

HBComposer - User Guide

Version 1.3.1b - © 2025 Marco Ristuccia



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Introduction

HBComposer is an unofficial tool for pre-processing *Hasselblad* RAW files. It is able to perform the following *3FR* to *3FR* operations in the RAW domain:

- Frame-Average
- Frame-Median
- Advanced Flat-Field correction

Since the produced files are still raw files, they can be further processed in any RAW developer, especially in *Hasselblad Phocus* **without losing the advantage of the *Hasselblad Natural Color Solution* (HNCS)**. The advanced flat-field correction is able to fix the infamous *Hasselblad PDAF banding* issue and any **sensor tiling** artifacts generated by digital backs when used in conjunction with technical cameras and shifted wide-angle lenses.

***** DISCLAIMER ***** *I am in no way connected to Hasselblad, nor does Hasselblad endorse this project. This tool is the result of my personal initiative and the files produced are not guaranteed to be 100% OEM compliant. Moreover, Hasselblad may change their RAW file specs in any moment causing the tool to stop working.*

Product installation and execution

Getting HBComposer

HBComposer is offered for free. You can download it from my web site under the following link:

<https://photography.marcoristuccia.com/hbcomposer-an-hasselblad-raw-file-composer/>

Support my work *Please consider donating to allow me spend more time in improving it and fix any bugs. Thank you!*

Installing HBComposer

The *HBComposer* installation file is a typical *Apple DMG* archive. Once downloaded, just double click on it, a window will show up (*Figure 1*).

Just drag the *HBComposer.app* icon onto the *Applications* one. The application will be installed, if a previous version is already present, *macOS* will ask whether to overwrite the old version.

Installing Java runtime

To run *HBComposer*, a *Java* runtime needs to be installed on your system. The minimum supported version is **Java SE 11**, although it is highly recommended to install **Java SE 21 LTE** (Long Time Support) or **Java SE 24** (the latest version to date).

You can download Java from the following link:

<https://www.oracle.com/java/technologies/downloads/?er=221886#jdk21-mac>

Running HBComposer

Once installed, you will find *HBComposer* among the *macOS* applications. Just click on it. Please be patient, the application startup may take a few seconds since *macOS* needs to verify the application and instantiate the Java runtime environment.

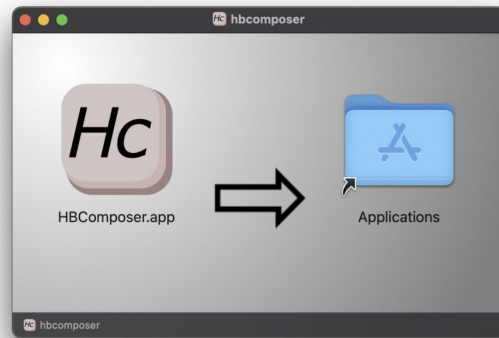


Figure 1: HBComposer installation window

Since I'm officially part of the Apple Developer Program, I have digitally signed and notarized *HBComposer* as per *Apple* recommendations. Security wise, *MacOS* should not complain about installing it, apart from advising you that the application has been downloaded from the Internet and asking for your authorization to proceed.

Since the application will not be downloaded from the official *Apple Store* however, you may need to slightly relax the security settings by allowing applications from “**Apple Store & Known Developers**”. Such an option can be found under **Settings** -> **Privacy & Security** as shown in *Figure 2*.

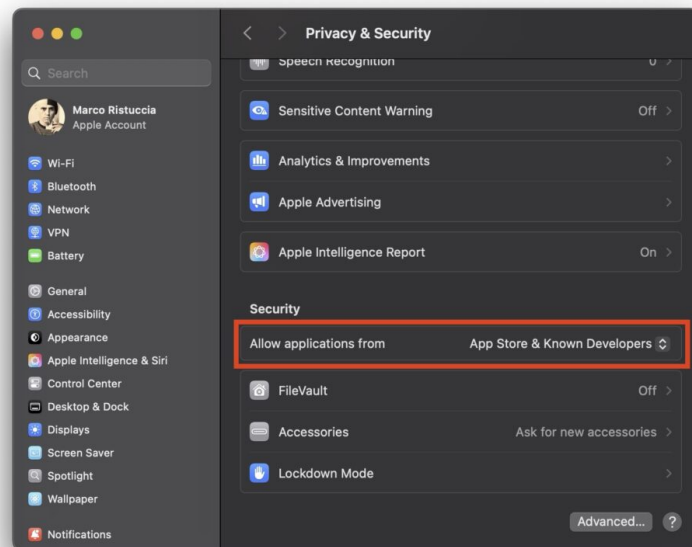


Figure 2: macOS Privacy & Security settings

User interface overview

In *Figure 3*, a screenshot of the graphical user interface (GUI) is shown.

