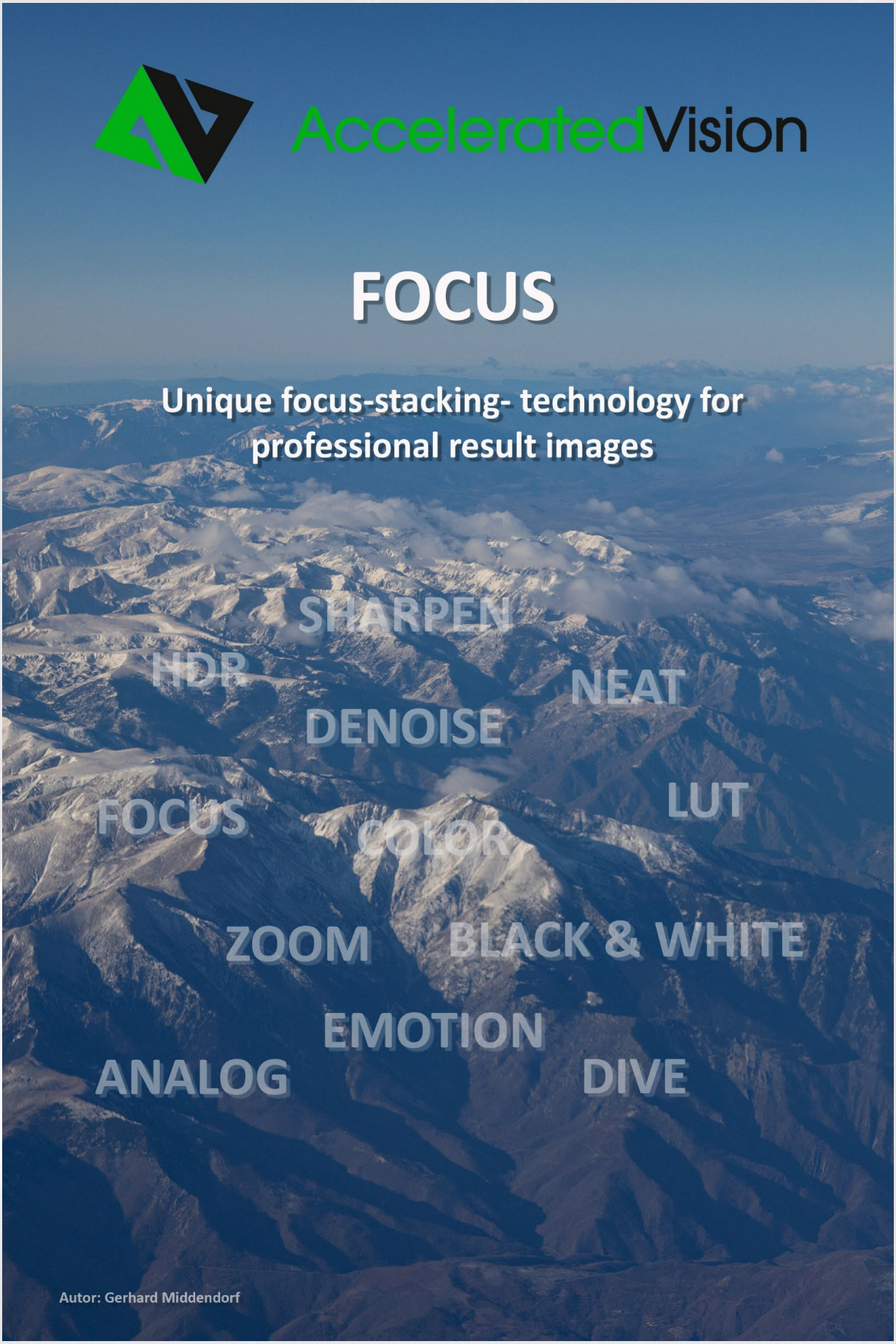

AcceleratedVision
FOCUS
Unique focus-stacking- technology for professional result images
SHARPEN
HDR
NEAT
DENOISE
FOCUS
LUT
COLOR
ZOOM
BLACK & WHITE
EMOTION
ANALOG
DIVE
Autor: Gerhard Middendorf

Guide to the special functions of the programmes

FOCUS

Consistently sharp images of a photographed subject – a pipe dream or a reality? You can usually achieve a large depth of field by setting a very small aperture (large f-number). However, with a single shot, it is almost impossible to achieve uniformly high sharpness across the entire subject area, but only individual points of sharpness or a limited area of sharpness.

FOCUS offers the solution with its unique focus stacking technology.
Focus stacking means that several images of the same subject are taken with different focus distances (bracketing) and then combined into a single image (stacking).
Focus stacking is the combination of a photographic image sequence in which the individual images differ in terms of the selected focus point.

These differently selected sharpness or focus points, combined with the unique focus stacking feature of this software with its many unique selling points, enable a fascinatingly large depth of field with exceptional detail across all desired parts of the image for every photographed subject.
In **FOCUS**, you can load up to 1500 images as a focus stack.

Of course, you will usually achieve the best results with images taken on a tripod or macro slide for macro photography.
The good news, however, is that **FOCUS** also “forgives” a forgotten tripod and produces impressive results from image sequences taken by hand.

This applies to all still lifes and types of motifs such as landscape, architecture or product photography, flowers and fruits, but especially to macro photography. Living creatures or motifs that move are naturally very limited or not suitable at all.

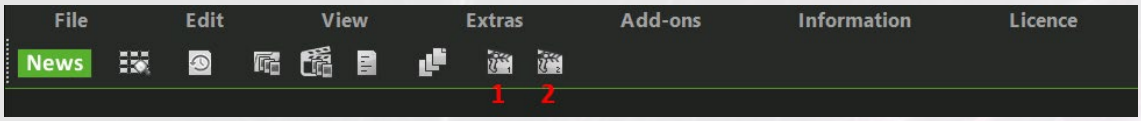
With this software, you can simply let the programme do the **automatic stacking** for you and enjoy excellent results in a matter of seconds, which in many cases eliminates the need for further processing.

Or you can use **FOCUS interactively** and selectively intervene in the process to optimise the result image to your individual preferences – anything is possible.

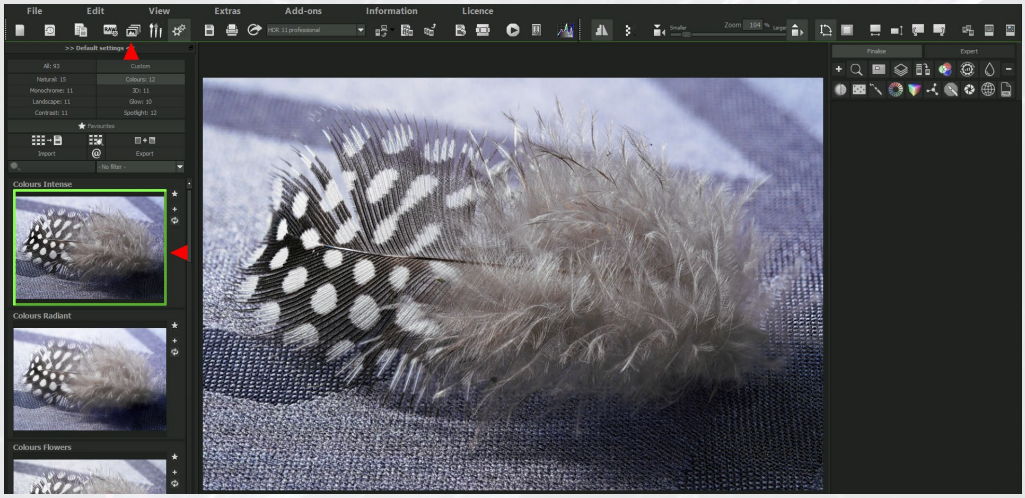
Note: The cross-programme functions, modules such as the RAW module, all other modules offered that can be displayed via the toolbar and the expert mode can be found in the corresponding guides.

Table of contents

1. Home page with 2 example images



After starting the programme, the **FOCUS** start screen offers a special feature that most other programmes do not have: **2 sample images**.



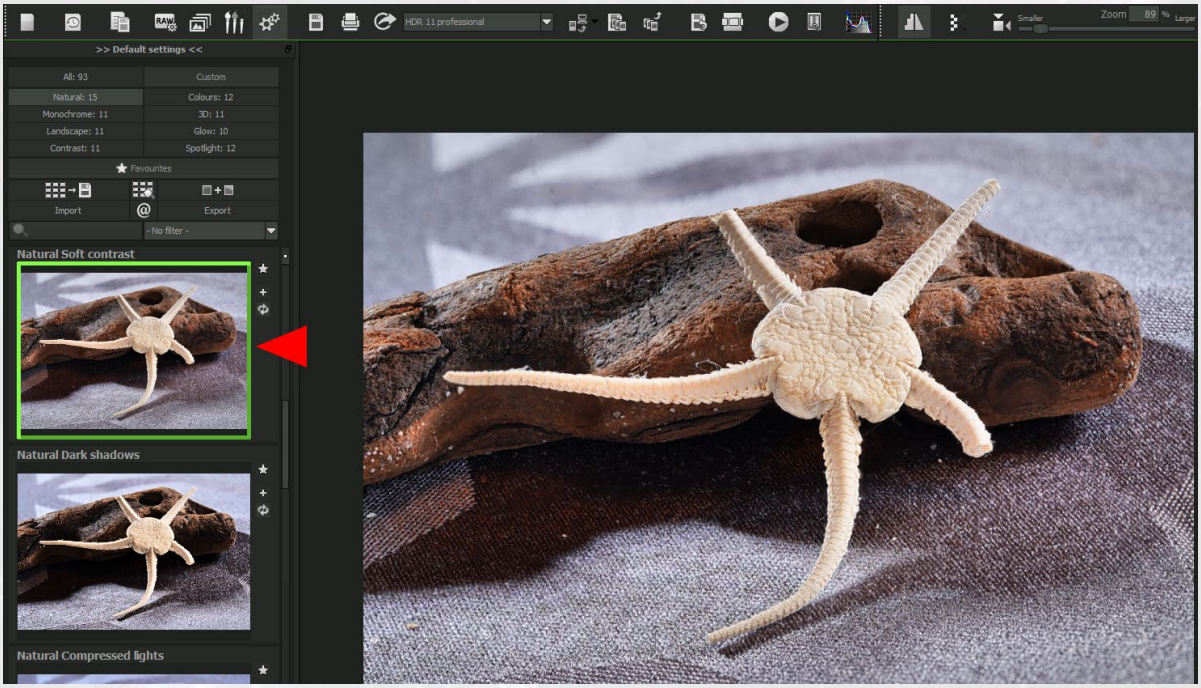
The first example shows the automatically calculated result image of an image sequence and the performance of the programme in post-processing when you click on button (**1**). **FOCUS** has selected the Preset **Colours Intense** for this example image.

If you want to see how many images make up the image sequence for this result image and where the focus is for each individual image, click on the **Edit image sequence** button at the top of the toolbar ...

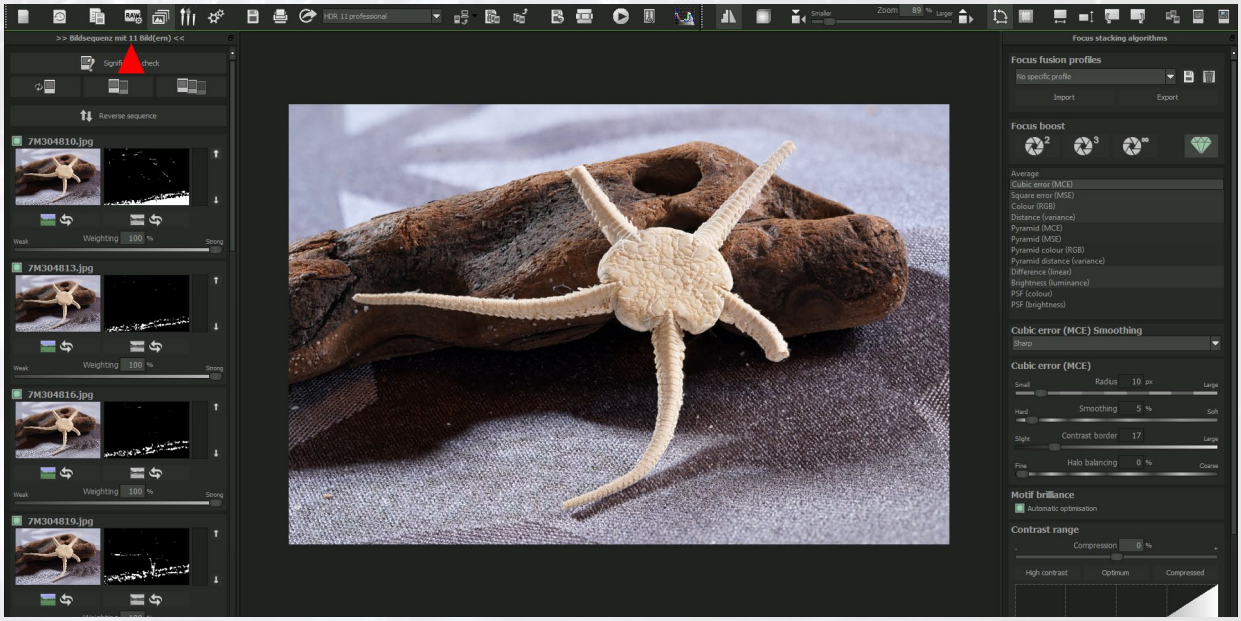
... to the '**heart**' of the programme with the user interface, where the imported individual images, in example 13, are stacked and 'merged' into one image with all the current presets on the left and right sides.

2. Sample image

Go to **File/Home page** to return to the home page and view the second sample image, ...



... which is even more impressive given the consistent sharpness of the fusion image with the **Natural Soft Contrast** preset in an image look that you can adjust to your liking by selecting a different preset if necessary.

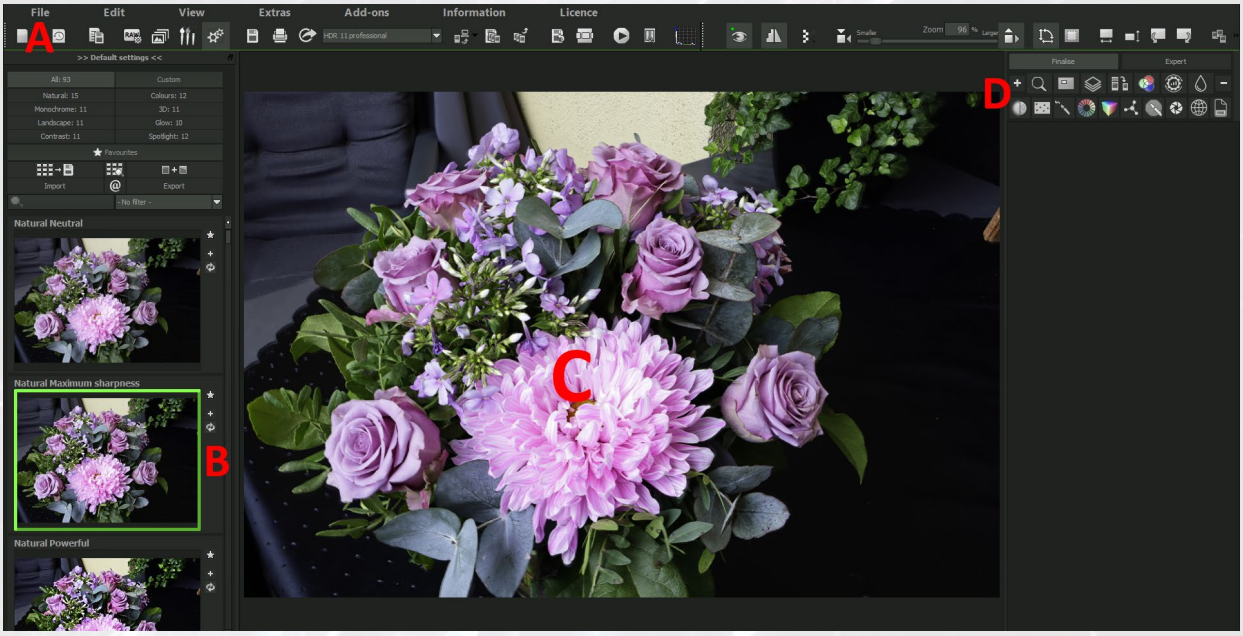


After switching back to the fusion area interface, you will see the result image again, which was assembled from the loaded **image sequence of 11 images**.

2. Workspace with toolbar

If you own another **Accelerated-Vision programme**, you do not need to make any changes. The layout and use of the menus, tools and modules offered in the toolbar or RAW module are identical, require no adjustment and are described in detail in the **General Functions guide**.
Special features such as selected **presets** and the **image sequence player** are described in the following chapters.

Note: The user interface is designed for **4K screens**. On **Full HD screens**, you will need to scroll down a little to see all modules and options.

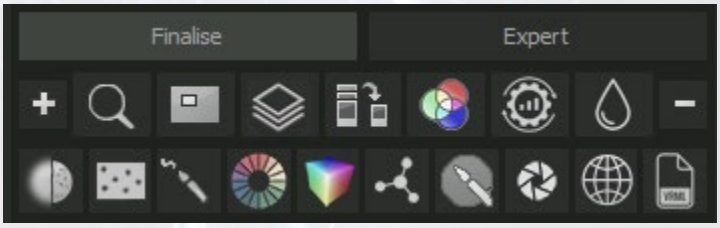


FOCUS's workspace is divided into four main areas:

A: Menu and toolbar.

B: Presets and the various preset categories.

C: Image area with the automatically 'calculated' result image.



D: Toolbar in finalise mode with **selectable modules** (see next page).
Clicking on the **plus sign** displays all modules, while clicking on the **minus sign** collapses all modules as shown in the graphic.
This allows you to quickly configure the interface so that it is optimally tailored to your workflow. The currently set configuration is retained even after the program is closed and restarted.

Selectable modules in the toolbar

Top row:

1. **Magnifying glass/comparison view**.
2. **Point of Interest**.
3. **Fusions profile area:** This module is identical to the module in the **Edit image sequence** area. The individually created profiles can be changed or tested here in post-processing as required.
   The selected fusion profiles in **Post Processing** and in the Image Sequence Editing area are identical and are changed synchronously in both areas when a different profile is selected. As long as no individual profile is saved, **no specific profile** is displayed.

4. **Blending algorithms section:** If you show this module, the same algorithms (**focus stacking method**) as in the Edit image sequence section will be displayed. **Cubic error** (MCE) is set by default. If you select a different algorithm, it will be changed synchronously in both sections. Clicking on the button or the small arrow next to it will list all stacking methods.
   By clicking on the **browser icon**, you can view the different effects of each method.
5. **Intelligent colour space**.
6. **Optimisation assistant**.
7. **Colour toning**.

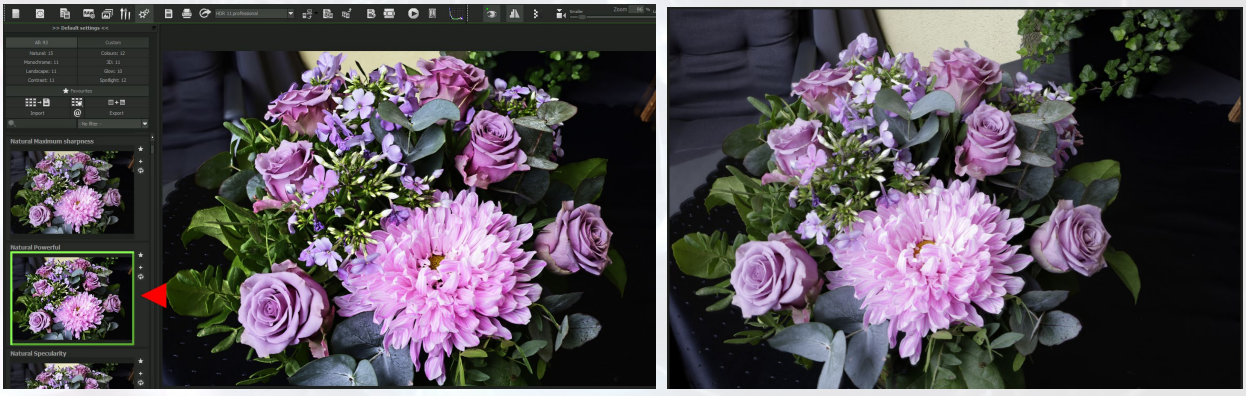
Lower row:

8. **Virtual micro-details**.
9. **Grain module.**
10. **Selective drawing**.
11. **Colour module**.
12. **LUT-module**.
13. **AI training area**.
14. **Sensor error correction**.
15. **Focus peaking analysis area**.
16. **Web-animation area** (see chapter **Web-animation area**).
17. **VRML area** (for 3D printing, see chapter **VRML area**).

3. Presets

After loading an image sequence, as in most other *Accelerated Vision* programmes, you can select a desired image look from the various preset categories by choosing a preset, in this example **Natural Powerful**.
If you want to understand which effects are responsible for the selected image look so that you can adjust them to your personal taste if necessary, switch to **expert mode** and view all effects belonging to the **Natural Powerful** preset in the list of selected effects.
In most presets, **AI effects**, i.e. effects that have been trained with neural networks, ensure an optimised result image.
In the example image, the other effects that determine the image are **colour luminosity** and **local contrast balance**.

