and View NX are proprietary Windows software provided for Nikon cameras and are able to accurately develop raw images to match the in-camera rendering. Behind the scenes both programs generate ICC profiles which incorporate recipes for tonal changes according to their adjustments. Such profiles can be used as input ICC profiles in RawTherapee to lead to almost identical rendering, following the same recipe. The Nikon input ICC profiles are proprietary and cannot be distributed. Fortunately, this software extracts and generates input profiles on-the-fly in a temporary folder during runtime. Please coordinate use of these profiles according to licensing agreement of Nikon software. You can use installation of trial versions of Capture NX 2 and View NX to try the process below to refer to the generated profiles within RawTherapee.

- 1 First you have to install Capture NX 2 (version 2.3.8 was tested, the trial version is sufficient), but View NX 2 (free) should also work.
- 2 Open the NEF file in Capture NX 2. While the program is running and your picture is open by the program, look at the following hidden folder:

```
<Windows directory>:\Users\<<your username>\AppData\Local\Temp\Nkn<random strings>.tmp
```

The temporary ICC profiles will be created in this folder, similar to this one:

```
Nkx_D90_962_1_03_0_00_10_00_00_00_05_00_0200_0_0_476.icm
```

Under Windows XP the path differs:

```
C:\Documents and Settings\<<your username>\Local Settings\Temp\Nkn<random string>.tmp
```

- 3 Under *Picture Control* click on the *Launch Utility* button. While the utility is running the profiles will temporarily appear in the folders listed above. They appear there because Nikon applies generic profiles to your pictures. These are named „picture control” settings. For example, Capture NX 2 has „neutral”, „standard” and „monochrome” profiles. For use with RT you must simply know that Nikon generates different ICM profiles with every different setting. To ease the choices, the „neutral” ? „standard” ? „vivid” ? „landscape” settings seem to be similar, apart from the increased saturation and contrast. You should be able to tune the tone curves in RT, so in general, a single „neutral” profile should be good starting point.

**WARNINGS:** other settings may also generate new ICM files! You must be particularly aware that pictures shot under artificial lighting will have different profiles, and using such profiles with daylight shots will result in color casts. D-lighting dramatically changes contrast.

If in doubt, open your particular image you want the color profile for and use that profile in RT. In most cases, a generic color profile will be sufficient.

# Command Line Options

## Usage:

<code>rawtherapee [&lt;selected dir&gt;]</code>	Start RT GUI browser inside dir.
<code>rawtherapee &lt;file&gt;</code>	Start GUI editor with file.
<code>rawtherapee -c &lt;folder&gt; &lt;files&gt;</code>	Convert files in batch with default parameters.

## Options used with `-c` (`-c` must be last option):

```
rawtherapee [-o <output>|-O <output>] [-s|-S] [-p <files>] [-d] [-j[1-100]]|-t|-t1|-n] -Y -c <input>
```

<code>-o &lt;file&gt; &lt;dir&gt;</code>	Select output file or directory.
<code>-O &lt;file&gt; &lt;dir&gt;</code>	Select output file or directory and copy PP3 file into it.
<code>-s</code>	Include the PP3 file next to the input file (with same name) to build the image's parameters, e.g. for <i>photo.raw</i> there should be a <i>photo.raw.pp3</i> file in the same directory. If the file does not exist, internal default values (not those in Default.pp3) will be used.
<code>-S</code>	Like <code>-s</code> but skip if the PP3 file does not exist.
<code>-p &lt;file.pp3&gt;</code>	Specify PP3 file to be used for all conversions. You can specify as many <code>-p</code> options as you like (see * below).
<code>-d</code>	Use the default raw or non-raw PP3 file as set in Preferences > Image Processing > Default Image Processing Parameters.
<code>-j[1-100]</code>	Specify output to be JPEG (on by default). Optionally add compression 1-100.
<code>-t</code>	Specify output to be uncompressed 16-bit TIFF.
<code>-t1</code>	Specify output to be compressed 16-bit TIFF (ZIP compression).
<code>-n</code>	Specify output to be compressed 16-bit PNG.
<code>-Y</code>	Overwrite output if present.