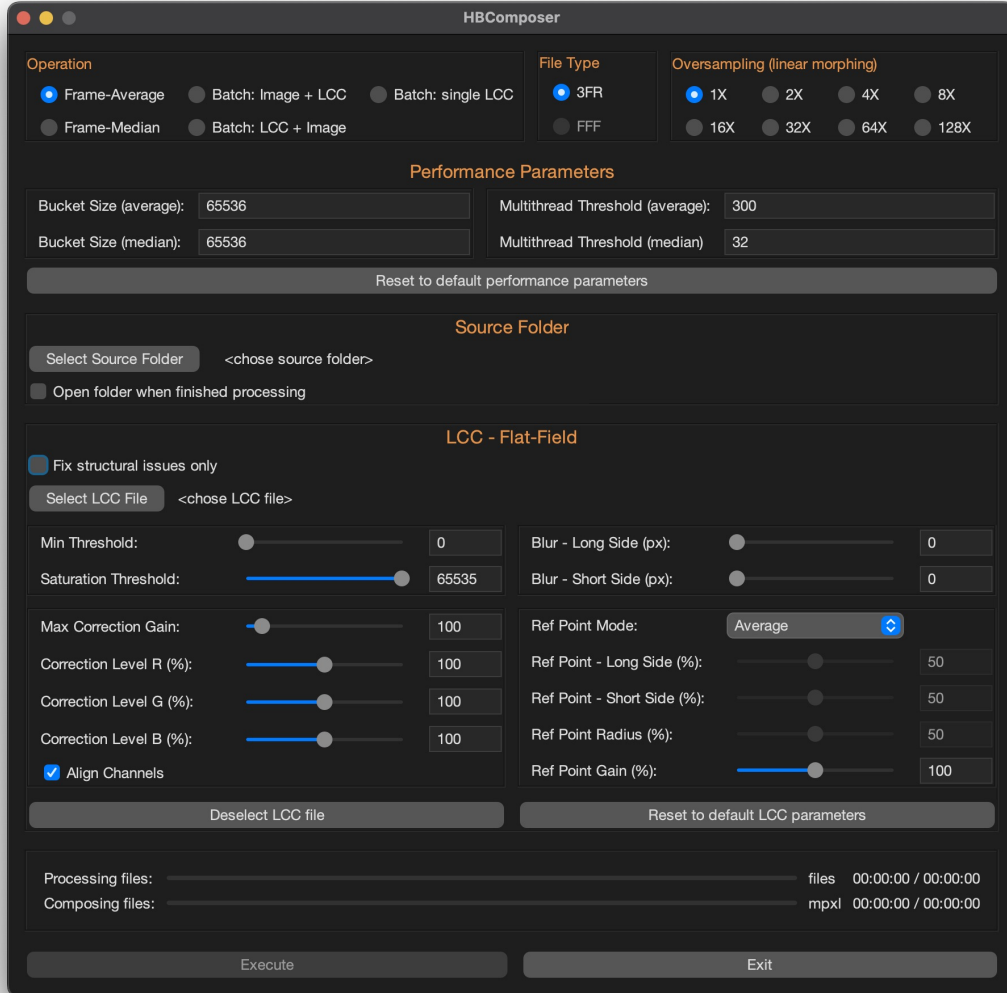


Figure 3: HBComposer - User interface

In the following sections, the general configurations are described first. Each operation will be then explained in detail on dedicated sections.

File Type

The tool has been initially designed to operate on both *3FR* and *FFF* Hasselblad RAW files.

Due to technical reasons though, only *3FR* files are supported at the moment. For such reason, the *FFF*

option is grayed out and is not selectable.