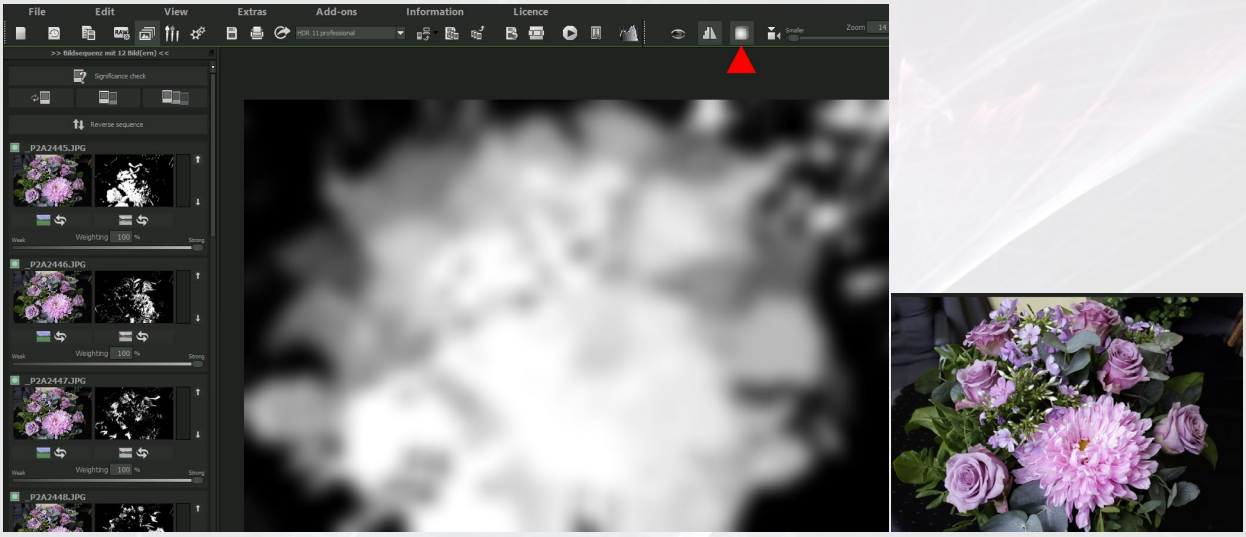
Note: The general handling of presets, 'reading' and changing default settings in **expert mode**, and creating your own presets is described in detail in the **Presets guide. Here are two special features**:



Comparison with the fusion image: Right-clicking on the image does not show the original as usual, because there is no original image, but rather a comparison with the **fusion image** that was created in the Edit **Image Sequence area** (right). The **Natural Neutral** preset comes closest to this fusion image because here the only effect of weighted black/white point changes the result image only imperceptibly.

Category 3D

This category offers another special feature.



The **3D presets** are based on the **depth map** automatically created with the focus stack. This depth map can be used to calculate selected spatial effects, which are shown in the presets as examples.
Note: A good depth map can only be created if the focus stack is captured very accurately and contains enough images.

Example 3D High focal distance: The 'responsible' effect in the selected preset is **3D focal distance/rotation**. Using the parameters that are displayed below when the effect is activated, you can continuously adjust the **focal distance** (**focal distance slider**), move the **focal point** from back to front or vice versa (focal point slider), or vary the centre of the calculation using the pivot point in the window below.

Animation: Clicking on the **small triangles in front of the parameters** (also for the other effects in this and other presets) triggers an animation of the respective parameter, which runs through the effect continuously and can be stopped at any point with the **ESC key**.

Preset 3D Depth fog

Image example 2 with a different model motif and the **3D Depth fog** preset: With this preset, the 'fog bank' can be moved from front to back in the motif space (**depth slider**), the i**ntensity** can be varied from low to high (**intensity slider**) and, if required, the fog colour can be coloured as desired using the colour wheel.

Each of these selectable presets offers a three-dimensional feature. It is worth trying out.

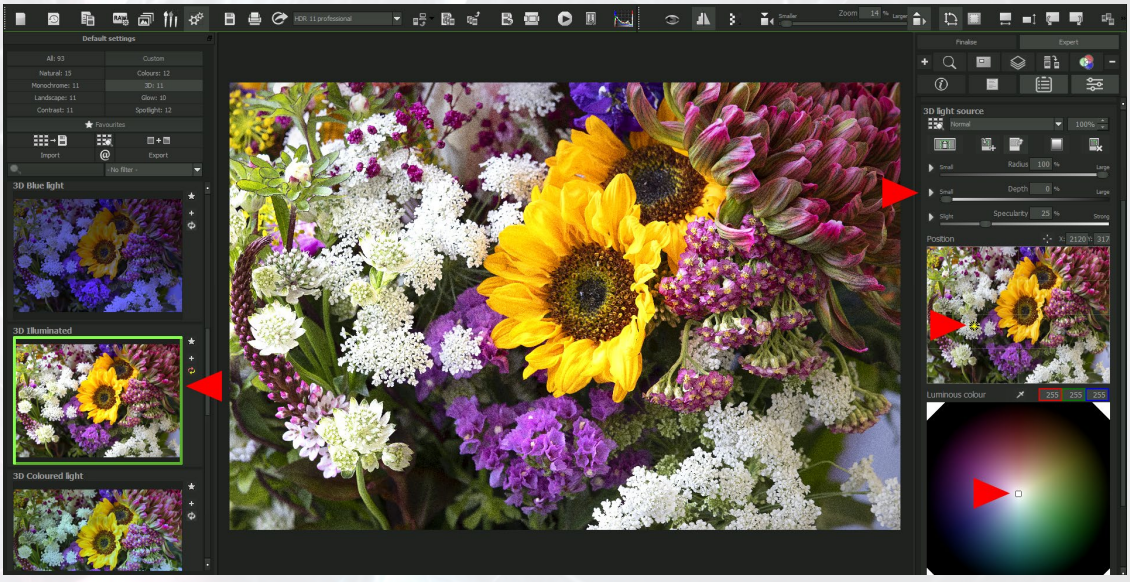


Image example 3 with a flower motif and the **3D Illuminated** preset: With this preset, you can vary the **radius** of the light source, which controls the area of influence of the 3D lighting (**Radius slider**), the **depth** of the 3D light source (**Depth slider**) and the intensity of the **specularity** (**Specularity slider**). In the two windows below, you can determine the desired **position** of the light source and the **colour** in the colour sphere. This allows you to create impressive variations and image looks for the imported image sequence.

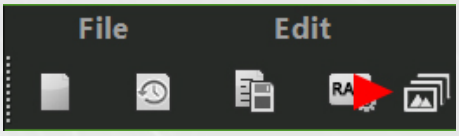
4. Flash workflow

If you rely entirely on the automatic mode, **you will obtain a very good, convincing result in just a few steps**.

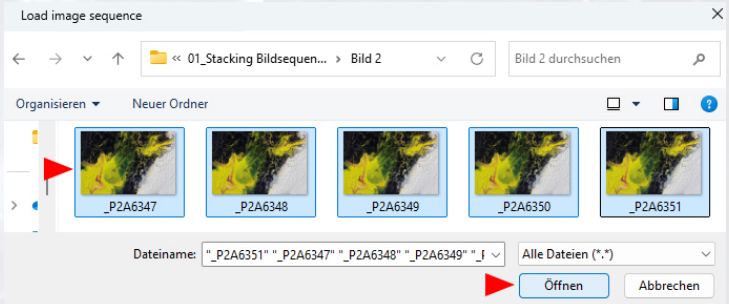
Step 1: Load the stacking sequence.
Step 2: Confirm the preset or choose an alternative.
Step 3: Save and/or crop the image beforehand or choose scaling suggestions – done!

Step 1: Import image file

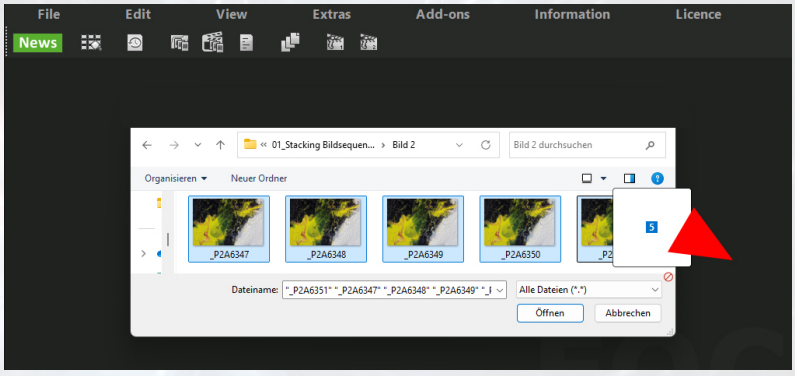
There are several equivalent ways to load image files and drag them into the program window, which are described in the **General Files guide**.
When loading an image sequence, you can also choose the method that is most convenient and fastest for you:



1. **Load file/image sequence**: Click on **Load image sequence** in the file menu or on the icon in the toolbar to select the folder of your choice in the folder that opens ...

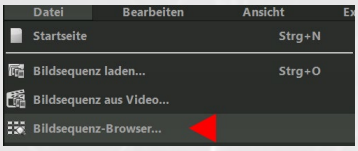


... the desired images and load them into the program with another click.

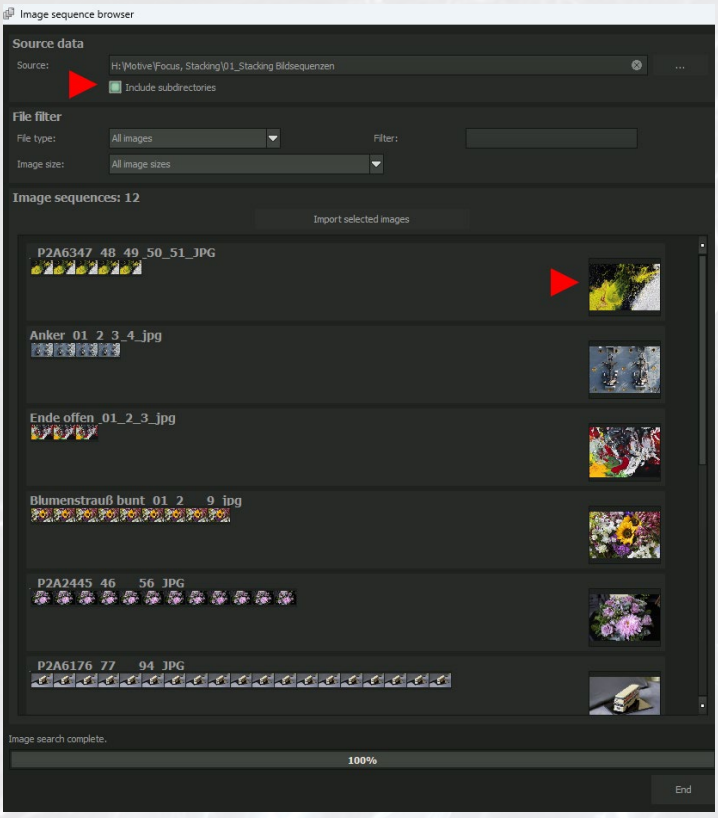


2. **Drag & Drop:** With this method, open the folder in Explorer, select the desired images and simply **drag and drop** the files into the program window by holding down the left mouse button.

3. Import via browser

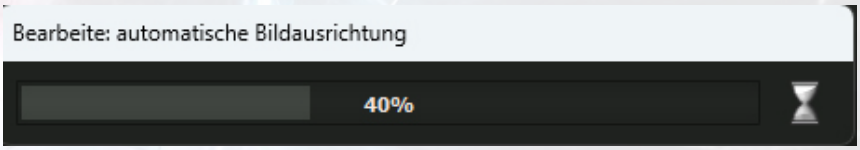


By clicking on the **image sequence browser** in the file menu or the **browser icon** in the toolbar ...



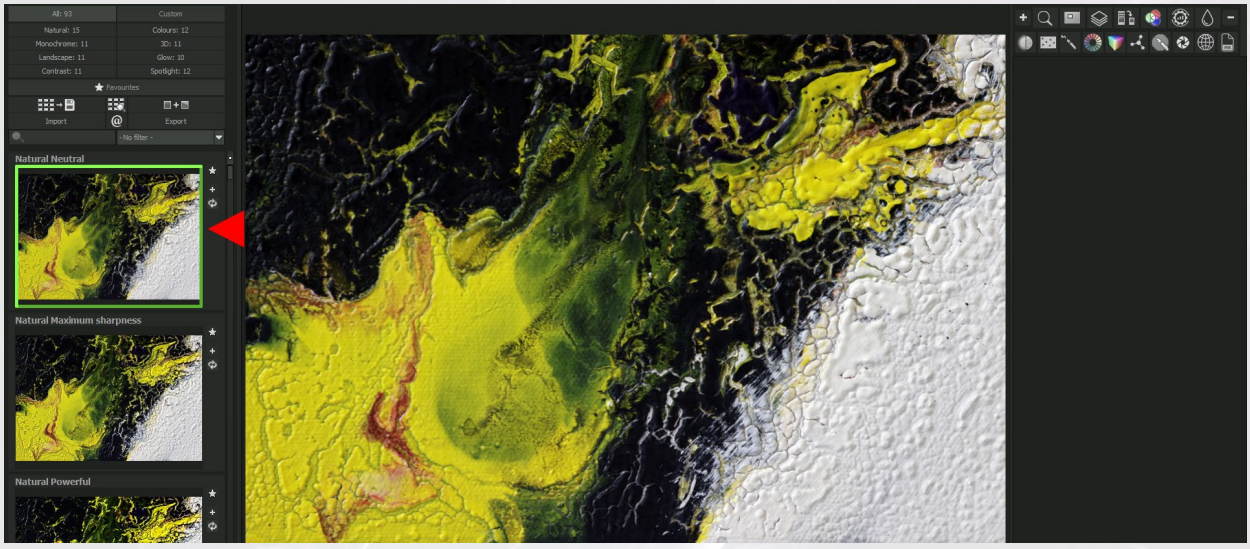
... the window with the image sequence browser opens. For example, if you enter JPG in the file type field, only the JPG sequences will be displayed and you will no longer have any duplicates. If you want to narrow down your selection further, click on **all image sizes** and you can **filter** the image sequences, e.g. larger or smaller than a desired **megapixel** number or **cm unit** of measurement.
Enlarge thumbnail: Move your mouse over the preview image to enlarge it.

Load image sequence:

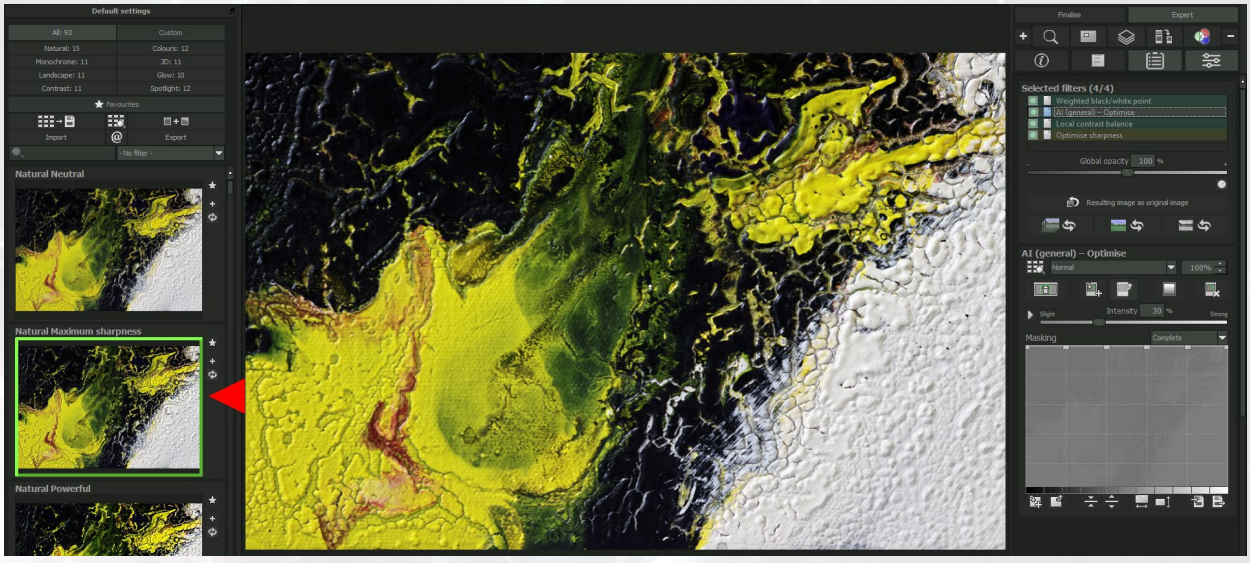


Double-clicking on the thumbnail (or enlarged view) of a desired image sequence imports it with the information **Edit: automatic image alignment displayed and further image preparation**. This information is displayed for all three methods described.

Step 2: Confirm the default preset or select an alternative

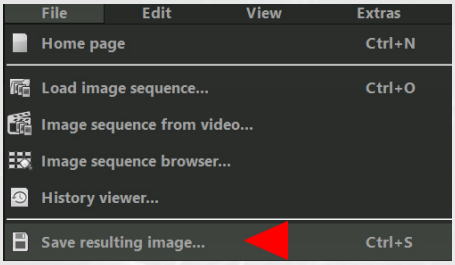


After loading an image sequence, you will see the result image with the default preset **Natural Neutral**, which shows the **fusion image** with minimal deviations because this preset only has the single effect of **weighted black/white point**. **If you are satisfied with this result, save this result image in the next step and you will have completed the flash workflow in two steps.**

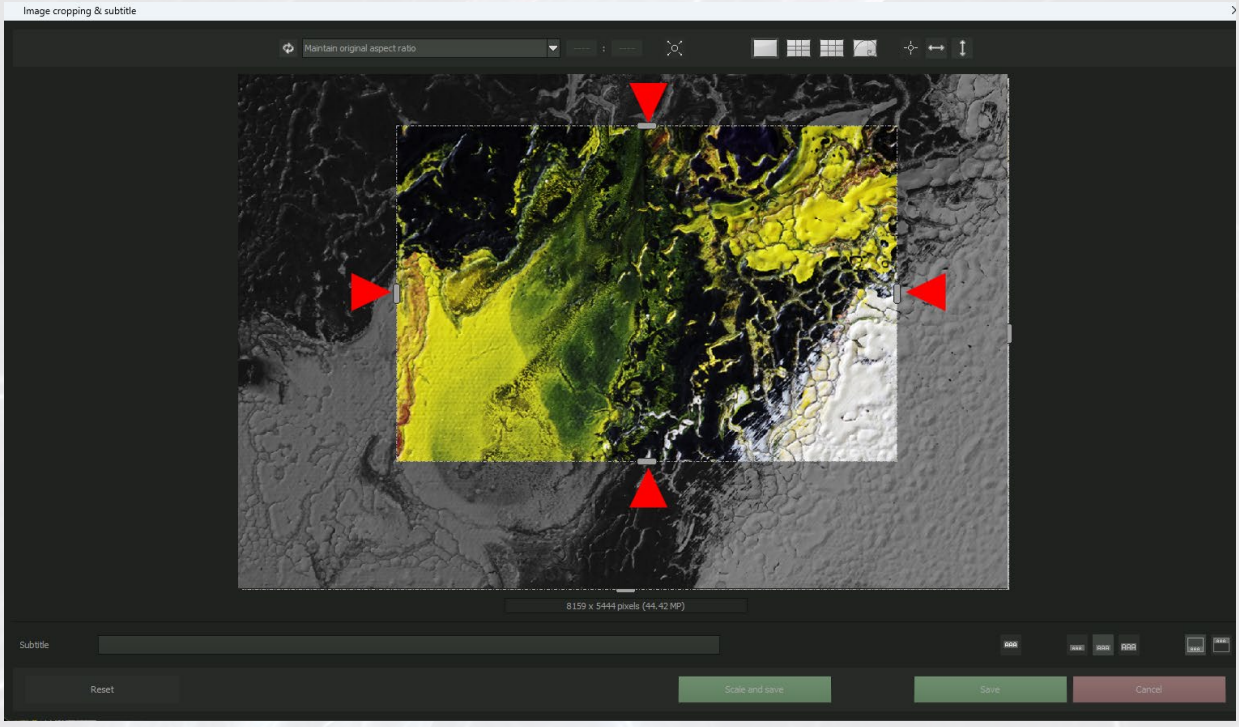


If you want to try out other presets in the same or other categories, click on them to try out different presets that may better suit your individual preferences and select, for example, **Natural Maximum Sharpness**, in which the effects **AI Optimise**, **Local Contrast balance** and **Optimise Sharpness** ensure optimisation of sharpness, colours and contrast and give the image greater depth.

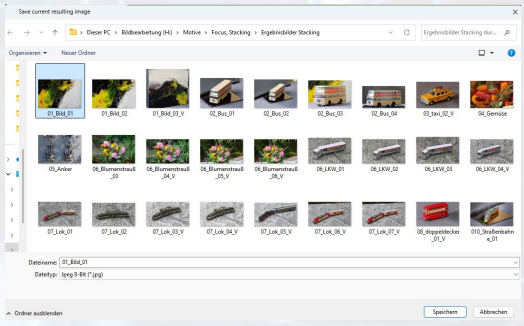
Step 3: Save the result image, crop it or use the scaling options



Click on **Save Resulting Image** in the File menu or the **Save Resulting Image** button in the toolbar ...



... switch to the **Image cropping & subtitle** window, where you can crop the image and/or add a caption if necessary.
Scale and save offers the option of using various scaling presets, e.g. for social media formats, before the image is saved. Click on the **green save button** ...



... save the image in a folder of your choice.

Note: All image cropping and scaling options are described in detail in the **General Functions guide**.

5. Manually editing image sequences – Introduction

As we have seen, the automatic mode with all standard settings delivers good to very good results in many cases.
With focus stacks in particular, the result depends heavily on the subject, the quality of the stacks and the number of individual images, among other factors.

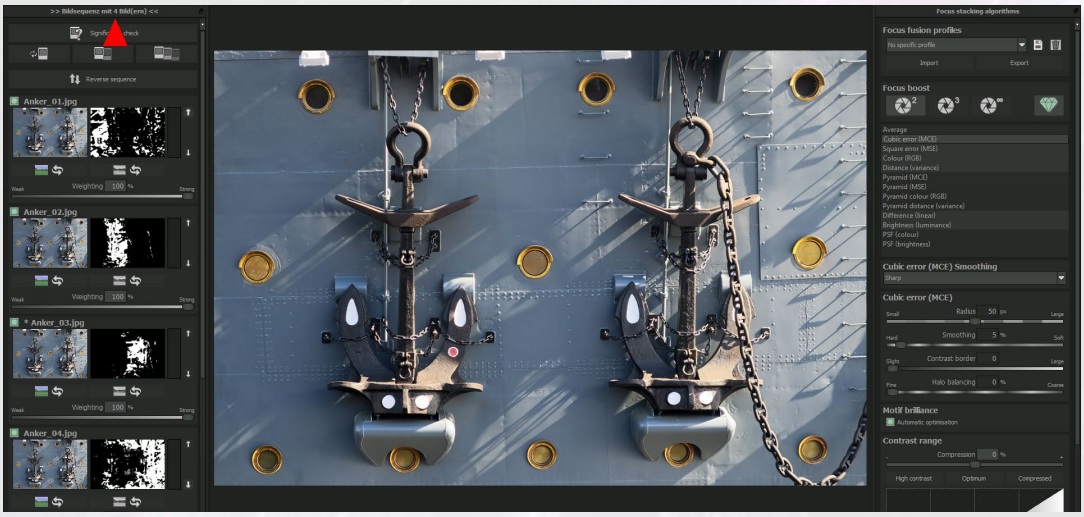


As already described in the introduction, it is almost impossible to achieve uniformly high sharpness across the entire subject area with a single shot, especially in macro photography. Instead, only individual focus points or a limited focus range can be achieved. This can be more in the **foreground** (left graphic), the **centre** of the image (middle graphic) or in the **background** (right graphic).