Your PP3 files can be incomplete, RawTherapee will set the values as follows:

- 1 A new profile is created using internal default values (hard-coded into RawTherapee),
- 2 then overridden by those found in the default raw or non-raw PP3 file (if `-d` has been set),
- 3 then overridden by those found in the PP3 files provided by `-p`, each one overriding the previous values,
- 4 then overridden by the sidecar file if `-s` is set and if the file exists; the time where the sidecar file is used depends on the position of the `-s` switch in the command line relative to the `-p` parameters, e.g. `-p first.pp3 -p second.pp3 -s -p fourth.pp3`

# Examples

## Example 1

In Linux, process a single raw which resides in /tmp and is called “photo.raw”, use its sidecar file (photo.raw.pp3) during conversion, save it in the same dir as “foo.tif”, and overwrite the file foo.tif if it exists:

```
rawtherapee -o /tmp/foo.tif -s -t -Y -c /tmp/photo.raw
```

## Example 2

In the next example, we’ll assume that you want to quickly process all your raw photos from the /tmp/jane01 directory to a web subdirectory by using the default profile as a basis, using the sidecar profile if it exist, but with removing some Exif tags (e.g. the camera’s serial number) and adding some IPTC tags (e.g. your usual copyright parameters), plus resize and sharpen the image for the web (spread over multiple lines for clarity):

```
rawtherapee -o /tmp/Jane01/web
             -p ~/profiles/iptc.pp3
             -s
             -p ~/profiles/exif.pp3
             -p ~/profiles/web.pp3
             -t
             -Y
             -d
             -c /tmp/Jane01/
```

The processing profile will be built as follows:

- 1 A new profile is created using internal default values (hard-coded into RawTherapee),
- 2 then overridden by those from the default raw profile (-d),
- 3 then overridden by those found in iptc.pp3,
- 4 then overridden by those found in the sidecar file (-s) if it exists, so you can force some IPTC tags even if already set by iptc.pp3,
- 5 then overridden by those found in exif.pp3, so you can force the profile to erase some tags,
- 6 then overridden by those found in web.pp3, to resize and sharpen the image, and make sure that the output colorspace is sRGB.

As you can see, the position of the -s switch tells when to load the sidecar profile relative to the other -p parameters. That is not the case for the -d switch.

## Example 3

In the third example, we will see how long it takes to process every raw file in a directory, assuming that each raw photo has a corresponding processing profile:

```
time {
    for f in /home/user/photos/2011-11-11/*.raw; do
```

```
rawtherapee -o /dev/null -S -t -Y -c "$f";  
done  
}
```

# Shortcuts

Mode	Shortcut	Action
Any	<b>Ctrl+F2</b>	Switch to File Browser
Any	<b>Ctrl+F3</b>	Switch to Queue
Any	<b>Ctrl+F4</b>	Switch to Editor (when in single tab mode)
Any	<b>F11</b>	Toggle fullscreen.
Editor	<b>1</b>	Zoom to 100%
Editor	<b>-</b> or <b>_</b>	Zoom out.
Editor	<b>+</b> or <b>=</b>	Zoom in.
Editor	<b>8</b>	Background color of image preview: theme-based
Editor	<b>9</b>	Background color of image preview: black
Editor	<b>0</b>	Background color of image preview: white
Editor	<b>&lt;</b>	Show/hide highlight clipping.
Editor	<b>&gt;</b>	Show/hide shadow clipping.
Editor	<b>Shift+B</b>	Before/After view.
Editor	<b>C</b>	Crop tool. <b>Shift-click-drag</b> within the cropped area to move the entire crop border
Editor	<b>Ctrl+E</b>	Edit current image in external editor.
Editor	<b>Ctrl+S</b>	Save current image.
Editor	<b>Ctrl+Shift+S</b>	Save current processing profile (the one next to the image file and/or in the cache). Use this to minimize damages if RT crashes.
Editor	<b>Ctrl+Shift+Z</b>	Redo.
Editor	<b>Ctrl+Z</b>	Undo.
Editor	<b>Double-click</b> on canvas outside photo	Cycle canvas color (black / theme background color / white).
Editor	<b>F</b>	Fit to screen.
Editor	<b>H</b>	Hand / cross tool (standard); use this to navigate around a zoomed image or to move the frame that defines where the detail window is.
Editor	<b>I</b>	Show/hide Exif info overlay.
Editor	<b>Right-click</b> in the preview area	Get back to default cursor (after having used the pipette for white balance or the straightening tool).  If RGB indicator bar is enabled, this freezes/un-freezes its indicators
Editor	<b>S</b>	Select straight line (Rotate tool).
Editor	<b>Shift+drag</b> crop	Allow to move crop border.
Editor	<b>W</b>	White balance.
Editor	<b>r</b>	Toggle Preview mode - Red
Editor	<b>g</b>	Toggle Preview mode - Green
Editor	<b>b</b>	Toggle Preview mode - Blue