Performance parameters

Such parameters only apply to the Frame-Average and Frame-Median operations. There is a couple of them for each of the two operations:

- **Bucket Size**

Represents the sliding memory window which buffers the part of the image that is currently in memory while processing the frame compositions. It is represented in bytes. The default value is a good compromise for the majority of systems. If your system happens to have a large amount of RAM (> 36GB) you can try increasing this value (keep it a multiple of 4096). This may speed up the composition operation. Be aware however that you may experience memory over-allocations, in such case the application may slow down or even crash with an unexpected exception. If this happens, just restart *HBComposer* and reset to the default performance values. If you decide to venture into changing this parameter, you'll need to find the sweet spot.

- **Multithread Threshold**

Represents the maximum number of parallel processing threads. The default value is a good compromise for the majority of systems. If you have a large amount of CPU cores (> 14) you can try increasing it. This may speed up the composing operation. If you decide to venture into changing this parameter, you'll need to find the sweet spot.

*NOTE: Please Be aware that **all performance parameters are remembered** after closing and reopening the application. You should always check their values when reopening HBComposer for a new project. They can be reset to the default values by clicking the dedicated button.*

Source Folder

A user selectable folder where all operations are performed. All images to be processed must reside there. The processing is not recursive, therefore any sub-folder is not processed. You have the option to automatically open such folder after the processing is finished.

Processing progress & statistics

In the bottom area of the application window there are progress bars that are updated while processing. The composition operations will process files first, then compose them, so both progress bars are updated. The batch LCC operations only update the first progress bar.

Operations

Frame-Average

This operation will perform a composition of all images found in the Source Folder, producing a single RAW image which represents a pixel-by-pixel average of all processed images. The output file will have the name **FA.3FR**. This file is automatically ignored by all the operations, so you can keep it there and re-run *frame-average* or *frame-median* without it to be part of the composition. It will be simply rewritten.

In a typical situation, you place your camera on a tripod and use the featured internal intervalometer to shoot a series images of the same scene at a specified time cadence.

Figure 4 presents an example of the results that can be achieved with a frame-average.

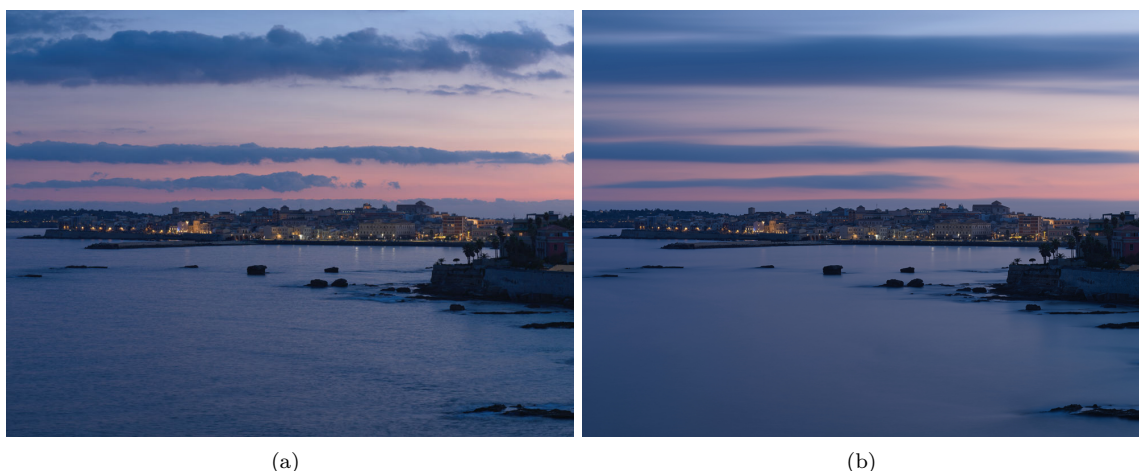


Figure 4: (a) Single frame (b) Frame-average of 160 RAW images

It shows the result of a frame-averaged composition of 160 shots, each one made at ISO 64, f8 and 0.8s exposure time without any ND filter. It produced a RAW image which is equivalent to a 2-minutes long exposure taken with an 8-stops ND filter on.

Frame-Average may be useful for the following purposes:

- **On static subjects, it reduces the overall image noise, especially in the shadows.**
Noise is reduced the square root of the number of averaged frames averaged. So, if you average 4 images, noise will be reduced to 1/2 of the noise you'd have on a single image.
- **On moving subjects, it produces an effect similar to the long-exposure.**
An advantage of this technique is that you can operate in daylight without the need of an ND filter, as you should have in a standard long-exposure image in order not to overexpose it (see note just here below).
A disadvantage is that as of now *Hasselblad* cameras don't allow shooting images at a speed greater than 1 image every two seconds. Thus, **fast moving objects may not be represented as a continuous trail** in the final composed image. To try to partially compensate for this issue, an **oversampling** function has been added to the tool. You find it in the top-right area of the application window. This feature adds fake intermediate frames where each pixel is created as a linear interpolation between each couple of real frames.