The prerequisite for a consistently sharp image in **FOCUS** is several individual images of a subject that are in focus at least once in every area of the image, from the foreground to the background. **The sum of these individual images, which have essentially 'passed through' the subject, forms the focus stack.**

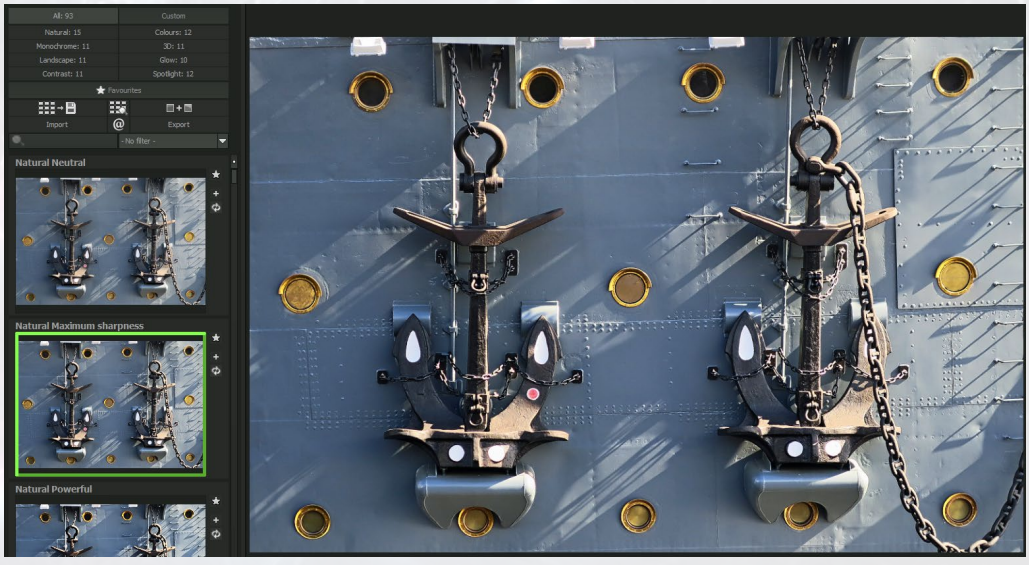
Once you have invited this stack into **FOCUS**, the program uses its unique stacking technology to calculate **one** consistently sharp image as the final result.

If you want not only good results, but the best results that can be achieved with FOCUS, the programme offers a range of options in the image sequence editing area that allow you to further improve and optimise the results through individual adjustments and tailor them more specifically to your personal taste.



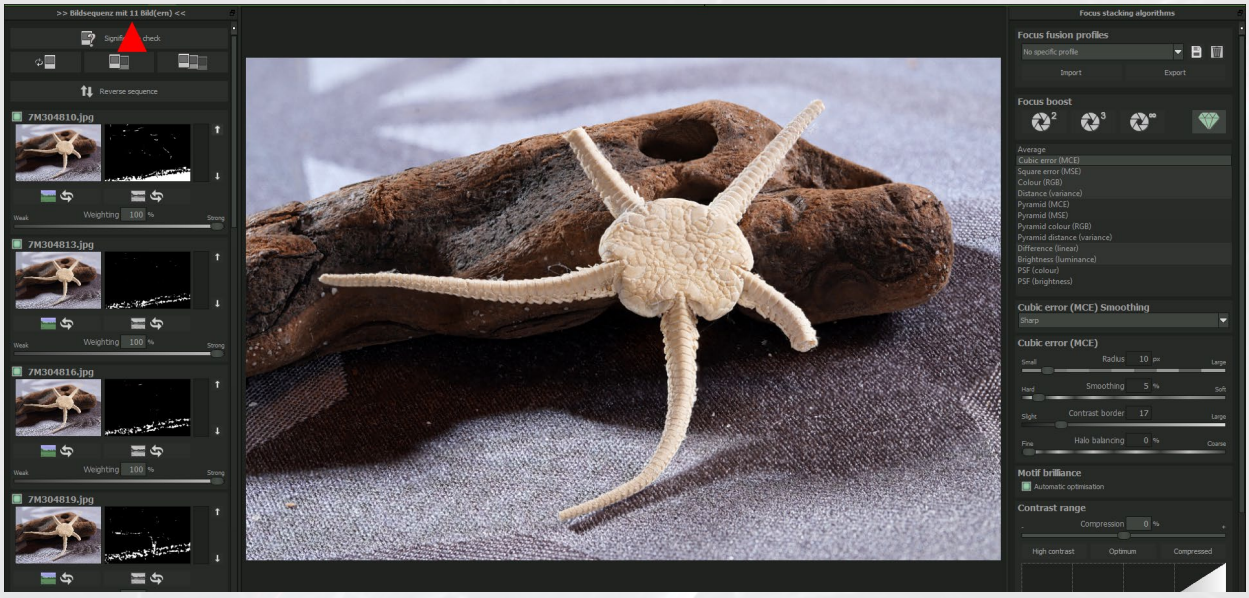
In the **fusion area**, all images in a stack are **superimposed**, **precisely aligned** and calculated to produce a single finished image with **all image-relevant sharp areas**.
FOCUS and fusion enlarge and 'outsmart' the camera's narrow focus range with the quality you get from the camera in the best focus range.
So here, instead of combining different exposure series as in **HDR**, **multiple focus planes are combined**.

FOCUS gets the most out of the image and the camera, more than the camera can achieve per frame.



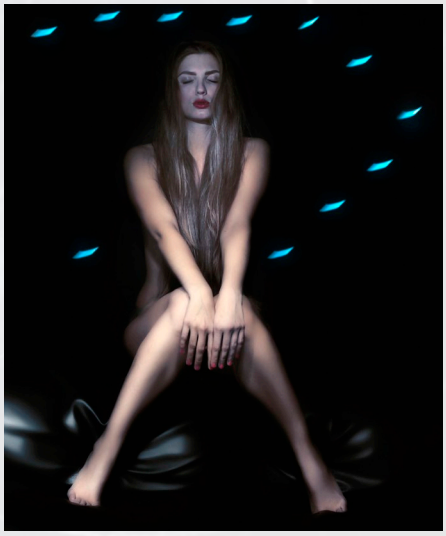
In **Post-processing**, you can give the fusion image the desired look or character by selecting a preset, or edit it using the various modules available until it meets your requirements.

Various shooting scenarios, setting the focus range



A continuous focus range from the foreground to the background is rarely desired, as in the example image with the starfish, where the background has been deliberately left out of focus so that the viewer's attention is directed solely to the main subject.

Since FOCUS 'processes' the images in the fusion area from front to back, it makes sense to photograph the individual images of the focus stack from front to back as well.
You decide where the first image should begin the first plane of focus in the foreground and where it should end with the last image and transition into the blurrier background.



Of course, there are also subjects that are not suitable for these image sequences and where consistent sharpness is not desired, e.g. female portraits where the focus should be on the eyes with a beautiful background bokeh, or subjects that have been deliberately photographed slightly out of focus.

Should you use a tripod or shoot handheld?

The basic rule for focus stacking is: only photograph still lifes with a tripod or, even better, with a slide, especially in the macro range.
Any movement in a focus stack makes it difficult to achieve a very good or optimal result, for example, if you are shooting handheld and/or the object is moving, such as a bouquet of flowers in the wind or moving people or animals.

The good news is that **FOCUS** uses unique technology to compensate for minor 'outliers' even in image series that were "shot" by hand, such as this model of the swiss 'Crocodile' (**30 images with automatic focus bracketing function**), and automatically aligns them. This information is displayed each time an image sequence is loaded.

How many images should be photographed in a stack?

The sample images with the ship anchors (**4 images**), the starfish (**11 images**), the product photo (**15 images**), the 'crocodile' (**30 images**) or the bouquet of flowers (**12 images**) and the fact that you can upload **between 2 and 1,500 images** to **FOCUS** show that there is no clear answer to this question for every motif.

A helpful rule of thumb is to take twice as many pictures as there are depth planes in the subject.

Example: This bouquet of flowers has many layers of petals and leaves. To cover the entire bouquet optimally, about **50 images** would be necessary. The respective decision also depends on the size of the focus range or the 'depth' covered by the camera.

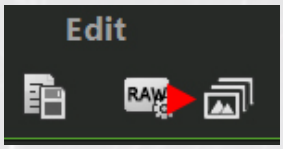
With an extreme macro lens, for example, the focus range is minimal, between one and two millimetres. The bouquet of flowers in the example has a depth of about 20 centimetres.

The result with this macro lens would be **one image per 2 mm**, or **about 100 images** in total, but that's not all: Since the focus areas should overlap for an optimal result, approximately twice as many images are recommended, which would be **about 200 individual images** for this 'microscope stacking'.

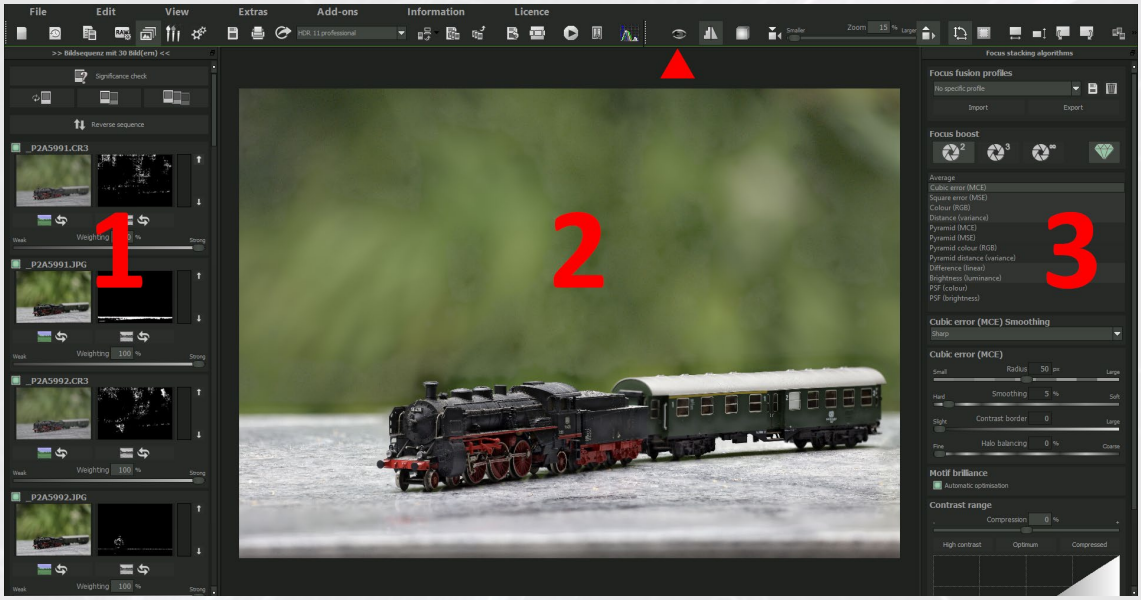
With a focal length of **40 mm**, which was used to photograph this bouquet of flowers, **10 to 15 images** would normally suffice. In fact, this stack consists of **12 individual images**.

For most 'normal' subjects, you can assume a figure between 10 and 15 images for a stack as a guideline and expect a very good result image.

6. Edit image sequence – Interface overview

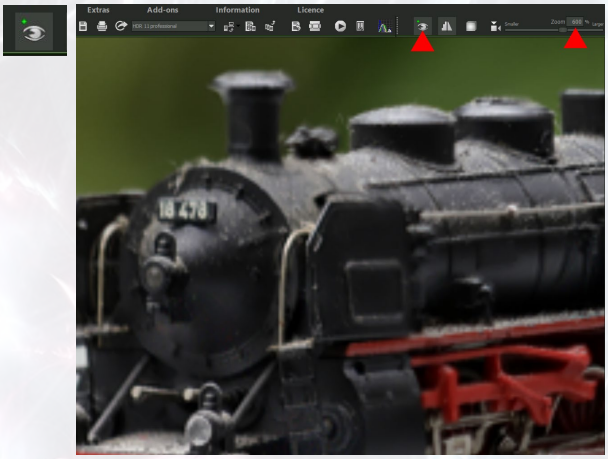


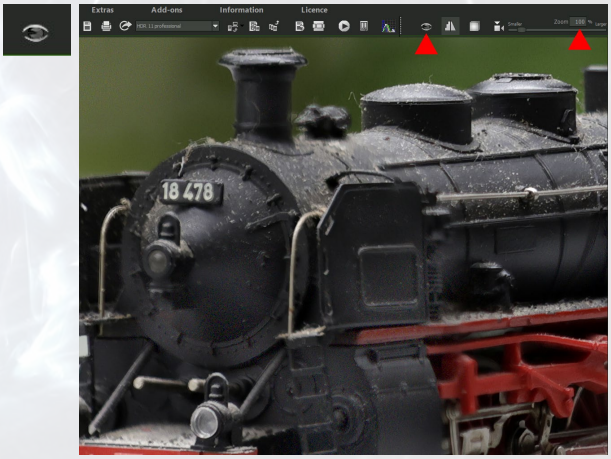
By clicking on the **Edit image sequence** button …



… switch to the **Focus Fusion interface** with its three main areas:

1. **Merge area:** Focus stack with the individual images.
2. **Merger image in the preview window**.
3. **Algorithms** and other modules**.**





Note: In the fusion area, it is particularly useful to disable the default **Quick preview mode** (graphic on the left) by clicking on the button with the **eye symbol** in order to better assess the focus areas. All calculations are now performed at full image size.
The difference between the same image section at **600% zoom** in preview mode (left image) and at **100%** in original size is striking. Even with the image view adjusted (double-click on the image), the difference is clear and makes it easier to assess the sharpness.

Overview Focus stack with individual images

1. **Display of the number of individual images from the loaded image sequence.**

2. **Significance test (see chapter Significance Test).**

3. **Three options** for how many images are active and included in the calculation. By default, the first button is active, which means that all images in the image sequence are included in the calculation, as indicated by the small green square in the top left corner of the thumbnail. Clicking the middle button activates only every second image for the calculation. The green box now turns grey for every second image. Clicking on the third button activates only every third image for the calculation. Here you can check, if necessary, what the result image would have been if, for example, you had only taken every second or every third image from 30 shots. If the result is just as convincing, the subsequent calculation times will be faster; otherwise, click on the button that achieved the best results.

4. **Option to reverse the order of the stack:** Clicking this button reverses the entire order of the image sequence. This option is used to reverse the creation of the **depth map** and thus swap the foreground and background (see chapter **Depth Map**).

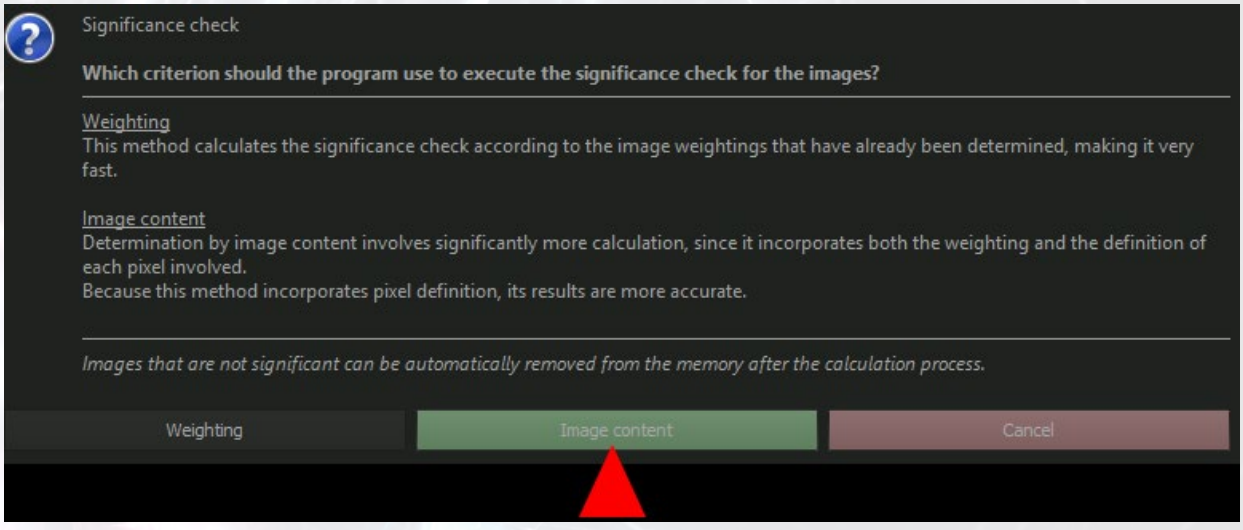
5. **Miniature (preview) of the focus stack image,** with the corresponding **weighting matrix** (mask) and weighting parameter to the right (see chapter **Focus stack** with single images).

6. **Options to open the Selective Drawing transfer window** and transfer the **single frame** (left) or **mask** (right) directly to one of the composing layers (image) or to any layer in Selective Drawing (mask) (see chapter **Transfer Window**).

Note: The overview on the right-hand side with the **algorithms** is presented in the chapter **Algorithms and other modules**.

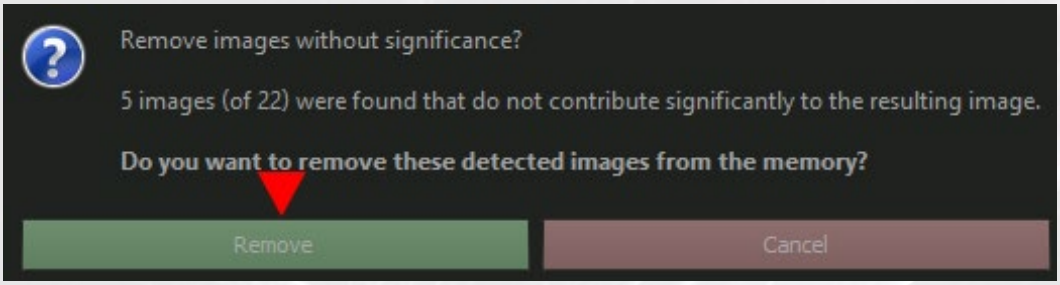
7. Significance check

The **significance check** is a very helpful function. It allows you to identify and remove images that do not play a significant role in the event image.
In this example, the focus stack consists of 22 images taken with a tripod.
By clicking on the **Significance check** button ...

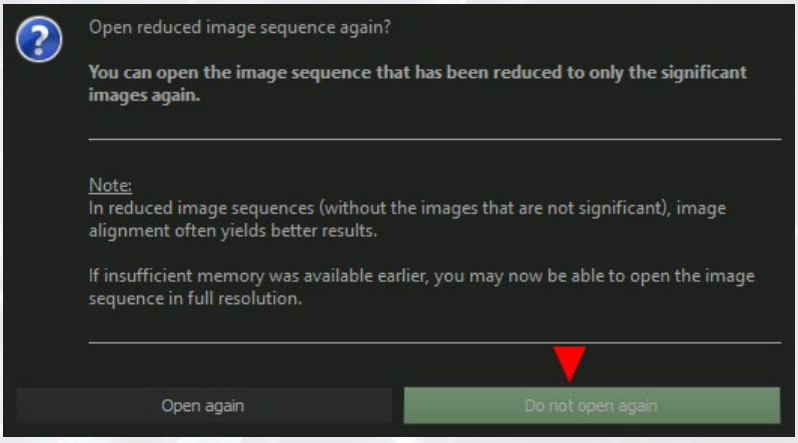


... a window opens in which you can choose between two different criteria for the check: **Weighting** and **Image content**.
The default method, **Image content**, is more computationally intensive but produces a more accurate result because it also takes into account the pixel sharpness of each pixel included.

Result of the significance check



Confirm your selection by clicking on the **Image Content** button. The stack will be analysed and the result will be displayed in a new window.
In the example, **5** of the **22** images loaded were found to contribute little to the result image.
As a rule, it is of course advisable to follow the suggestion to remove these images from memory.
By clicking on **Remove** ...



... the last window appears with two options: to reload the image sequence **reduced by 5 images** or **not**.
By clicking on this button ...

... the stack, reduced to 17 images, is recalculated and the corrected fusion image is displayed.

8. Views of the individual images in the focus stack

After switching to the merge area, you will see a preview thumbnail (1) of all individual images belonging to the loaded stack or image sequence on the left-hand side, in example 20.
The individual images are listed in ascending order of file numbers.
Each preview thumbnail includes:

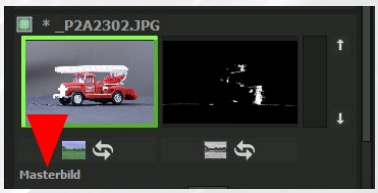
- A weighting matrix (**2**).
- A weighting slider (**3**). Additional parameters are displayed after clicking on a preview thumbnail (see next page).
- A button (**4**) where you can select a weighting colour for the drawing mode (see chapter Editing weights).
- Use the arrows to the right of the weighting matrix (**5**) to move the individual images up or down as needed.

Note: The buttons for the transfer windows are described in the chapter **Transfer Windows**.

Order of images: If you have photographed the images from foreground to background as in the example, the image with the **sharpest focus in the foreground** is the **first** at the top, and the image that was photographed **last with a sharp background** is the **last** at the bottom.

Exclude/include image from calculation: The **green button** in front of each individual image indicates that these images are activated and included in the calculation.
Clicking on the **green button** turns it grey and excludes this image from the calculation. Clicking on the grey button again turns it green and the image is once again included in the calculation.

Display individual images in the preview window



When you click on a selected preview thumbnail, this image is **outlined in green** and displayed in the preview window in the centre. At the same time, another parameter, **Exposure**, is displayed, along with the option to delete the image (**minus sign**).