Editor	<b>v</b>	Toggle Preview mode - Luminosity
Editor	<b>Shift+F</b>	Toggle Preview mode - Focus mask
File Browser	<b>~</b>	Show only images without a rating.
File Browser	<b>1 through 5</b>	Show only images with specific rating
File Browser	<b>6</b>	Show only not edited images.
File Browser	<b>7</b>	Show only edited images.
File Browser	<b>Alt+~</b>	Show only images without color label.
File Browser	<b>Alt+ 1 through 5</b>	Show only images with specific color label.
File Browser	<b>Alt+6</b>	Show only images that were not recently saved.
File Browser	<b>Alt+7</b>	Show only images that were recently saved.
File Browser	<b>Ctrl+O</b>	Sets focus to Browse path, selects contents.  Browse Path shortcuts: ~ - user's home directory ! - user's picture directory Press "Enter" to refresh. Press Ctrl+Enter to reload
File Browser	<b>Ctrl+F</b>	Sets focus to the Find box, selects contents. Press "Enter" to execute search ( <i>comma-separated values list is supported</i> ) Press "Escape" to clear the Find box
File Browser	<b>D</b>	Clear all filters: ratings, color labels, edited(not), saved(not), trash can
File Browser	<b>F2</b>	Call up the dialog for file rename. If multiple thumbnails selected, dialog will be called for each.
File Browser	<b>T</b>	Show trash contents.
File Browser, Editor	<b>Alt+E</b>	Switch to exposure tab.
File Browser, Editor	<b>Alt+D</b>	Switch to details tab.
File Browser, Editor	<b>Alt+C</b>	Switch to color tab.
File Browser, Editor	<b>Alt+T</b>	Switch to transform tab.
File Browser, Editor	<b>Alt+R</b>	Switch to raw tab.
Editor	<b>Alt+M</b>	Switch to metadata tab.
File Browser, Editor	<b>Ctrl+L or L</b>	Toggle left panel
File Browser, Editor	<b>Alt+L</b>	Toggle right panel
Editor	<b>Shit+L</b>	Toggle Top panel

Editor	<b>Ctrl+Shift+L</b>	Toggle Left and Top panels
File Browser, Editor	<b>Alt+Shift+L</b>	Toggle Right and Top panels
File Browser, Editor	<b>Ctrl+Alt+L</b>	Toggle Left and Right panels
Editor	<b>Ctrl+Shift+Alt+L</b>	Toggle Left, Top and Right panels
File Browser, Editor	<b>M</b>	Toggle all peripheral panels (maximize main panel)
File Browser, Editor	<b>Ctrl+Q</b>	Add current image to processing queue.
Tool Panel	<b>Ctrl+click</b> on a slider's reset button	The slider is reset to the value it had when the image was loaded in the Editor, or when the image was selected in the File Browser.
Tool Panel	<b>Ctrl+drag</b> a curve point	The point moves slower than the mouse cursor. Allows finer adjustments to the curve.
Tool Panel	<b>Shift+drag</b> a curve point	The point is snapped to key positions highlighted in red.
Tool Panel	<b>Right+click</b> over a tool panel title (foldable section)	Unfolds clicked section and folds all others.

### Windows-only shortcuts

Mode	Shortcut	Action
File Browser, Editor	<b>F5</b>	Open result image in default viewer (must have been processed before). Uses current queue settings to determine output file path.
File Browser, Editor	<b>Ctrl+F5</b>	Open Explorer in the raw directory and select current image.
File Browser, Editor	<b>Shift+F5</b>	Open Explorer in the queue output directory and select current image if already converted.
	<b>Alt</b>	When pressed while working in the Editor tab, it temporarily enables both shadow and clipping indicators during preview image updates.

# Contributors

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