Frame-Median

This operation will perform a composition of all images found in the Source Folder, producing single RAW image which represents a pixel-by-pixel median of all processed images. The output file will have the name **FM.3FR**. This file is automatically ignored by all the operations, so you can keep it there and re-run *frame-median* or *frame-average* without it to be part of the composition. It will be simply rewritten.

In a typical situation, you place your camera on a tripod and use the featured internal intervalometer to shoot a series images of the same scene at a specified time cadence.

Figure 5 presents an example of the results that can be achieved with a frame-median.



Figure 5: (a) Single frame (b) Frame-median of 34 RAW images

It shows the result of a frame-median composition of 34 RAW shots, each one made at ISO 64, f8 and 1/10s exposure time without any ND filter. All moving objects have been automatically eliminated in the produced RAW image.

On scenes containing moving objects, like **cars, persons, etc...**, *frame-median* may be useful to **cancel them out from the final image**. For example, a crowded place where many people pass by can be turned into an empty space. This can be useful, for example, in architecture photography.

Like with *frame-average*, oversampling could help in smoothing out some gaps, on moving clouds for example, although it will increase calculation times (see an example of oversampling results below in the dedicated section).

Oversampling Oversampling introduces “fake” frames into the image compositions with the goal of smoothing out some gaps that may arise when there are moving objects in the scene, and the time interval between image captures is so long that it may create gaps and visible steps.

In *Figure 6* you’ll find a result comparison on a frame-median composition of **100 images shot at a frequency of 1 every 10 seconds**. Without oversampling, gaps in the clouds are visible in the upper and central right part of the image. An oversampling of 16X succeeded in smoothing things out.



Figure 6: (a) Frame-median with no oversampling – gaps are present in the clouds (b) Frame-median with 16X oversampling – gaps in the clouds are smoothed out

Flat-Field Correction

HBComposer features a *flat-field* correction operation and offers an advanced set of fine-tune parameters.

This technique consists in taking an additional image, called *flat-field* or *LCC*, while holding a thick piece of plexiglas in front of the lens. This special image should be acquired in the very same conditions of the image it will then correct. Aperture, focus, shift/tilt levels, and light conditions need to match. The shutter duration can be adjusted to get a correct exposure of the *flat-field* image. A good *LCC* exposure is key to the effectiveness of this technique.

From now on, the words *flat-field* and *LCC* will be used alternatively with the same meaning.

Figure 7 shows a typical histogram of a well exposed *flat-field* image.

Figure 8 shows a typical example of a flat-field image taken with a technical camera and a shifted (raised) lens.

Figure 9 explains how the *LCC* correction process works. The *flat-field* capture is applied to the original image to normalize it.

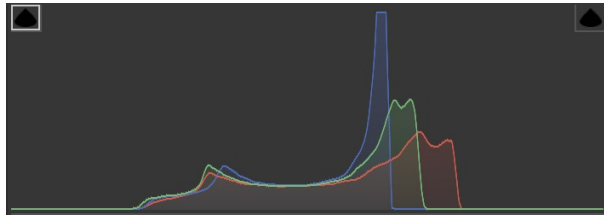


Figure 7: Histogram of a well exposed flat-field (LCC) image



Figure 8: Example of Flat-Field (LCC) image

Goals of flat-field correction

Flat-field correction allows to reduce and sometimes fully eliminate the following image issues:

- **Color aberrations** when taking images with **shifted lenses**. The issue is particularly evident on non-BSI sensors when used in conjunction with symmetrical wide angle and ultra wide-angle lenses, such as the *Schneider-Kreuznach* technical ones, but also some *Rodenstocks* can cause this problem.
- **Vignetting** when taking images with **shifted lenses**. The issue is particularly evident if using symmetrical wide angle and ultra wide-angle lenses, such as the *Schneider-Kreuznach* technical ones, but also some *Rodenstocks* may cause this problem.
- **PDAF sensor banding**, an issue that has been discovered by GetDPI forum member @diggles while using use the most recent *Hasselblad CFV-100c* digital back together with a *Schneider-Kreuznach Apo-Digitar 5.6/35 XL* lens. It shows up when shifting such lens, especially on uniform areas like the sky. In *Figure 10* is presented an example of PDAF banding fix performed by *HBComposer's flat-field* correction.