Master image: An image is selected by **FOCUS** as a **master image** according to various criteria and cannot be deleted (graphic on the right).

Switching from a single image to a merged image: Clicking on the thumbnail again removes the green border and displays the merged image in the preview window.

Weighting matrix

For each individual image in the focus stack, the corresponding **weighting matrix visualises the areas that are sharp from the programme's perspective** and that are taken into account to a greater or lesser extent for the focus stack generation. **Bright areas** are given **greater weighting** in the calculation than dark areas.

These weightings are directly related to the selected algorithms and can be further customised using the corresponding **parameters** (see chapter **Algorithms**).

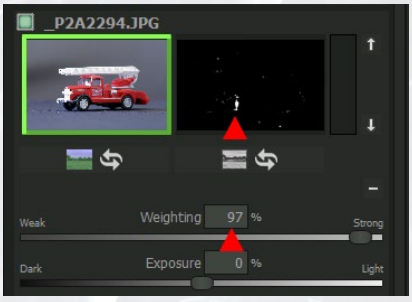
Display individual mask: Clicking on an individual weighting matrix highlights it in green (graphic on the right) and enlarges it in the preview window for better evaluation.

For example, if you click on all the individual images one after the other from top to bottom, you can easily assess which individual images contribute most or least to the fusion calculation.

Delete images: Click on the **minus sign** to delete an image.

Parameters of the individual images

As a rule, you do not need to change the default settings for the weighting and exposure controls.
Weighting: Use this slider to adjust the weighting of individual images as needed, giving them more or less influence in the overall calculation.
Since the default setting is **100%**, ...



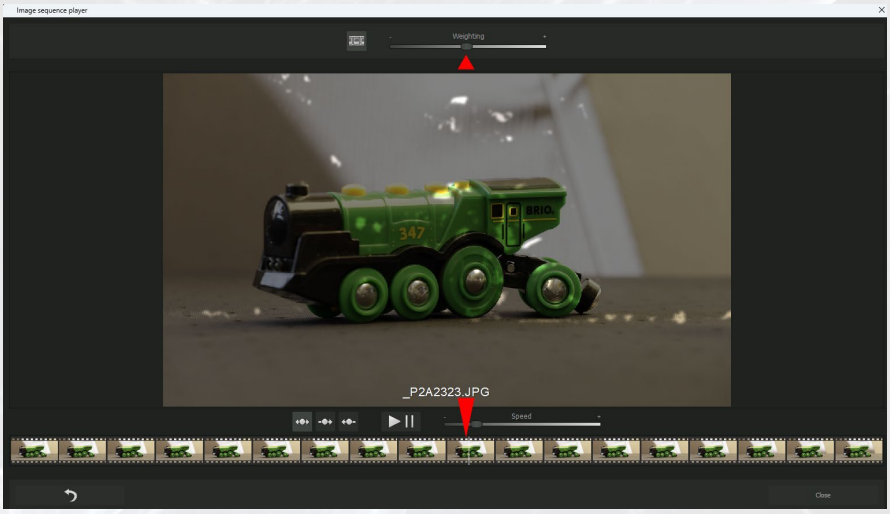
... any reduction would result in a weaker weighting. In the example, the weighting has only been reduced minimally to **97%**, but the difference to the 100% weighting in the graph above is striking.

Exposure: Use this **exposure value slider** to adjust the brightness of the image. The default value is **0%**. A reduction of **50%**, as in the example, lowers the exposure value by **1 EV** (exposure value), which corresponds to **halving the amount of light**. Similarly, an increase of **50%** would **double the amount of light**.
The visualisation in the mask shows a slight change compared to the matrix in the standard position, the preview image is clear and the fusion image has become slightly darker due to the changed weighting.

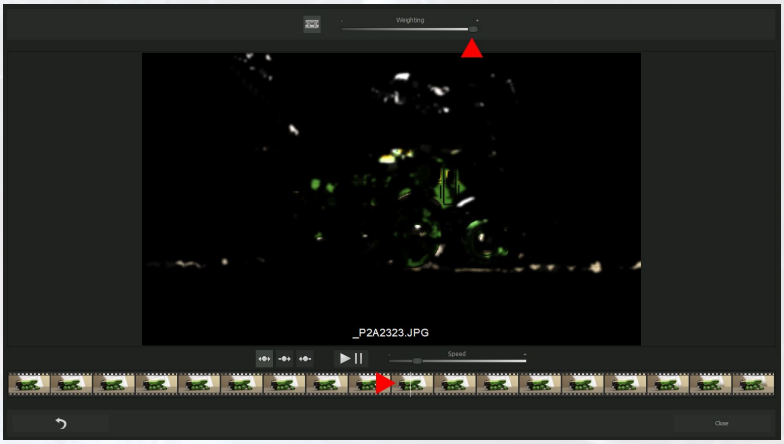
9. Quick overview of the image sequence with the player

You can see an even faster and animated overview of the individual images with the **image sequence player**, which can be started from the toolbar in the post-processing and fusion areas.

By clicking on the button with the **play symbol** ...



... the window with the player opens.
This image sequence player lists the same individual images from an imported stack (20 in the example) in the bottom row from **left to right** as the fusion area from top to bottom.
However, it offers several special features: The graphic shows a **combined view** of **weighting** and **image display**, because the **weighting control** smoothly blends both views as desired. In the example, the slider is set to the middle and takes both views into account equally.



If the slider is set to the far right, only the **weighting** is displayed. In this setting, when scrolling through, you can quickly see where the programme has identified the sharp areas and exactly what is being used from which image and added together in the fusion.

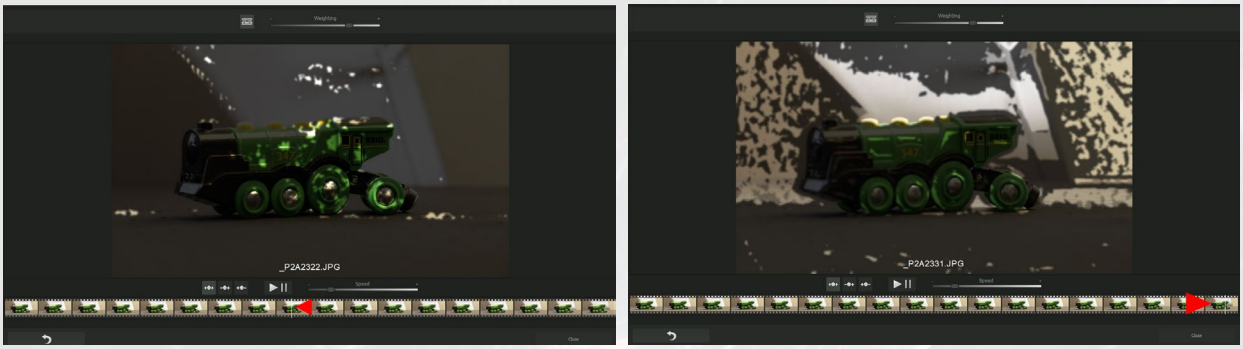
If the slider is set to the far left, ...

... the view of how the **image was photographed is displayed**.
When you scroll through, you can clearly see **how the focus shifts from the front to the back of the image**.

Quick overview of the timeline:

After selecting the desired view, you can click on the white line at the beginning of the first thumbnail and hold down the left mouse button to scroll through the image sequence.
Display file names: Stop scrolling and move the mouse over a thumbnail in the timeline while the image is paused. The corresponding file name will be displayed in the centre above the timeline, making it easier to find images in the fusion area, especially for larger sequences, if, for example, you have discovered an image while scrolling through that should be excluded from the calculation.

Quick assessment of the stack



This combined view allows you to quickly assess the loaded stack according to various criteria, such as correct image alignment or correct order, and, if necessary, call it up specifically in the fusion area.

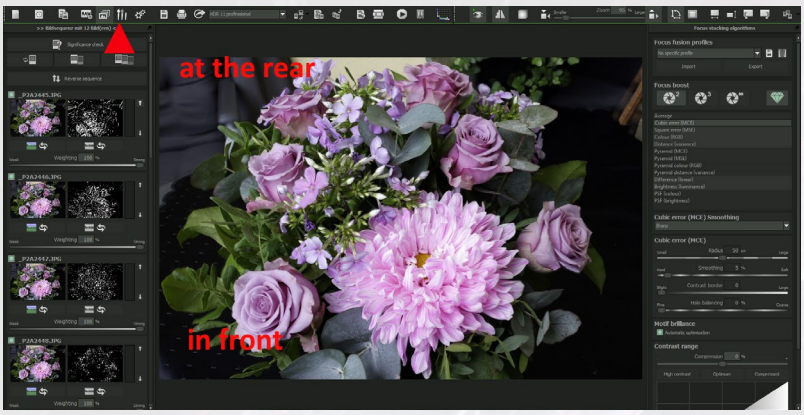
Fast animation with the player

The player overview is even faster: clicking on the **play button** plays the image sequence and pausing it at the desired point with the pause button to the right. The speed control allows you to continuously adjust the playback speed from slow to fast.

Setting the playback mode: Use the buttons to the left of the play button to set the desired playback mode. The default setting is '**forward and backward**' (left). Clicking the next button switches to "**forward**" mode, while clicking the right button switches to '**backward**' mode.

Enable blending: If **blending** is enabled (button at the top left next to the weighting slider), everything will be smoothly blended during playback.

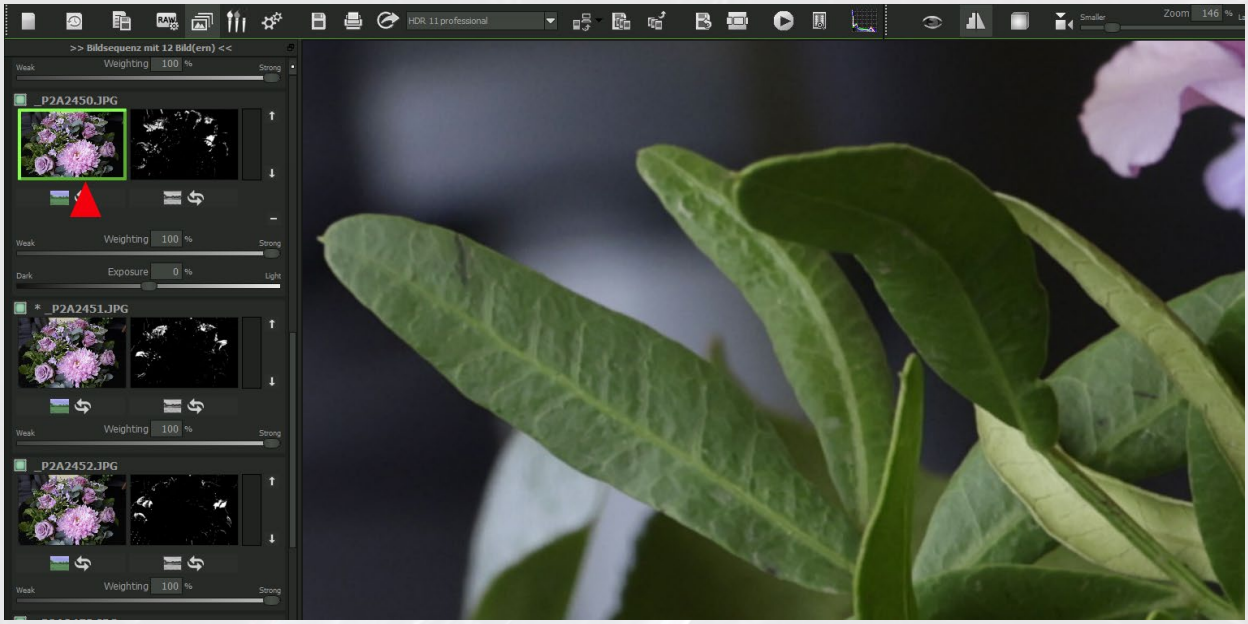
10. Edit weights, targeted removal of halos



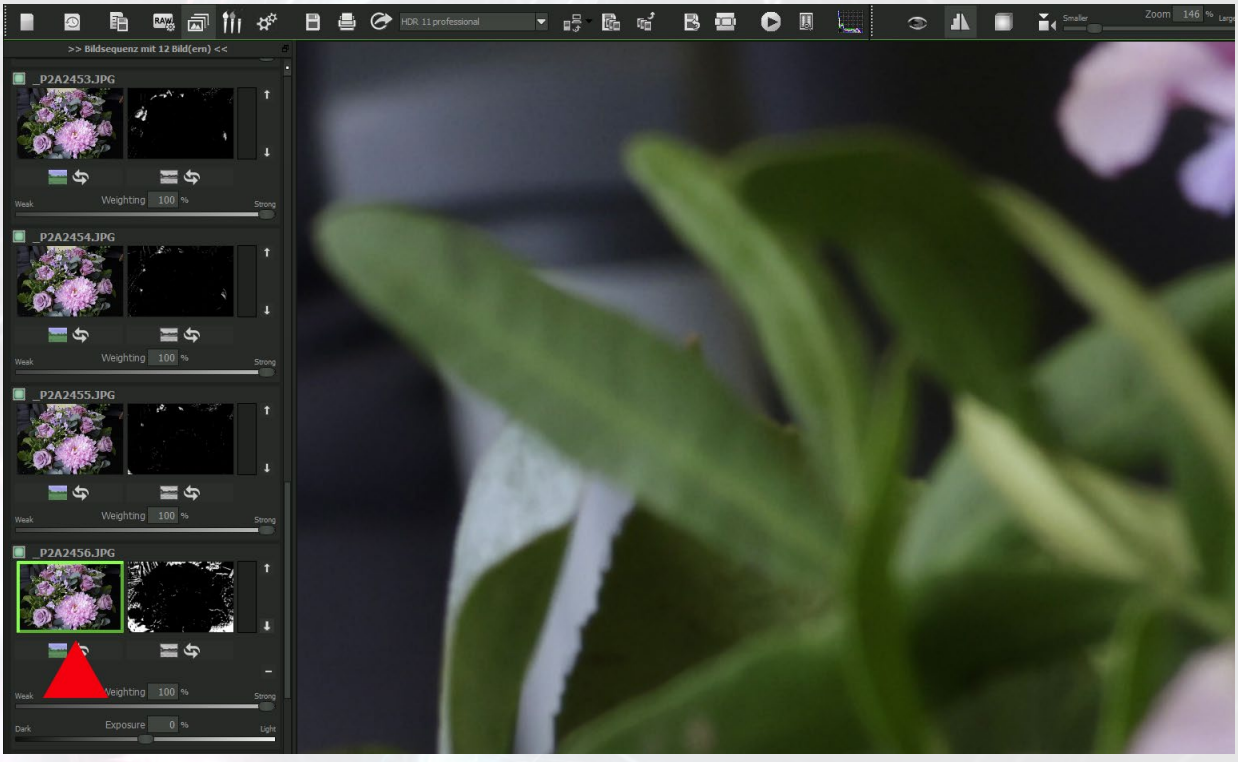
Sources of error in image sequences: Most focus stacks, especially those taken by hand, such as the bouquet of flowers in the example, have minor or more significant errors that prevent the best possible result, even though **FOCUS** aligns images automatically based on the sharp areas and corrects these disruptive conditions as best as possible.
Essentially, the sources of error are blur halos or blur veils with two different causes:
Focus halos or blurring caused by different **focus planes:** These errors are practically unavoidable with most types of subjects that have multiple or numerous focus planes, such as this bouquet of flowers with numerous layers of petals and leaves. Why is that?
As a rule, you photograph a subject like this from front to back.

If the foreground is in focus (left image), the background is out of focus, and vice versa: If the rear area is in focus, the foreground is blurred (graphic on the right) and at the edges of this blur, where the focus planes behind or in front of it are increasingly no longer visible, unsightly blurring or **halos** form at the transitions. This is unavoidable because the bokeh is created at the same contour but at a **different depth of field**.
Another effect: the edge and the bokeh become increasingly wider (larger) and obscure everything behind them the further the focal plane moves backwards, with the result that a **new contour** is created at the edge of the bokeh in comparison to the first (sharp) contour.

Halos caused by shaky



These sources of error can arise if the camera is moved slightly during stacking, or if, for example, this bouquet of flowers moves in the wind during shooting, or if the background changes slightly during stacking, as shown here in image **450** ...



... and 6 frames further on to image **456**, where it is clear to see that both the leaves and the background have moved slightly in the meantime.

FOCUS offers the best solutions for both problems with the **Edit Weights** module.

Note: Both sources of error are visible in this image.

Solutions

The paths to the best solution are the same for both problems:

1. Try **switching off Focus Boost** to see if this improves the situation (see the **Focus Boost** section), although this is rarely successful.

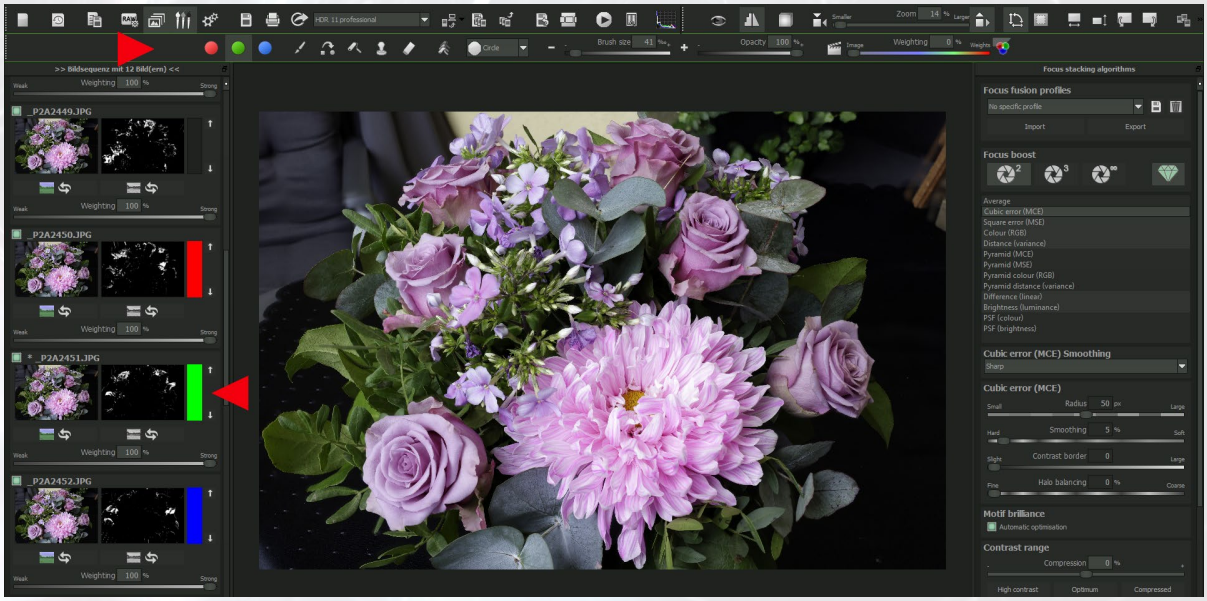
2. Experiment with the **parameters** of the default **Cubic Error** (**MCE**) algorithm, especially with the **radius** or **halo balancing slider** (see chapter **Algorithms**).

3. Select an **alternative algorithm**, e.g. **PSF** (**colour**), and if necessary experiment with the corresponding parameters (see chapter Algorithms).

4. Use the **Painter** in the **Weights** module to quickly and effectively eliminate or significantly reduce errors.

The **Painter** described here is the **best and most effective method** if the other options do not achieve significant improvements.
The Painter is a powerful tool for manually editing an image via the individual frames in the series in order to modify selective image areas and, if necessary, apply these changes to all images in the stack.

The tools in the **Edit Weights** module can be displayed in the **toolbar** from the post-processing or fusion area.
By clicking on the button with the **brush symbols** (Painter) ...

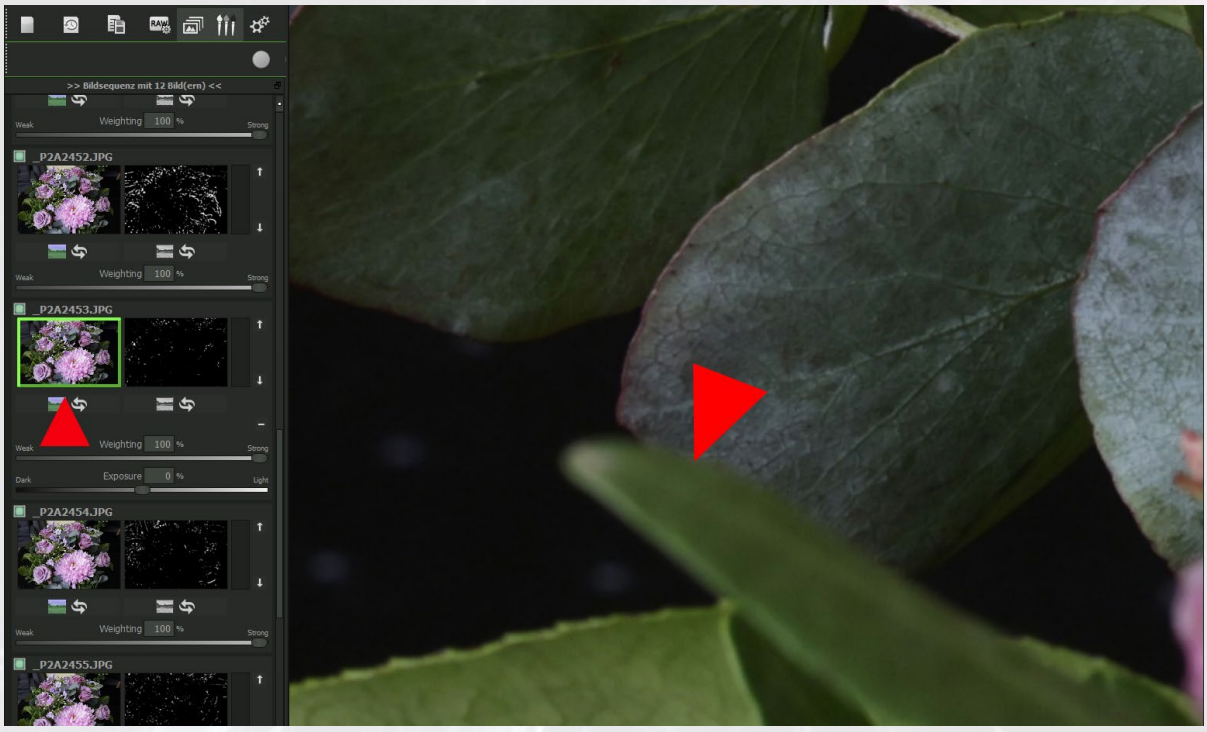


... a new **toolbar** is added at the top of the fusion area and three images with weighting colours are assigned to the stack. **Green** is assigned to the master image.

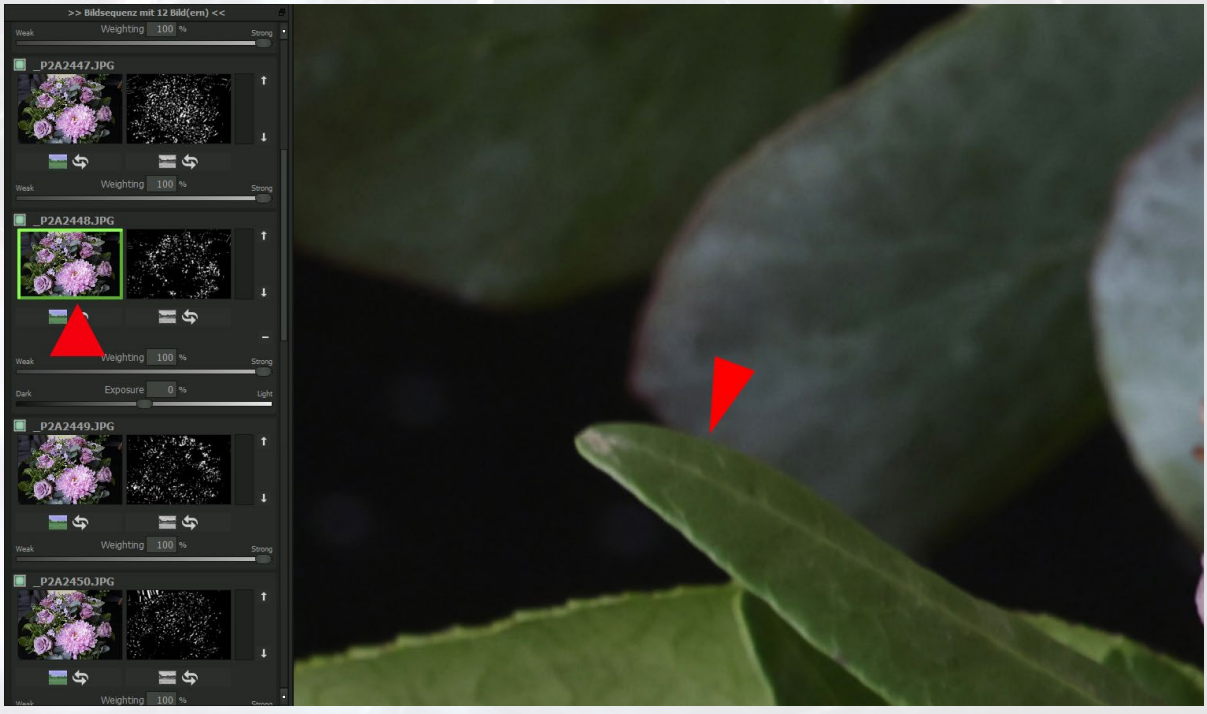
Note: This guide describes the functions that are necessary for troubleshooting and are sufficient in most cases to achieve the best results.
All other functions of the toolbar are listed in keywords at the end of this chapter.

Example: Removal of focus halos (blurring)

The steps to remove unwanted halos from the stack are **always the same, quick to implement and independent of the type of halos**.

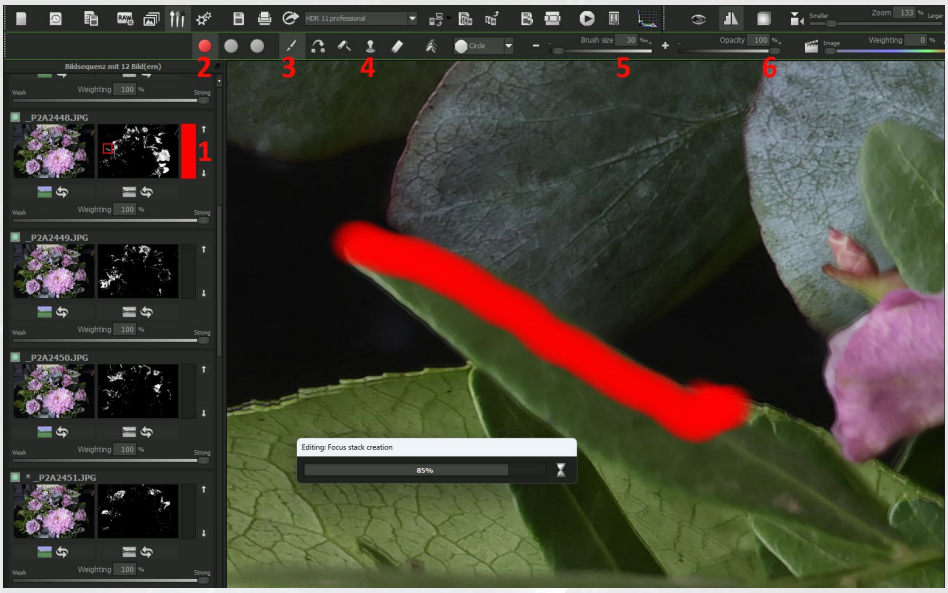


Step 1: Select the single frame from which the halos are to be removed (in the example, image **453**).



Step 2: Select the single image in which the part of the image with the desired sharpness **without halos** is to be used in all images in the stack (Image **448**) and determine the fusion image.

Step 3: Painting over and punching out the image areas without halos



Clicking on the button next to the image mask automatically sets the **weighting colour RED** for the drawing mode (**1**). It does not matter whether red, green or blue is selected here. The only important thing is that it **matches** the activated colour in the toolbar.

Activating the weighting matrix (**2**): If the colour **red** is selected, the **same colour** must be activated by clicking on it so that the Painter recognises the corresponding weighting matrix, in this example **red**.

Activate Painter (brush) (**3**): Clicking on the button activates the brush or the **Increase Weight** tool, which, depending on the opacity, incorporates the painted areas up to 100% into the calculation.

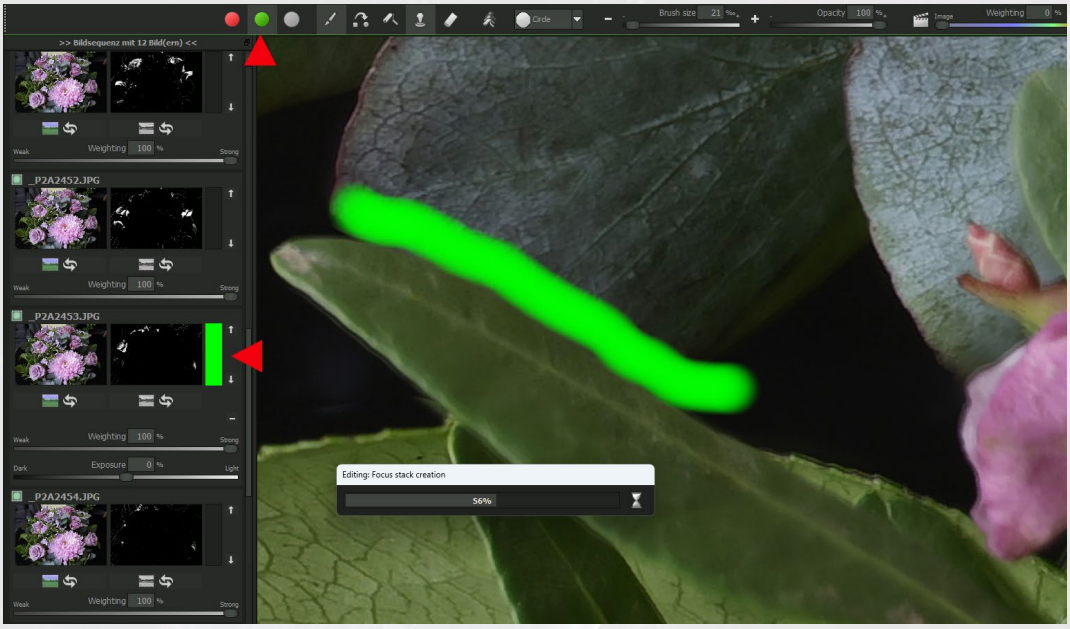
Activate stamping mode (**4**): Clicking this button ensures that the **combination of brush and stamping mode** applies the painted-over areas with the brush to **all images in the focus stack**.
This is easy to see in the masks: the painted-over area is white (red border), is fully included in the calculation, and in all other masks this area is black and excluded from the calculation.

Set brush size (**5**): The choice of brush size depends on the areas of the image to be painted over. In the example, a small brush size is appropriate.

Set opacity (**6**): Since the aim is not only to reduce halos but to eliminate them entirely, the opacity is set to **100%**.

Paint over areas: Once everything has been selected and set as described, use the brush to paint the red colour **inside the leaf along the contours** in the areas where all parts of the image should be as sharp as in this single image (graphic above). The area on the left of the leaf can also be painted over the edge because there is no image-relevant background there. When you put down the brush, the fusion is recalculated. If necessary, paint over another area, and this will also be recalculated afterwards.

Further correction of focus halos if necessary

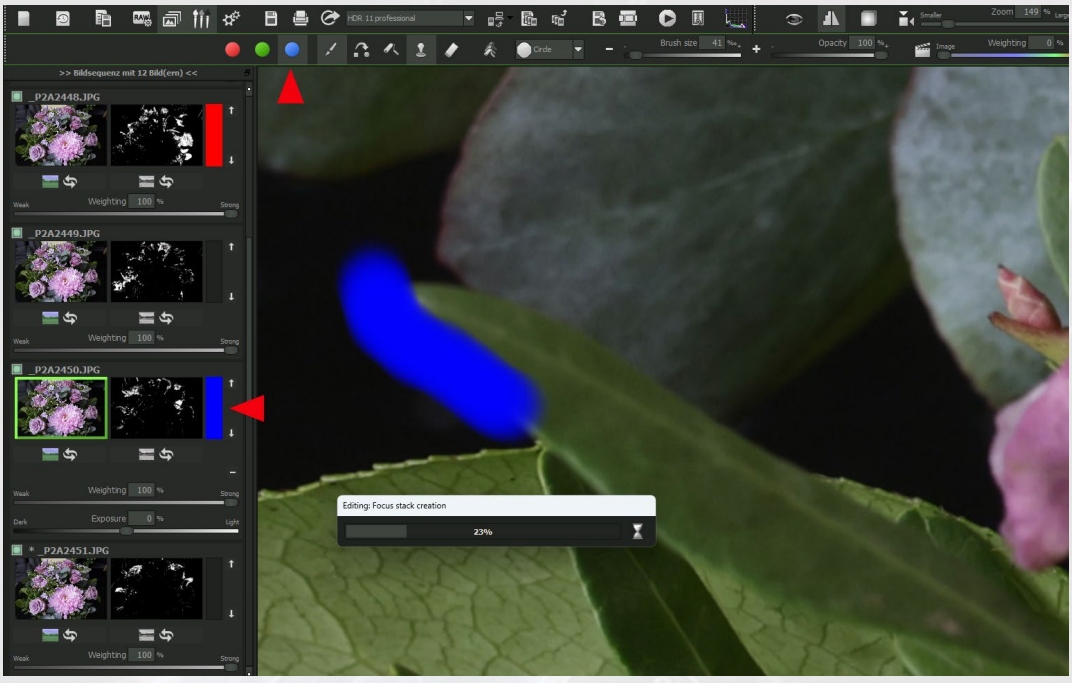


If you want to be absolutely sure that the focus halos have been eliminated as much as possible, switch back to the originally selected image (**453**) with the halo blur, which has now disappeared, and click on the button next to the matrix.

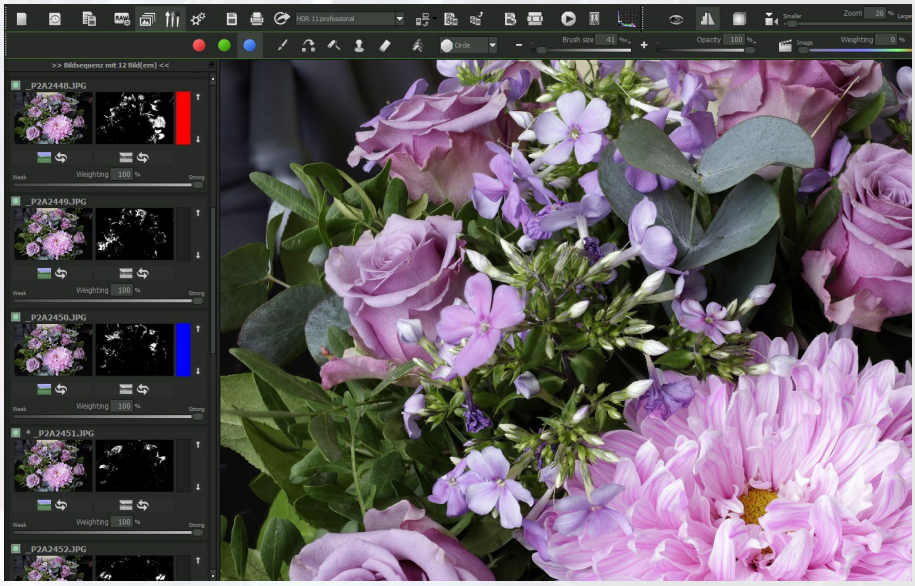
Confirm the colour **green**, which is now automatically selected, in the toolbar and use the combination of brush and punch tool to paint over the sharp **background sheet** with the clearly visible structures in this image, up to the edge of the previously corrected sheet in the foreground.

Result: These two corrections have fixed the errors discovered in the sharpness halos.

Halo effects caused by **shaky** can be removed using the same method.



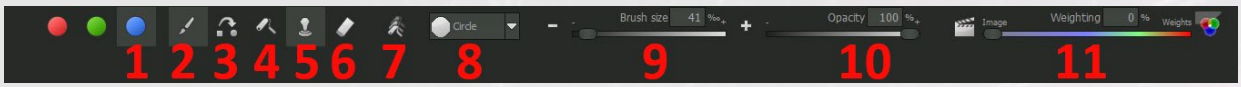
As described at the beginning, this was image **456 with** a motion blur halo and reference image **450 without** a visible halo effect.
Clicking on the button next to the matrix in image **450** displays the colour **blue**, which you can activate again in the toolbar.
Using the **combination of brush and stamping mode**, you can now paint over the lower area of the sheet and the edge with a slightly larger brush, as there is no image-relevant background there.



Conclusion: The combination of brush and stamping mode allows you to quickly remove any imperfections, such as halos, and optimise the fusion image.

Note: If you notice additional halos in other areas of an imported stack, remove them using the same method.

Toolbar



For most tasks, the **brush** and **stamping mode** used so far are sufficient.
For additional options such as **deleting** one or all of the weights entered, further tools are available that enable all desired adjustments or reversals in the event of incorrect weightings:

1. Activate the selected **weighting matrices**, in the example **blue**.
2. **Increase brush/weights**: In conjunction with the controls for **brush size** and **opacity**, the brush can be quickly adjusted to the areas to be painted over.
3. **Blur** to **smooth** weighting ranges retrospectively**.**
4. **Delete function:** After activating this tool, move it like a brush over the areas that need to be corrected or deleted. If **stamping mode** is also activated, deleting the areas you move over will affect all images, which is usually the desired effect.
5. **Stamping mode**, which can be activated for the **brush** and **blur** tools: When this mode is active, **all images in the image sequence are processed with the selected weighting colour**, increased in all other images and decreased in all other images.
6. **Reduce weight:** This tool can be used to reduce the weightings of an individual image. In the mask, you will see these overpaintings in black.
7. **Delete weights: Deletes all drawn weights.**
8. **Select an alternative brush form:** Clicking on the button or the small arrow next to it will bring up a selection of different brush forms that may be more suitable for the areas you want to paint over.
9. **Adjusting the brush size:** Use the slider to set the desired brush size.
10. **Adjusting the opacity**: Use the slider to set the desired opacity. **The default value is 50%**.
11. **Visualising weighting:** If required, the slider can be used to display the **image** (left) or the **weighting** of the image fusion to a lesser or greater extent (to the right).

11. Transfer-windows

These two **transfer options** below the image and matrix thumbnails are **very practical and save time because you can switch to selective drawing with just one intermediate step and quickly manipulate selected image parts or masks**.

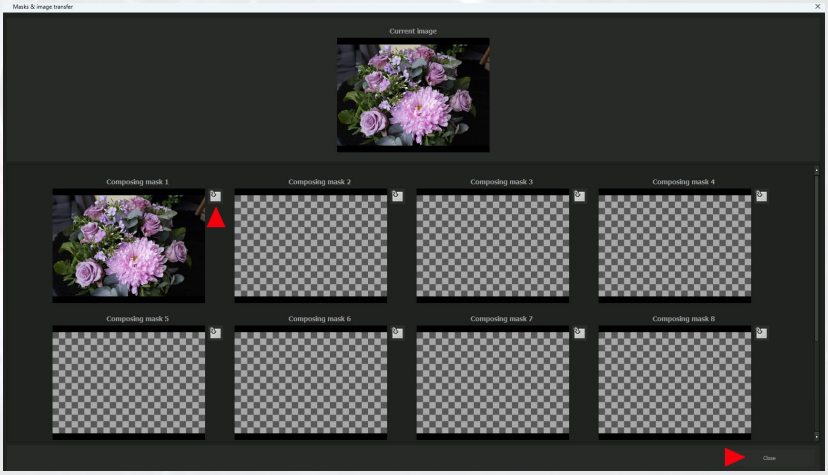
For a better demonstration, an image sequence has been invited, which has been reduced to 3 images (front, centre and rear focus areas).

Image transfer: Click the **left button** to transfer the desired **image** from the current image sequence to a composing mask in **Selective Drawing**, in this example the middle master image.

Mask transfer: Click the **right button** to transfer the corresponding **mask** with the set weighting for **selective drawing** to one of the available masks, e.g. to the **effect masks**.

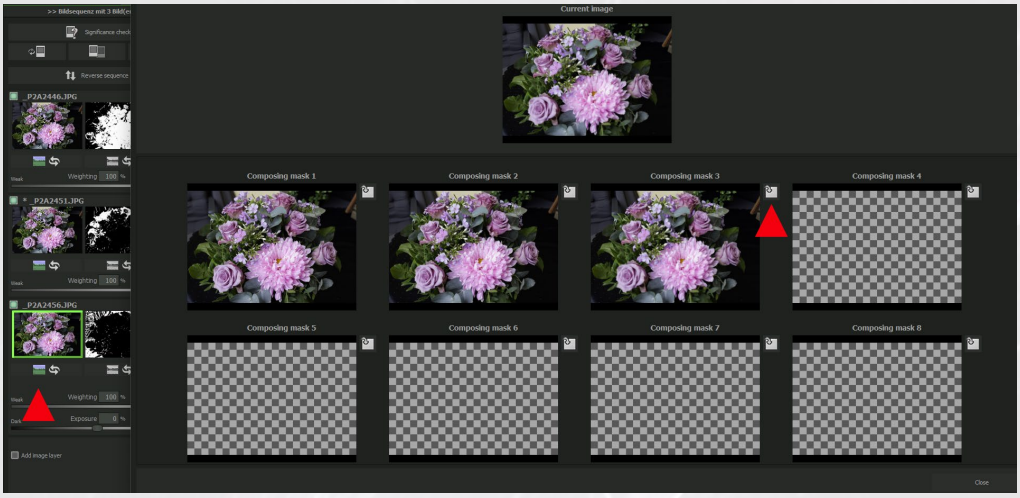
Note: The **Selective Drawing module** is described in detail in the **Selective Drawing** guide.

Example image transfer



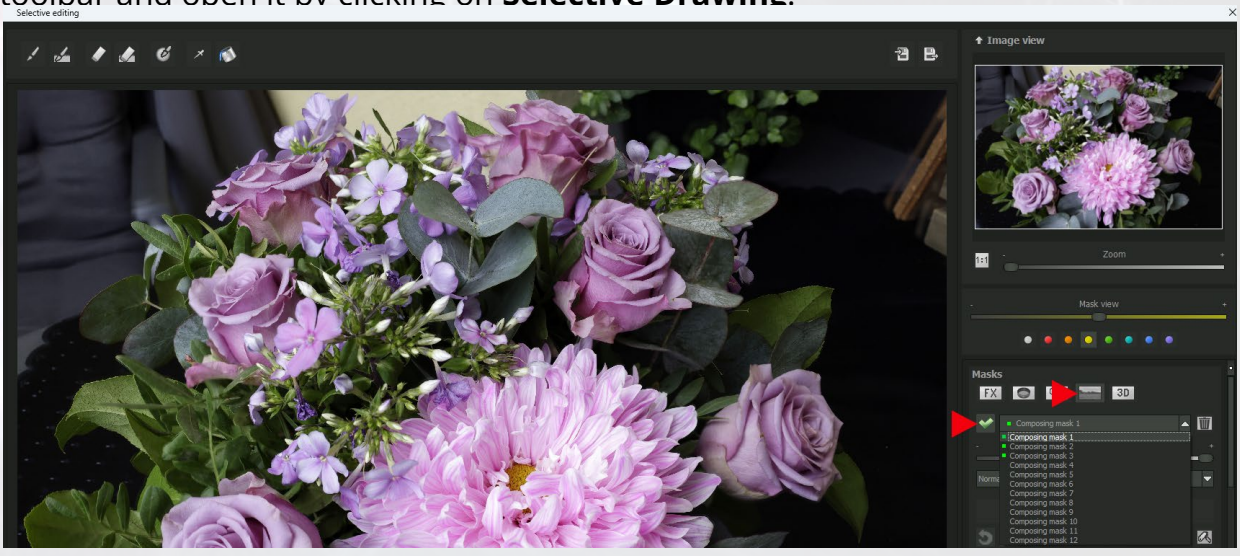
Clicking on the **Image Transfer button** opens the **Masks & Image Transfer window**. Clicking on the button with the arrow inserts the selected image into **Composing Layer 1**.