You can follow the forum discussion under the following link (click on it):



Figure 9: Flat-field application process



Figure 10: (a) Original image - PDAF banding and vignetting present (b) Processed image - Hasselblad PDAF banding and vignetting corrected

<https://www.getdpi.com/forum/index.php?threads/hasselblad-100c-and-35xl.75781/>

- **Sensor tiling**, an issue which makes evident in the final image the different tiles a digital sensor is composed of. The issue is particularly evident on non-BSI sensors when used in conjunction with symmetrical wide angle and ultra wide-angle lenses, such as the *Schneider-Kreuznach* technical ones, but also some *Rodenstocks* can cause this problem.
- **Dust spots** present on the sensor glass which are visible in the final image as darker circular or elongated shapes. In *Figure 11* is presented an example of dust spot fix performed by HBComposer's *flat-field* correction.

IMPORTANT NOTE: unfortunately, in case of extreme vignetting or CA, the flat-filed algorithm will not be able to correct everything. High noise and residual color casts need to be corrected later on in the image processing chain, in the RAW developer or in post-production.



Figure 11: (a) Original image - dust spot and vignetting present (b) Processed image - dust spot and vignetting corrected

Operations and flat-field correction

You can apply a *flat-field* correction during the following operations:

- **Frame-Average and Frame-Median**

In such cases, the flat-field correction is applied to the final composed image before saving it to disk. Select the LCC file and adjust all the parameters before executing the composition.

**** NOTE: for frame-average and frame-median operations, the LCC file must not be placed in the Source Folder together with the images to be composed, If it is put there, it will be mistakenly included in the composition as an additional frame. You can place it in a sub-folder instead, so that it won't be composed but only applied at the end.*

- **Batch LCC process on image couples**

In such case, you need to arrange images in the Source Folder in couples, so that when alphabetically sorted, each *LCC* image will immediately follow (Image + LCC) or precede (LCC + Image) its target image.

The corrected images produced by HBComposer will hold the original name with an addition of the "_HBC" suffix.

- **Batch image process with a common LCC image**

A single LCC is applied to all files present in the *Source Folder*. In such case, you need to manually choose the LCC image as you would do with *Frame-Average* and *Frame-Median*.

The corrected images produced by HBComposer will hold the original name with an addition of the "_HBC" suffix.

Flat-field correction modes

Since version 1.3.0b, HBComposer offers two ways of applying the *LCC* to a RAW image:

- **Full LCC correction**

It corrects all anomalies: PDAF banding, dust spots, sensor tiling, color cast and vignetting. After this step, LCC correction is fully done and you don't need to apply it through RAW developers.

- **Correction of structural anomalies only**

It only fixes PDAF banding, sensor tiling and dust spots. Usually, such anomalies are not addressed by the *flat-field* correction implemented in RAW developers like *Hasselblad Phocus* and *Adobe Lightroom*. After this step done HBComposer, you'll need to apply the *LCC* through a RAW developer as you would normally do in normal circumstances. This allows for maximum flexibility.

Flat-field correction settings

HBComposer offers a set of fine-tuning parameters for *flat-field* correction. Normally, you would leave everything at default values, with the exception of the *Ref Point* selection.

Here below a brief description of each setting is given:

Fix structural issues only As described above, this flag restricts the correction process to PDAF banding, sensor tiling, and dust spots only. Corrections of color cast and vignetting will be instead handled by external RAW developers through their proprietary *LCC* processes.

When this flag is enabled, all *LCC* fine-tuning controls related to color cast and vignetting will be disabled. The blur settings take on a slightly different role: they define the amount of blur applied to the *flat-field* image prior to be used on itself. This technique helps normalize the *LCC* image to a neutral, uniform baseline while preserving the structural anomalies necessary for correcting the RAW image. The minimum blur radius is 64 pixels, but you may need to increase it further if residual anomalies persist in the final image.

This flag is enabled by default, as the current implementation of *HBComposer*'s full *LCC* correction may introduce more noise than external RAW developers, likely due to the absence of a luminance noise reduction pass.