Insert more images



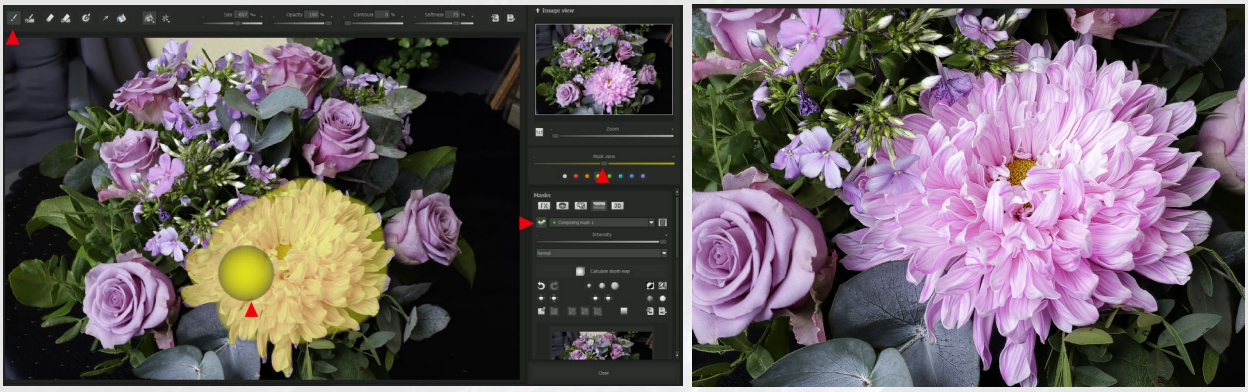
Click **Close** to return to the merge area and insert the other images into **composing layers 2 and 3** in the same way.

After switching to **post-processing**, display the **Selective Drawing module** in the toolbar and open it by clicking on **Selective Drawing**.

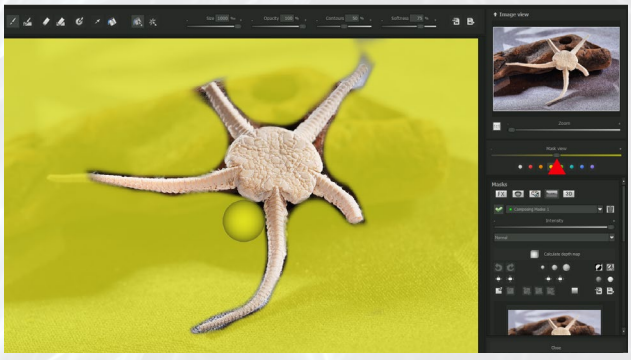


Now activate the Composing Masks area and then click on **Composing Mask 1** to display all 3 active masks.

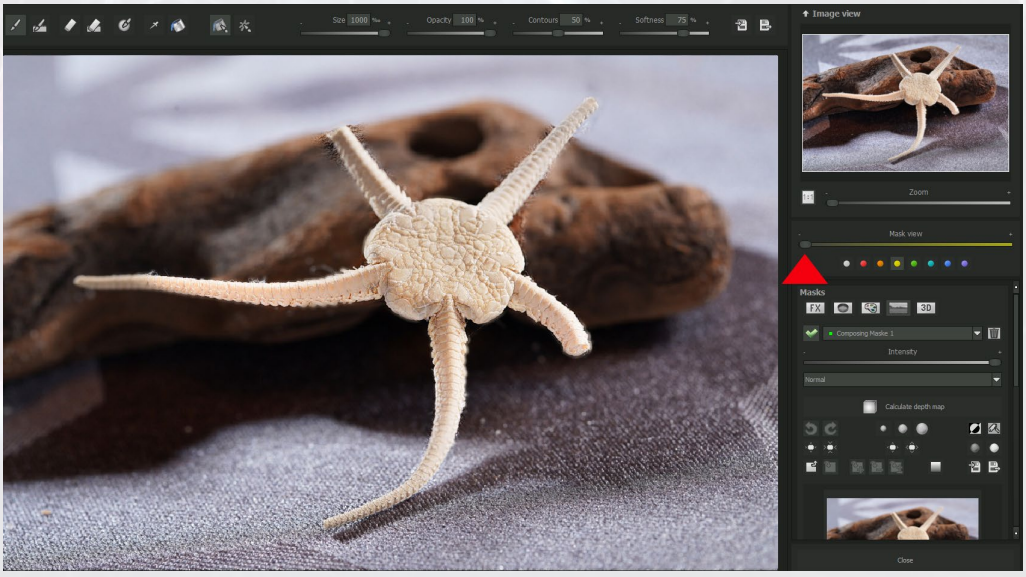
Manually ‘recreate’ the stack or highlight selected parts of the image



Now you can click on each of the three composing masks in turn to place them at the top of the layer hierarchy and use the brush to paint over the foreground, centre and background in the masks so that the stack is effectively “recreated” manually on the different layers by masking, as would be necessary without fusion software.
The alternative in **FOCUS** may be more appealing: you paint over selected parts of the image with the brush in an active mask, in this example **Mask 1**, in order to highlight a single flower, for example (graphic on the right).



In the example with the starfish, the areas **outside** the starfish in composing mask 1, where everything except the foreground was blurred, have been painted over...

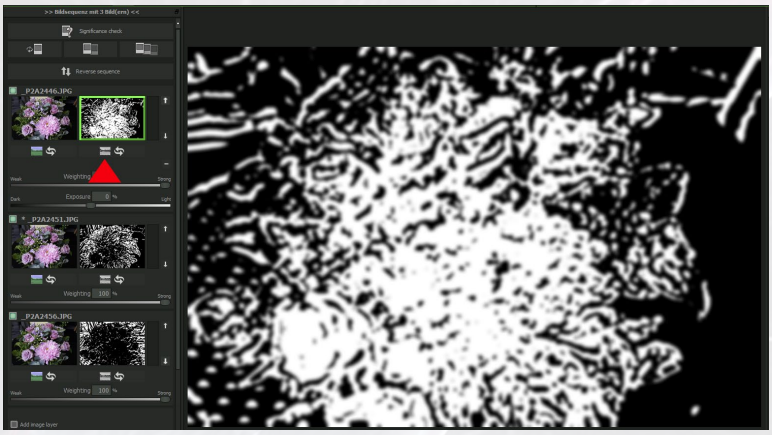


... that only the **main subject** is in focus.

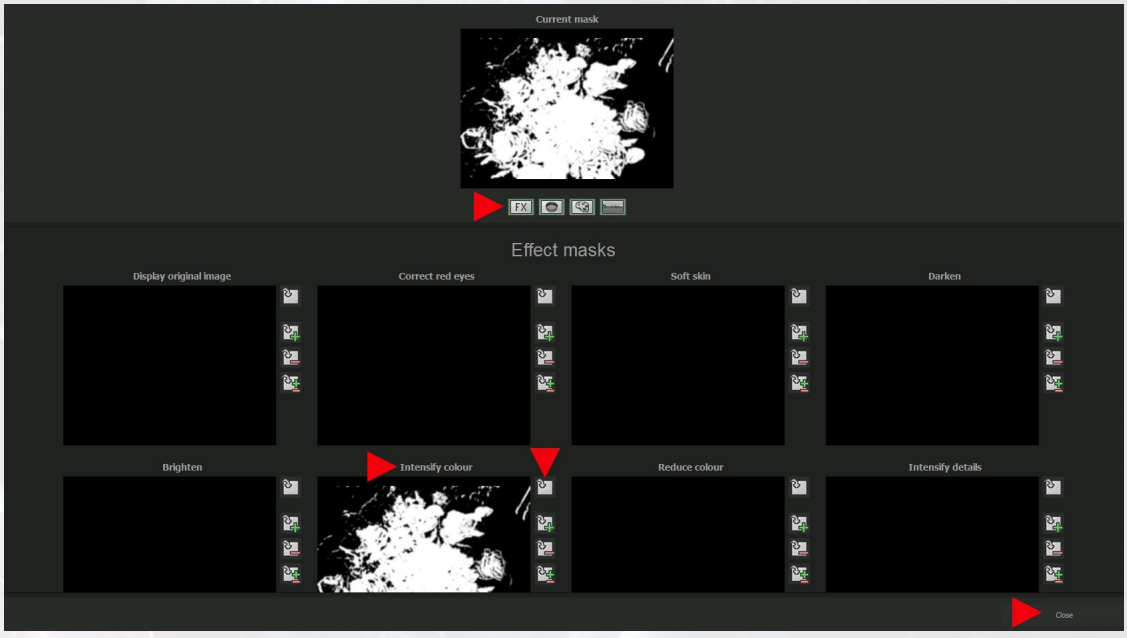
Transfer mask, e.g. to enhance colours

In many cases, it makes even more sense to quickly accentuate selected image areas by transferring a weighting matrix, e.g. by enhancing contrast or intensifying colours, and this is particularly quick and easy to do.

Example: Selectively enhance the colours of the bouquet:



If the **weighting matrix** associated with an image is activated, clicking on the button opens ...



... again the Transfer Window **Masks & Image Transfer** with the options below the current mask to manipulate a desired effect directly in the area of the **effect masks**, **colour filter** or **colouring masks**. The option on the right leads to the **composing masks**.

In this example, the colours in the front area of the bouquet are to be enhanced, i.e. in the areas that are visualised as light or white in the mask.

In the Transfer window, the first section, **Effect Masks**, is active by default with all effects displayed below it.

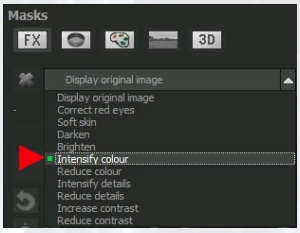
Click on the arrow button next to the **Intensify Colour** effect to insert the mask immediately.

Display result image in post-processing

After clicking on **Close** and switching to **post-processing** ...

... the more intense colours in the foreground are immediately visible without the need for further processing steps.

Correct the mask if necessary



If the colours now appear a little too strong, reactivate **the Selective Drawing** module and click on the small arrow next to **Display original Image** to see all the available effects and the active effect **Intensify Colour** (**green** box in front of the effect). With a simple click on the effect ...

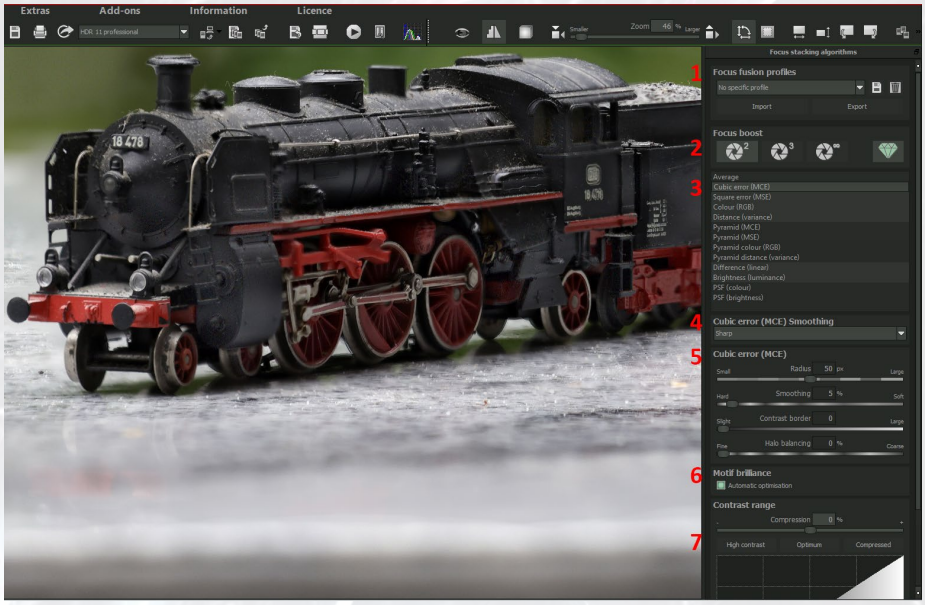
... all associated settings and parameters are displayed. Dragging the intensity slider to the left reduces the colour enhancement until the desired result is achieved.

Click **Close** to return to **post-processing**.

12. Overview of focus stacking algorithms and other modules

On the **right-hand side** of the fusion area, there are **various algorithms or methods for calculating the individual weighting images on the left-hand side**.
This section on algorithms essentially forms the '**heart' of the programme**. Since the options of all modules are directly related to a selected algorithm, this section will be described first, followed by the other modules.

Interface overview



1. **Focus fusion profiles:** Here you can create, save, import, export and, if necessary, call up your own profiles.

2. **Focus boost**: These technologies generate different result image variants of the standard or custom parameter settings in an internal calculation run and then recalculate these result images to produce an even sharper focus stacking image.

3. **Display and selection of the various algorithms.** The default setting in this most important area is the **Cubic error** (**MCE**) calculation method.

4. **Selection of different smoothing methods for the currently selected algorithm:** Here you can adjust the **smoothing of the weights** between **very soft** and **sharp** (default setting) as desired.

5. **Parameters** that are displayed for each selected algorithm and can be used to individually influence this algorithm if necessary.

6. **Motif brilliance**: This **motif brilliance optimisation** with automatic intelligent tonal value spreading is active by default.

7. **Contrast range**: In this module, you can use the three automatic optimisation buttons or the slider to adjust the contrast range as needed.

13. Algorithms

The algorithms offer various calculation methods for the individual images of a loaded stack and their weighting. By default, the **Cubic error** (**MCE**) algorithm is set.

These different methods lead to better or worse results in the fusion image, depending on the subject and recognisable problems such as the halo effects described above, and make the differences to the preset algorithm easier or more obvious to see.
This dependence on an imported image sequence with, for example, different numbers of focus planes, possible camera shake when stacking by hand, slight movements of the subject or background, and other factors that can cause problem areas such as the transition from one depth plane to the next, is why you can choose between different calculation types.
There is no **one method that guarantees the best result**.
If you want to achieve this best result, you should try out different methods to decide which algorithm best suits the currently loaded stack. This can be done very quickly with a single click.
The classification provides a useful guide when making your selection.

Four 'classes' of algorithms

1. The **first four** algorithms are **'direct' mathematical algorithms. Direct** because they work directly on the size of the image.

2. The **second category** offers the same algorithms as the first. The difference lies in the calculation method: these '**pyramid algorithms**' work with a **Gaussian pyramid** that calculates the image with **different resolutions**: first in **full resolution** or size, then in **half size**, **¼ size**, etc. Finally, everything is added together.

3. In the **third category**, you can choose between **'soft' algorithms**, which calculate a very soft result image.

4. The **fourth 'class'** offers **blur algorithms** to choose from.

Comparison of selected algorithms from the four ‘classes’ using the same motif

In the first graphic with the image section of a flower, the default algorithm is set to **Cubic Error (MCE)** from the **first category**. This algorithm uses the ‘classic’ method of ‘mean cubic error’ to determine the fusion image and, in **most cases, produces a very good result image**.

In this graphic, the **pyramid algorithm (MCE)** from the **second category** calculates the fusion image. The effects in the weighting matrix are minimal, but the result image appears sharper and of slightly better quality with **Cubic error (MCE)**.

If you switch to the **Difference (linear)** algorithm in the **third category**, the difference is striking: the focus stacking result image is **very soft**, which also makes a significant difference in the weighting matrices and does not ‘fit’ with this stack, but can be an attractive and interesting alternative for other subjects.

Very good alternatives to try: PSF (colour), PSF (brightness)

These **fourth-class** algorithms deserve special attention because in a focus stack where, for example, each focus plane was captured three to four times, each of these images is processed in terms of focus (focus stacking) and noise reduction (noise stacking).

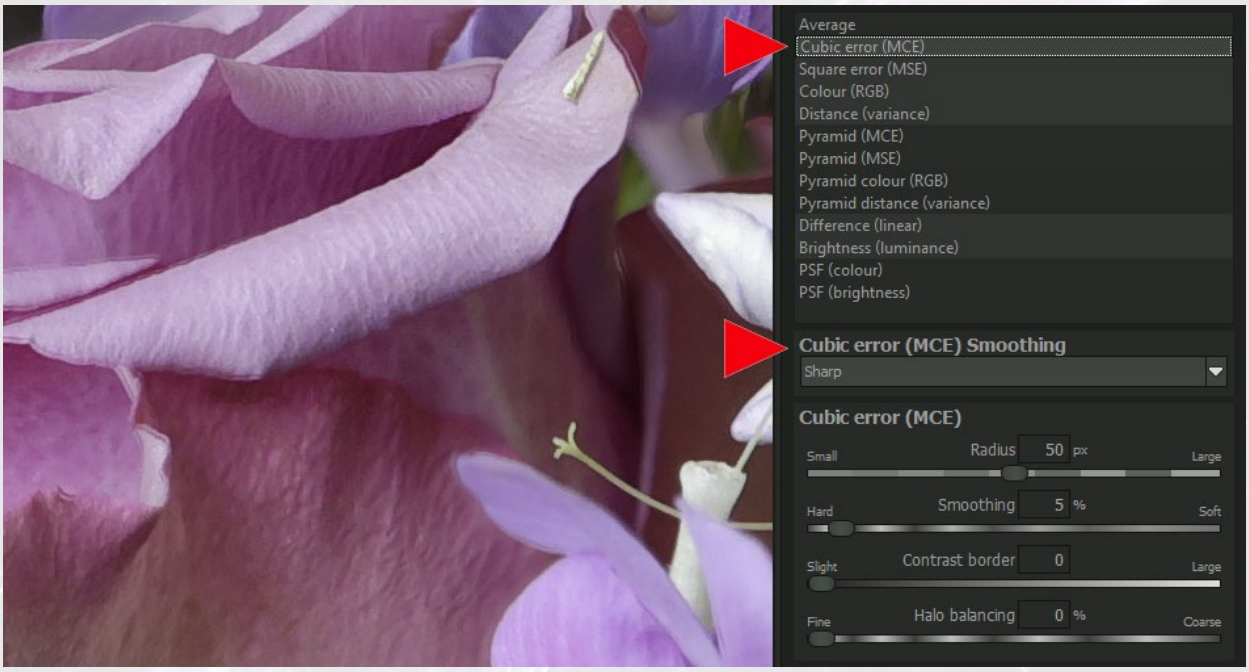
The **PSF (colour)** algorithm from this category, with the **p**oint **s**pread **f**unction (PSF) that is also used successfully in **SHARPEN**, performs a blur analysis for each image and uses this analysis to search for and determine the sharpest areas in the image.
This method, which performs blur analysis based on **colours** (and contours), is very computationally intensive and slower, but achieves **very good results with many stacks**, as in the example, where **this algorithm delivers the best quality result**.

The **PSF** (**brightness**) algorithm below in the last comparison example is slightly faster and determines the sharp areas based on the brightness in the image, which usually also leads to very good results.

This small selection of comparisons shows that it is worthwhile trying out different algorithms in the search for the best result image.

Optimise results with the parameters

Whenever an algorithm is selected, the corresponding parameters are displayed below it. These parameters can be used to fine-tune the fusion image, which is determined by the default settings, or to significantly influence it depending on the subject and the stack loaded.



In the example, the default setting **Cubic Error (MCE)** has been selected with the corresponding parameters.

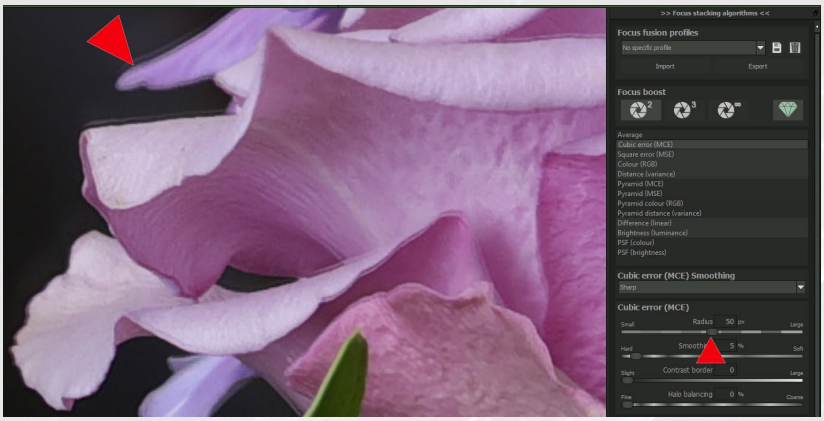
Radius: The **calculation range** or accuracy for the process. With this slider, which is set to **50 (px)** by default, you determine the size of the area to be sampled for the pixel to be calculated. A **high value** usually leads to a **better result** at the expense of longer calculation time**.**

Smoothing: The smoothing control, which is set to a low value of **5%** by default, allows you to control the sharpness of the edges and edge transitions in individual images. A **low value** produces a **detailed** and sharp result, while a **high value** produces a **softer** and 'deeper' result image.

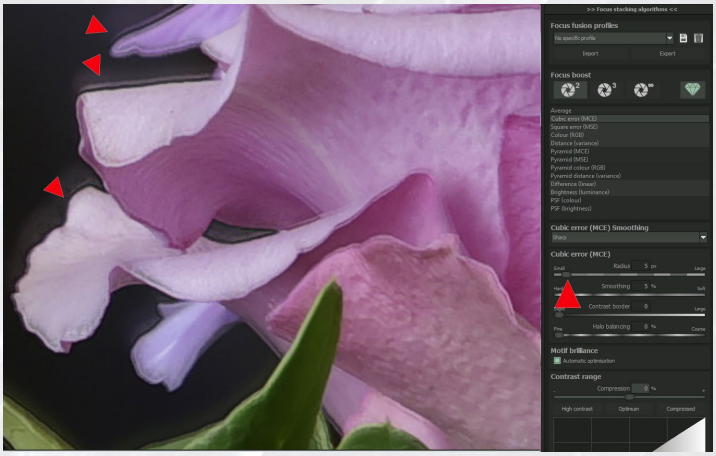
Contrast threshold: This control, which is set to **0%** by default, acts directly on the **depth map** (see chapter on depth maps) and determines whether a low or high contrast is used in the calculation.

Halo compensation: This slider, which is set to fine (0%) by default, reduces (or, in the best case, eliminates) stacking halos.
The set value determines whether the search should tend to focus on **fine details** (**small value**) or **large details** (**large value**).

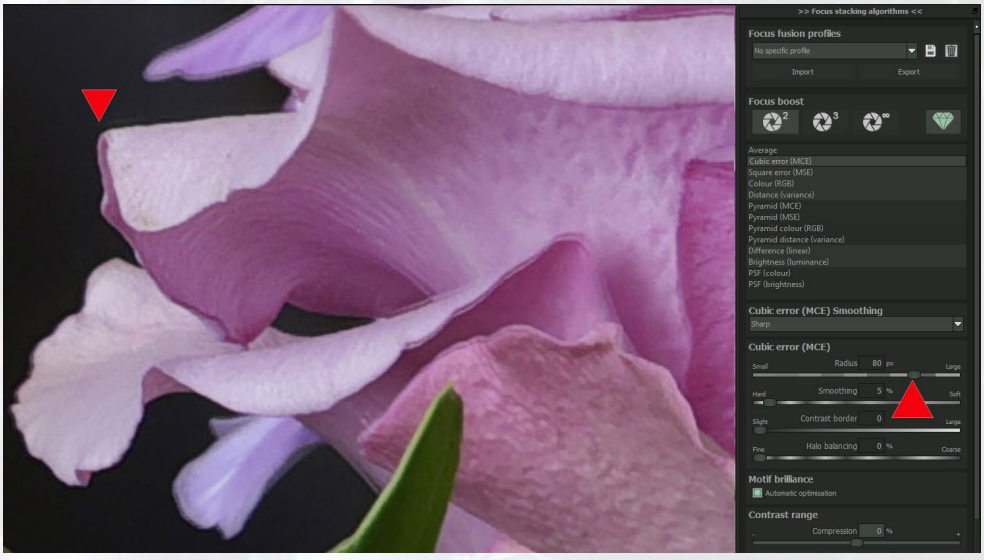
Example parameter **Radius**



In the example, set the default value of **50** to the low value of **5**, ...



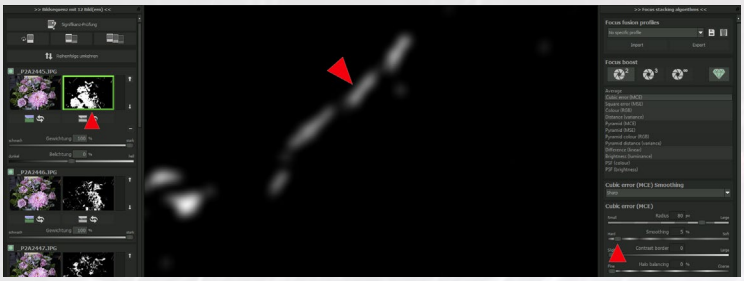
... you will see **strong halos** at all edge transitions.



If you increase the radius of the algorithm to **80**, for example, and 'tell' the programme to search for the sharpest area with a **higher calculation** accuracy around each pixel in a larger area, the **halos are barely visible**, although not completely avoidable, and the result is **significantly better**, but also more computationally intensive.

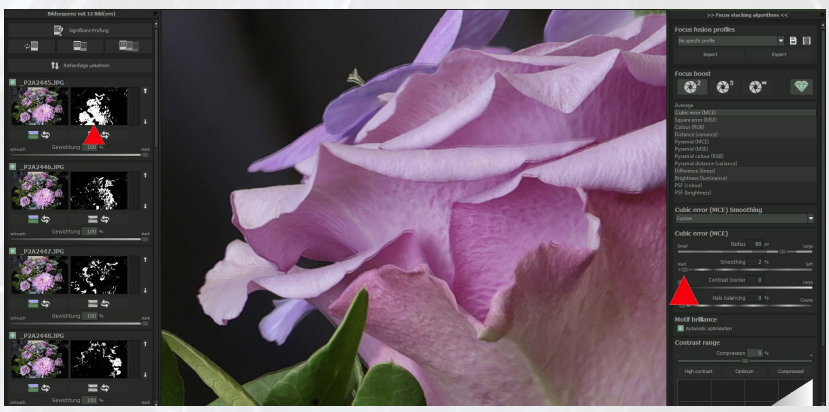
Note: When photographing a subject with many fine objects, such as pins lying next to each other, a **small radius** is recommended.

Example parameter **Smoothing**

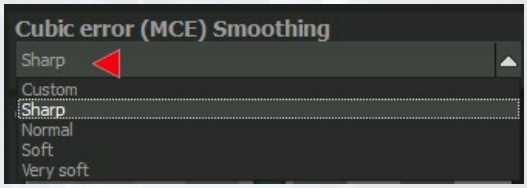


If the **smoothing slider** is set to the default value of **5%**, the mask will still look quite blurred after clicking on it.

If you increase the smoothing to **80%**, for example, these and all other masks will be very soft, which confirms the fusion image with **very smooth transitions**.



If you reduce the value to a 'hard' **2%**, the result looks very good and differs only slightly from the default setting.



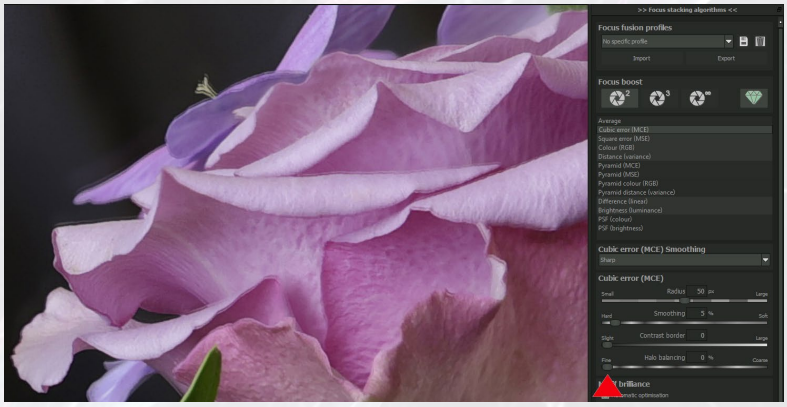
Smoothing variations: By clicking on sharp or the small arrow next to it, you can choose between several smoothing presets ranging from sharp (default) to very soft.

Note: At **0%**, you will not only see the pure focus stack with the **1:1 pixel masks**, which are extremely precise at this setting, but also **disturbing artefacts** in the dark background.

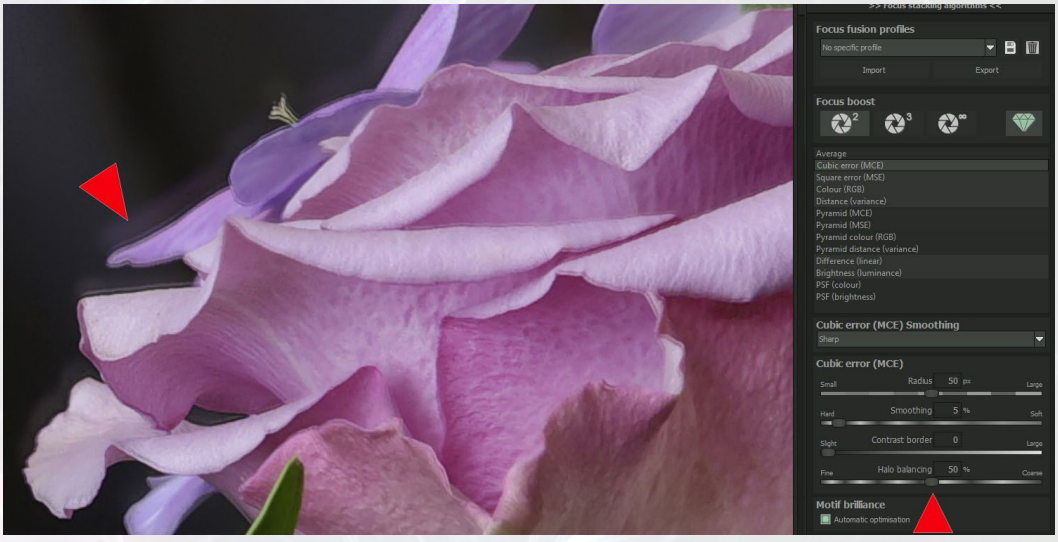
Example parameter **Halo balancing**

At the beginning of the chapter **Editing weights, removing halos selectively**, the recommendation was to try **turning off Focus Boost** or **experimenting with the parameters of the selected algorithm** before finding the best solution in the **Edit Weights** module using the **Painter**.

Halo balancing is a special parameter. This halo compensation also leads to greater calculation accuracy and ensures that focus halos are effectively suppressed, but not in all cases.



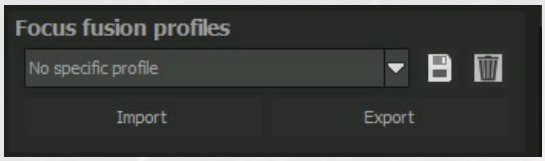
By default, the slider is set to **0%**. Since all other parameters are also set to their default values, you see the ‘normal’ fusion result image here.



If you drag the slider to **50%**, for example, the result is different, but not better, rather worse, which once again illustrates that each stack and each motif requires different methods to guarantee the best possible result.
In many cases, the result is better when a higher value is selected, but in some cases it is worse, as in the example.

Note: Once you have achieved the best result for you with the parameters for a selected image section, it is advisable to ‘wander’ through all parts of the image again, because the best result in one particular place may lead to a slight deterioration in another. In this case, a slight correction to the individual settings can then achieve the best possible overall image result.

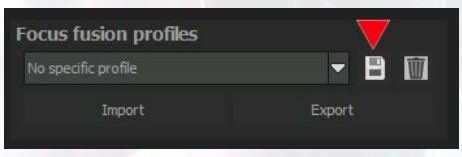
14. Focus-fusion profiles

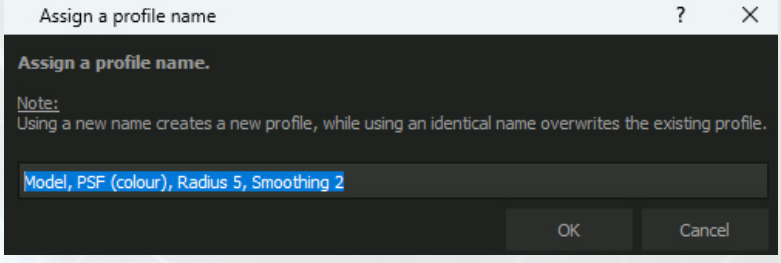


Once you have experimented with different algorithms and parameters and found a combination that you believe achieves the best possible result, you can use these current settings to create your **own profile**, save it, import it, export it and, if necessary, call it up again at any time.
It is best to assign the profile name in such a way that you can quickly find it again among similar stacks.

Example: With this stack of a car model, you have
- selected the **PSF (colour) algorithm**,
- increased the **Radius** parameter from **25** to **40%**,
- Reduced the **Smoothing parameter** from **5** to **2%**.

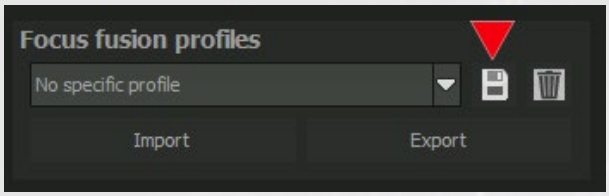
The best fusion result from your point of view with this combination can be quickly applied to similar motif stacks if required.





By clicking on the button, you can then assign a desired name in the dialogue box, in the example PSF (colour), Radius 5, that opens and confirm your entry by clicking on **OK**.

Recall created profile



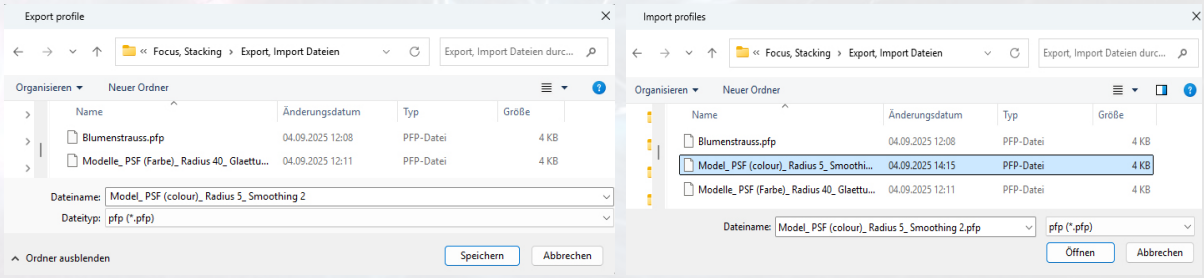
If you load a new stack with a similar motif, no specific profile will be displayed by default.
Click on this button or the small arrow next to it to display all individually created profiles.

Simply click on it to activate it and recalculate the stack with the saved settings.

Delete profiles: Click the button with the **recycle bin icon** to delete the current profile and remove it from the list.

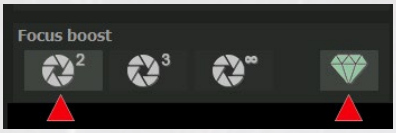
Export, Import profiles

If you want to make a saved profile accessible to other users, for example, and **export** it, or try out and **import** a profile from other users, click on one of the two buttons ...

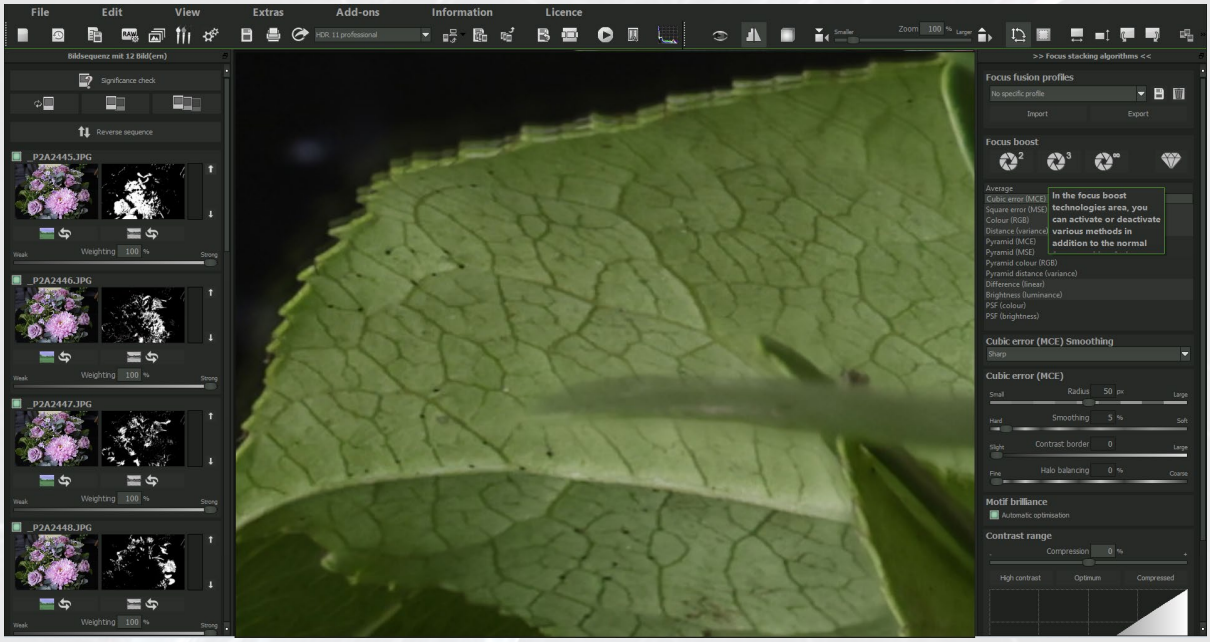


... and **export** the active profile to a folder of your choice (graphic on the left) or **import** a profile from the corresponding folder.

15. Focus boost



This module, which has two different technologies activated by default, is exceptional.



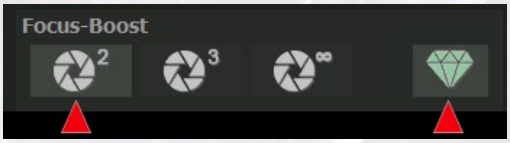
Example: If you **deactivate** Focus Boost after loading this well-known bouquet stack by clicking on the two buttons, the result will look like the graphic.

Clicking on the button with the **diamond symbol** activates a special sharpening process, Diamond-Cut Sharpening, which optimises the focus stacking result image by ‘extracting’ a little more sharpness from the image.

Focus Boost method

The three selectable **focus boost technologies** or **'improvement methods'** generate **different image result variants** from your individual or standard parameter settings in an **internal calculation process** (i.e. invisible to the viewer). These image results are then recalculated to produce an even **sharper** and generally **better** focus stacking image.

Example: In the **Algorithms chapter**, you saw how, for example, **increasing** or **reducing the radius** in a selected algorithm affects the result image. Individual parts of the image may produce better results with a higher radius, while others may produce better results with a lower value.

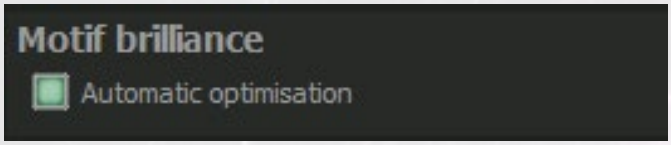


Focus 'remembers' the different 'interim results', selects the sharpest areas from both images, and calculates these **two result images** again with the **boost switched on by default** with the **2** ...

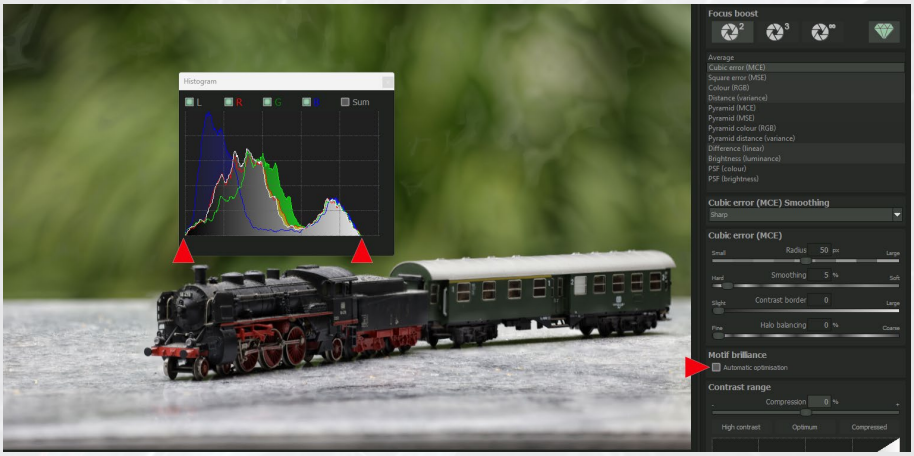
... and in most cases, as in the example, this produces a better result.

Clicking on the button with the number **3** will take **3 results** and add them together again.
Activating the **third focus boost** button with the **'infinity sign'** will recalculate a **large number of results**, which is correspondingly more computationally intensive and takes longer.
Note: Since there is no guarantee that the higher level will automatically improve the result for every algorithm, in every image area and for all stacks or subject types, it is advisable to experiment.

16. Motif brilliance

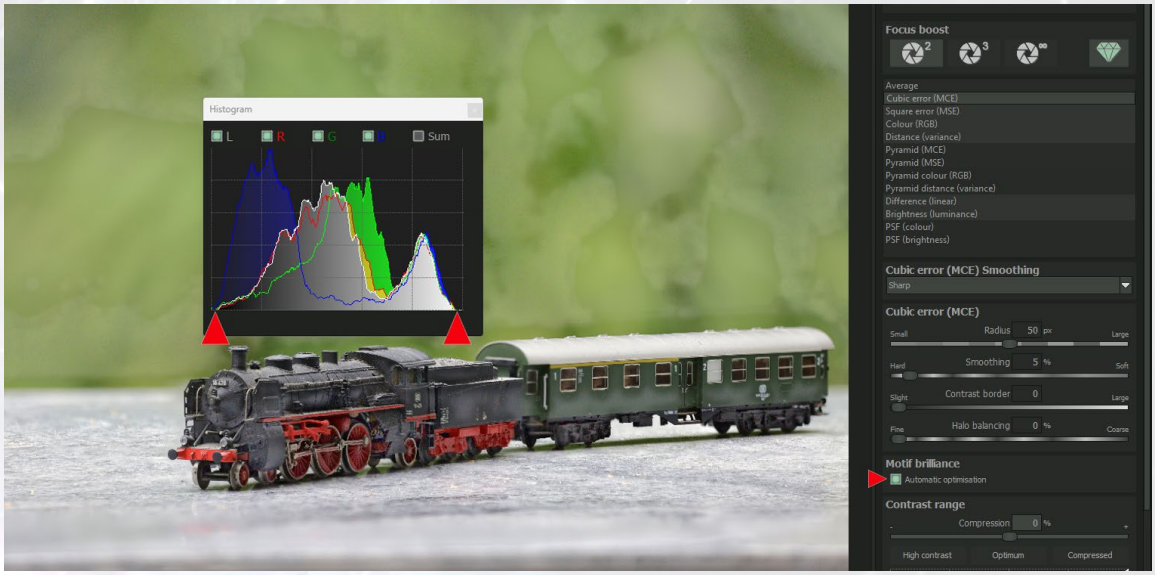


This module, which is enabled by default, **optimises** the histogram using **tone value spreading if necessary**.



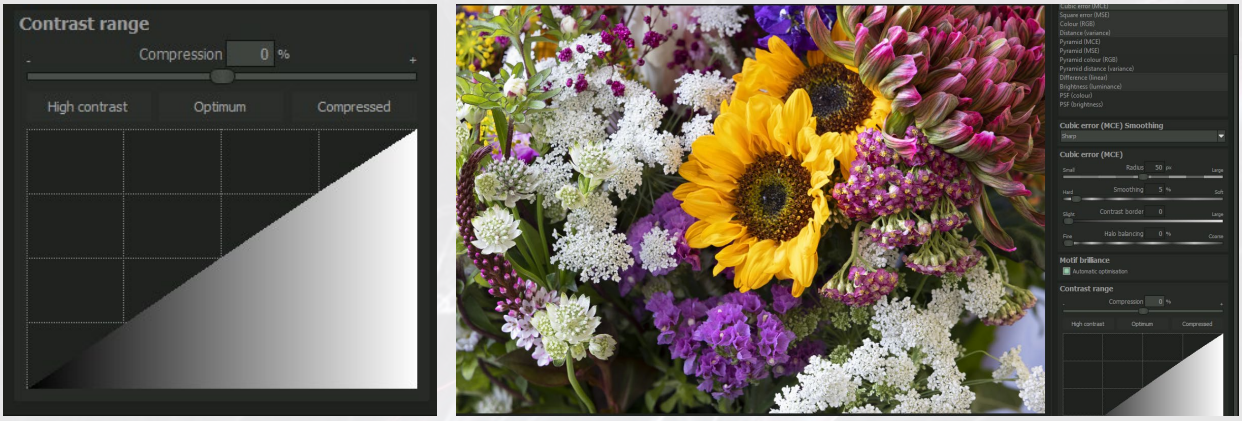
Motif Brilliance checks whether **white** is **white** (right boundary) and **black** is **black** (left boundary) in the histogram showing the distribution of brightness values, i.e. whether the histogram covers the entire spectrum from white to black and enables balanced contrast.