NOTE: this option will increase the execution time.

Min Threshold Sets the minimum value of the *LCC* to be considered for correction (0-65535).

Normally, *Hasselblad* RAW files have a black level set to 4096, so anything below that would work. You may need to increase it above 4096 if the sensor has some defective pixels that would create problems in the final image. This is really rare though.

If unsure, leave it to the default value (0).

Saturation Threshold Sets the maximum value of the *LCC* to be considered for correction (0-65535)

Normally *Hasselblad* RAW files have a maximum pixel level set to 65535. You may need to decrease this setting below that if the sensor has some defective pixels that would create problems in the final image. This is really rare though.

If unsure, leave it to the default value (65535).

Max Correction Gain The *flat-field* correction algorithm calculates an amplification factor for each pixel of the target image. This setting defines the its maximum (peak). The algorithm will cap the amplification factor to this value. Normally, it can be kept high. You may need to lower it down in case of clipping.

If unsure, leave it to the default value (100), or even 1000.

Correction Levels (R, G, B) (%) Sets the percentage of *LCC* correction to be applied on each color channel. Normally it should be kept to 100%. You may increase it together with the other channels to over-correct, or decrease to under-correct. If the three sliders are disjoined and set differently from each other, this correction can help in fine-tuning any global color cast, especially if the chosen reference point is not perfectly neutral (see below).

The *Max Correction Gain* caps the maximum amplification factor resulting from this setting. If unsure, leave the three levels aligned to the default value (100%).

Blur (long / short side) Sets the pixel radius of LCC blur along each side of the frame. This setting has two different meanings and consequent behaviors depending on the selected LCC correction mode:

- **"Fix structural issues only" option disabled**

Increasing it will reduce the noise in the final image, but it will reduce the effectiveness of any correction of structural image issues, like dust spots, sensor tiling and PDAF banding. For PDAF banding correction, the default value of (0, 0) is recommended. A slight blur along the long side (1-2px) may still work and also reduce the noise. It varies from case to case.

- **"Fix structural issues only" option enabled**

Sets the pixel radius of the LCC image when applied to itself before being applied to the RAW image. As opposed to the preceding case, here the blur value must be high (64 pixels or more) in order to correct PDAF banding and sensor tiling.

Sets the pixel radius of LCC blur along each side of the frame.

Increasing it will reduce the noise in the final image, but it will reduce the effectiveness of any correction of structural image issues, like dust spots, sensor tiling and PDAF banding. **For PDAF banding correction, the default value of (0, 0) is recommended.** A slight blur along the long side (1-2px) may still work and also reduce the noise. It varies from case to case.

Ref Point Mode The flat-field correction algorithm needs a reference value taken from the LCC image which will be used to normalize the final image in terms of colors and brightness. To simplify the matter, you can consider it as the white balance point. This setting allows to choose different modes of calculating it:

- **Average**

The average of the full *LCC* image is used.

In presence of high vignetting, it may produce a dark image, which you can try to counter balance by using the *Ref Point Gain* setting (see below),

In case of high CA, the full average may also cause some residual global color cast. In this eventuality, you can disjoin the *Correction Levels (R, G, B) %* sliders and try to counter-balance the color cast.

If some (under) clipping in the final image happens (usually pink areas), try to increase the *Ref Point Gain* (see below).

For any of the above problematic cases however, it is advisable to switch to *Custom Selection* mode and manually choose a good neutral LCC point/area.

This is the default selection.

- **Custom Selection**

Offers the option of selecting a specific point of the LCC (*Ref Point Radius* = 0) or a circular averaged area (*Ref Point Radius* is > 0).

This kind of selection works best in cases where a significant degradation in a zone of the LCC image is present. Just focus the reference point/area so that it keeps the degraded zone excluded (see *Ref Point (long/short side) (%)* and *Ref Point Radius (%)* below).

Ref Point (long / short side) (%) These sliders are active when you use LCC *Custom Selection* mode. They help positioning the reference point along the X-Y plane in percentage, like shown in *Figure 12*.

If unsure, leave the *Ref Points* to the default value (50%, 50%). This places the reference point at the very center of the LCC frame, which works well on average use-cases that usually only have a slight amount of peripheral aberrations.

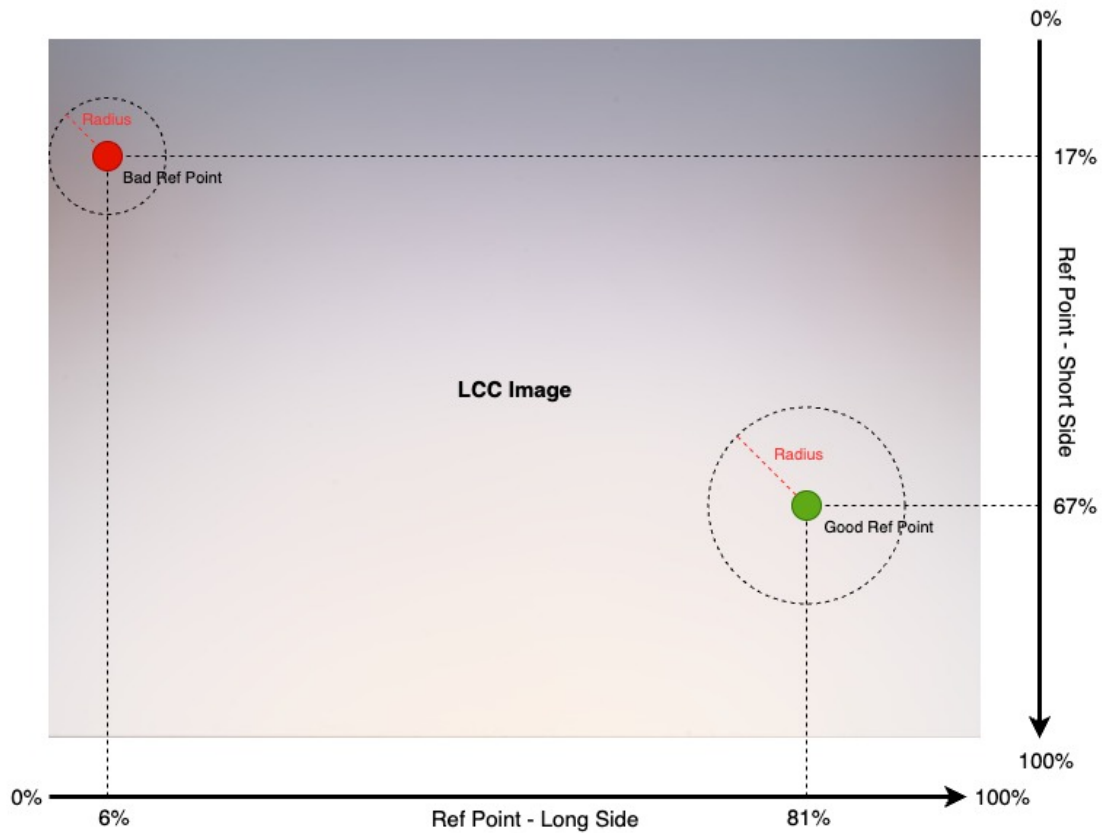


Figure 12: A scheme indicating how to use the Ref Point sliders to place the LCC reference point.

NOTE: unfortunately, the tool does not feature a live preview of the reference point/area placement nor of the LCC correction results. Multiple attempts may be needed to nail the right spot.

Ref Point Radius (%) When *Ref Point Mode* is set to *Custom Selection*, *HBComposer* offers the possibility of increasing the area around the chosen reference point. The area will cover a circle of a specific radius (percentage) around it. A radius of 0% corresponds to the very single reference point. The maximum radius (100%) corresponds to a circle around the reference point having a radius of half the diagonal of the *flat-field* image. Values within the area will be averaged.
If unsure, leave the radius to its default value (50%).

Ref Point Gain (%) In some situations, usually in presence of a highly degraded LCC image, and especially when including in the *LCC* reference area the black corners caused by reaching the extreme end of a lens IC, the produced image may result dark or even under-clipped (pink color areas). This parameter shouldn't be used normally, as it is better to define a proper *LCC* area through the settings described above. Though, increasing it may help in bringing the produced image to the right brightness level and avoid under-clippings as well.

If unsure, leave it to the default 100% and use the *Custom Selection* to select a good zone of the *LCC* which excludes such bad areas.

*NOTE: Please be aware that **all flat-field parameters are remembered** after closing and reopening the application. You should always check their values when reopening HBComposer for a new project. They can be reset to the default values by clicking the dedicated button.*