It has been photographed very well; there is little or no difference between the active and deactivated module.



If this is not entirely the case, as in the example where the histogram was not fully utilised, particularly in the bright areas ('white point' too far to the left), the tonal values are 'pulled apart' or spread out when the module is active so that everything is visible. The result is an **image that appears slightly more brilliant overall**.

17. Contrast range



The contrast range determines the ratio between the brightest and darkest areas in the image. In this module, you can set a desired basic contrast if required, which you can select either by clicking one of the three buttons or using the compression slider:

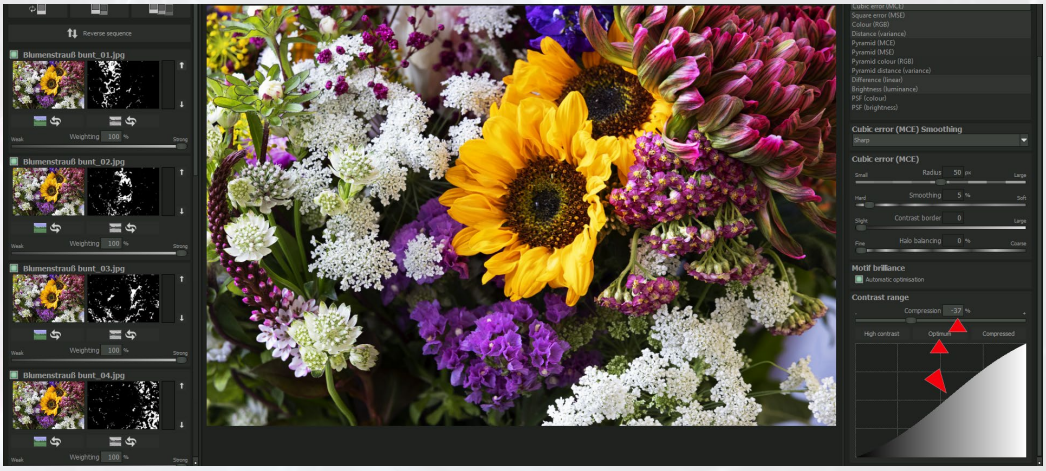
High contrast: Automatically optimises the dynamic range to produce a **high-contrast image**.

Optimum: Sets the image to an **optimum average exposure.**

Compressed: Automatically optimises the dynamic range to a **compressed image** (positive compression value).

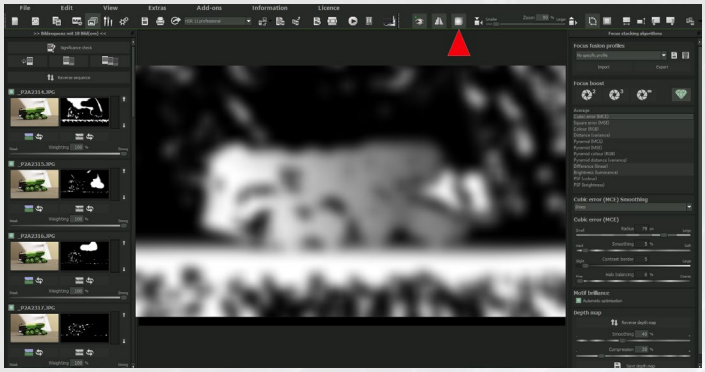
Compression: A **low value** (negative value) produces a **higher contrast** range, while a **high value** (positive value) produces a **lower contrast** range. The control setting always changes accordingly with one of the three presets selected. Of course, you can also set the value independently as desired.

Curve display: The curve display shows the dynamic range or exposure curve for the currently set compression value.

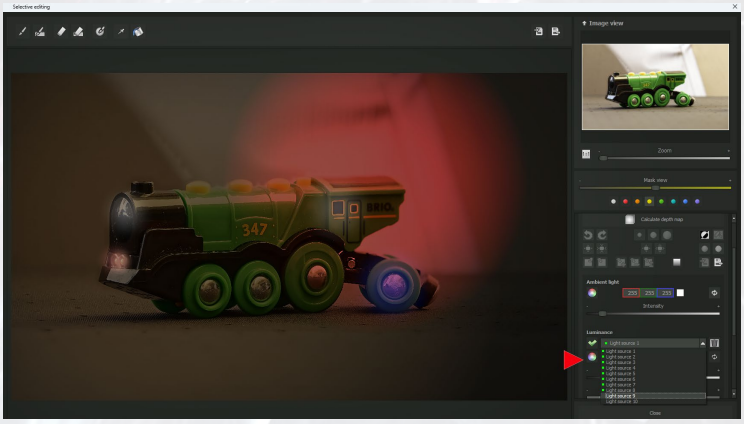


Example Optimum: Clicking on the middle button **Optimum** makes the image appear slightly more brilliant, and the compression slider is now set to a slightly increased contrast at the negative value **-37**. The previously linear exposure line has become a slight 'S-curve'.

18. Depth map



Focus automatically generates a **depth map** for each loaded stack.
Prerequisite: The Focus stack must have been captured either from **front to back**, as shown in the image example, or from **back to front**.

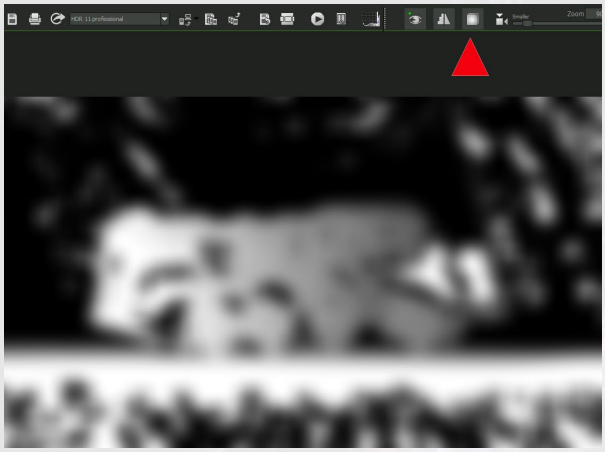


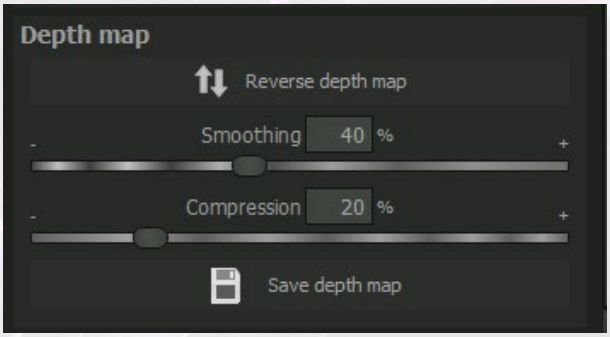
This depth map can be imported into **Selective Drawing**, for example, and used for a wide variety of spatial effects.

For example, in the area of **3D masks**, you can effectively illuminate a motif from the front and back using different light sources, as in the example of the locomotive, and thus create a completely different three-dimensional lighting atmosphere.
Note: This module is described in detail in the **Selective Drawing** guide.

This effect naturally also leads to interesting and atmospheric image effects with different presets, such as **Spotlight Intense spotlight** here.

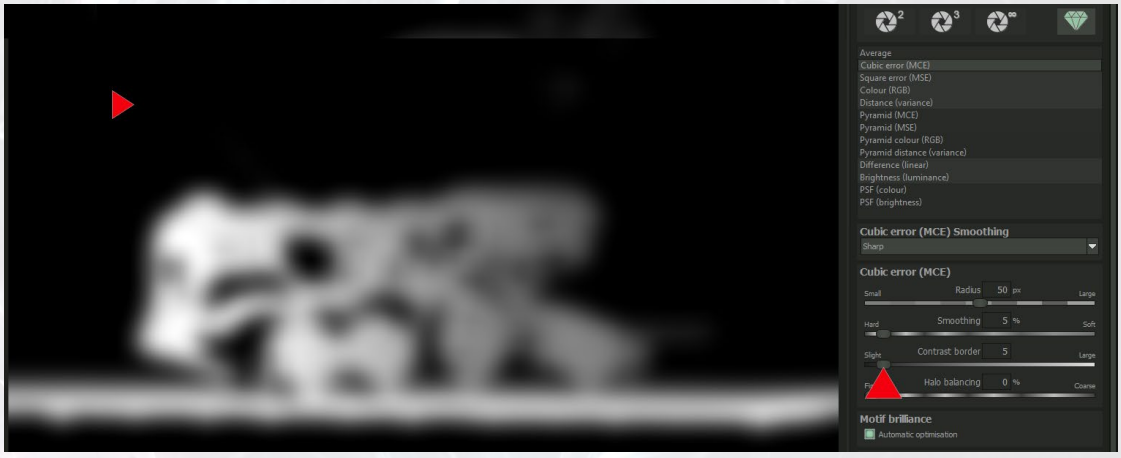
Display depth map





In a depth map, the **light to white areas** represent the **foreground**, while the **dark gray to black areas** represent the **background**. Clicking the button in the toolbar switches the image view associated with a **fusion image** to the **depth map view**.

Parameters: When the depth map is activated, the corresponding parameters are displayed:
Smoothing: This slider allows you to adjust the **smoothing of the depth map** from weak (left) to strong (right).
Compression: This control varies the **compression** of the **depth map contours**.
Reverse depth map: Click on **Reverse depth map** to **reverse** it.



The **contrast border** parameter described in the **Algorithms** chapter, which is set to **zero** by default, helps to shift the depth map in areas that are not clearly defined, such as the **areas in front of the locomotive** and the areas **behind the locomotive** in the example (graphic above), to the respective rear plane. If the contrast limit value is increased too much, “holes” may become visible in the depth map.
The “correct” or best threshold value must be found manually through trial and error. In the example, it is around five, with the result that all areas are clearly defined and show a “clean” depth map.

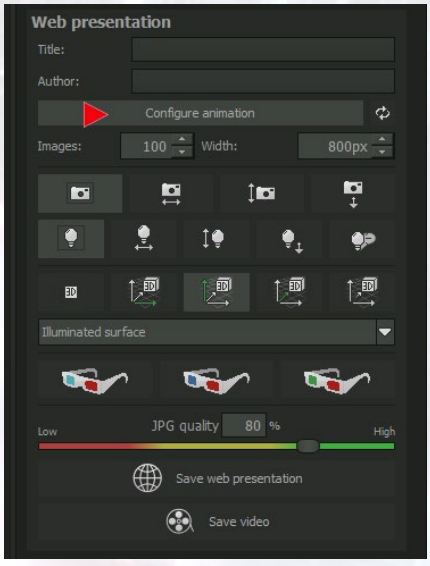
Note: Increasing the **radius** also leads to a better result for the depth map.

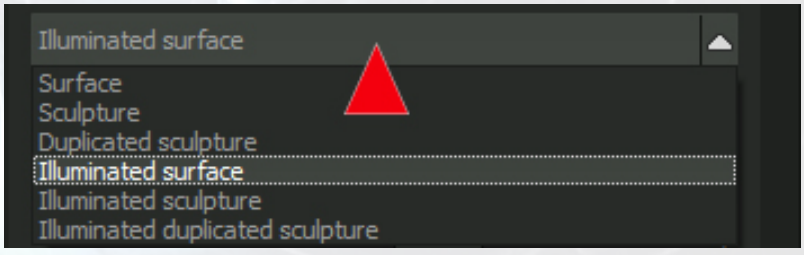
19. Web animation, VRML export

In this exciting module, you can generate **3D animations** of your focus stack as needed and save and play them as a **web presentation**.

Note: Since this module and the **VRML export** module are not directly part of Focus Fusion, they are only described briefly here. It is definitely worth trying out the various options, which will lead to amazing and surprising animated presentations that you can incorporate into your own movies or forward to interested parties.

If you have selected a desired preset from the **3D category**, in the example **3D High focal distance**, clicking on the button with the globe icon will display the web animation area.

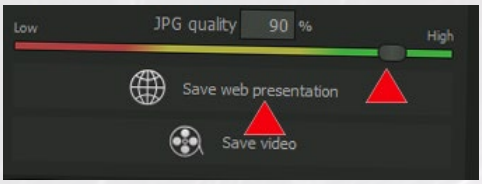




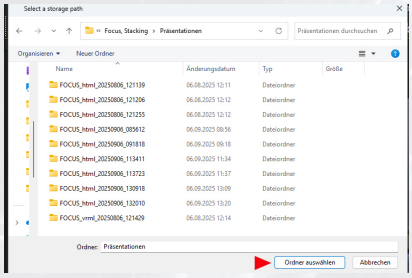
Configure animation: Clicking the **Configure animation** button displays the animation details area, where you can set or disable various **camera positions**, animations of the **3D light source**, and the type of **rotation** around the x or y axis.

Select illuminated surface: Clicking on the **illuminated surface** offers a choice of **different lighting options**.

Save presentation



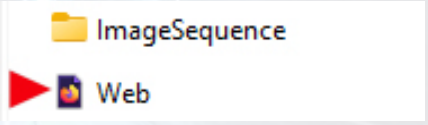
Determine storage quality: Once you have found the desired combination from the options offered, accept the default image **compression quality** (**50%**) or change it as shown in the example (**90%**).



Save presentation: Click the **Save web presentation** button, select a folder, and confirm by clicking **Ordner auswählen**. In the **Image Cropping & subtitle** window that opens, which you are also familiar with from the Flash Workflow chapter, click **Save**.

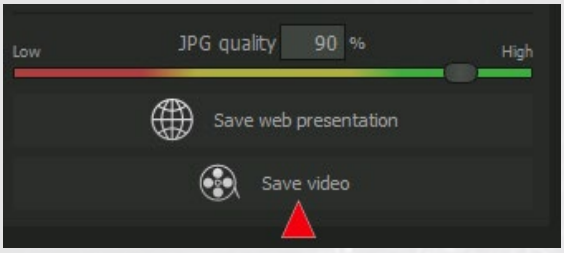
Note: The image cropping and scaling options are described in detail in the **General Functions** guide.

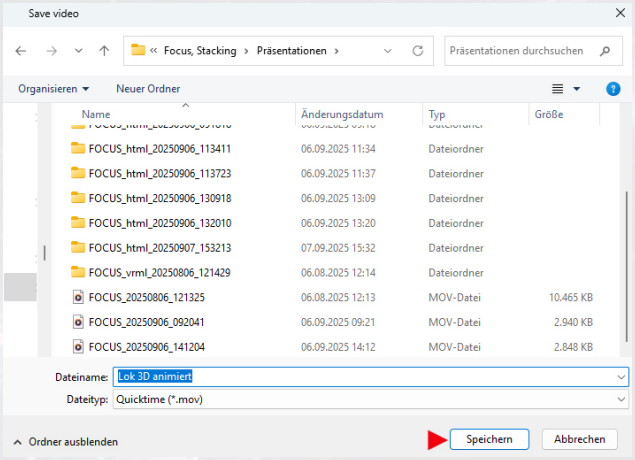
Play animation: Focus now calculates the animation and then plays it.



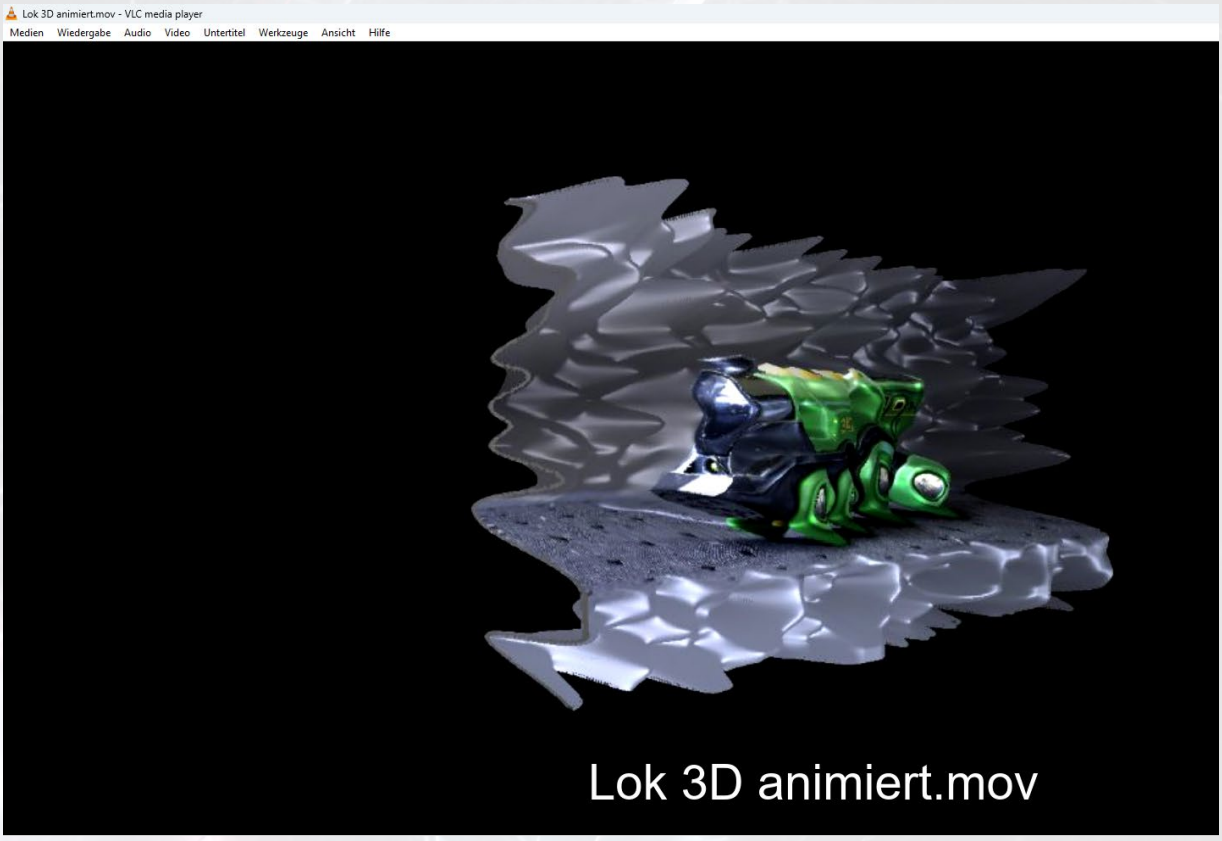
Recall and play back the file: The selected folder contains the folder with all the individual **image sequences** and the **HTML file**. Click on this file (**Web**) to recall it and play it back.

Save video presentation



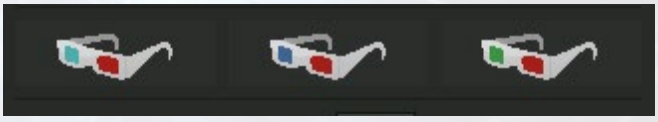


By clicking on the **Save video button**, you confirm that you want to save the video in the selected folder. Click on **Save** to confirm.



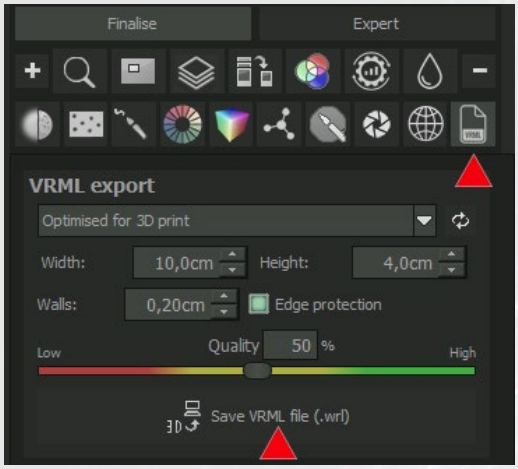
... and the video is played in a suitable player for the file format.

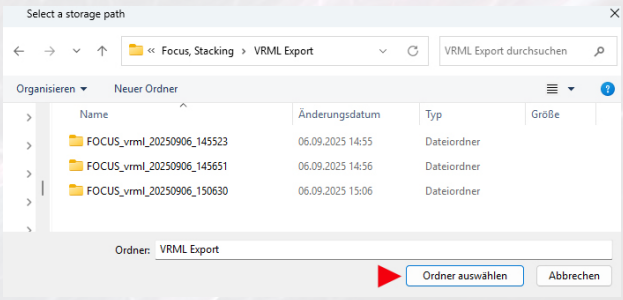
3D View



By clicking on one of the **3D glasses icons**, you can activate the 3D view using (from left to right) red-cyan, red-blue, or red-green **anaglyph glasses**.

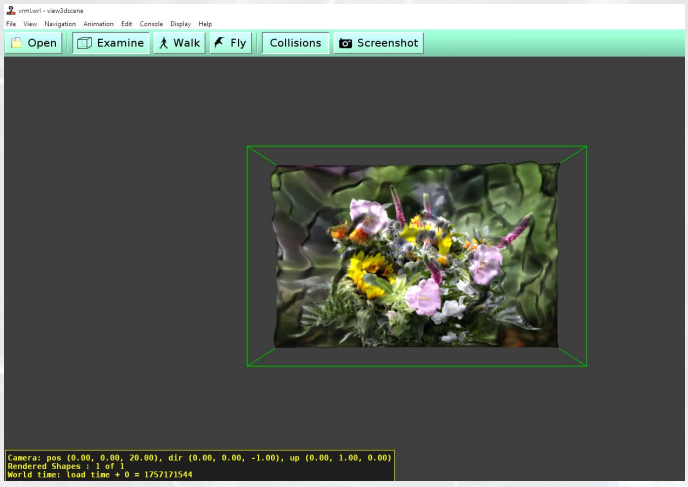
VRML-area

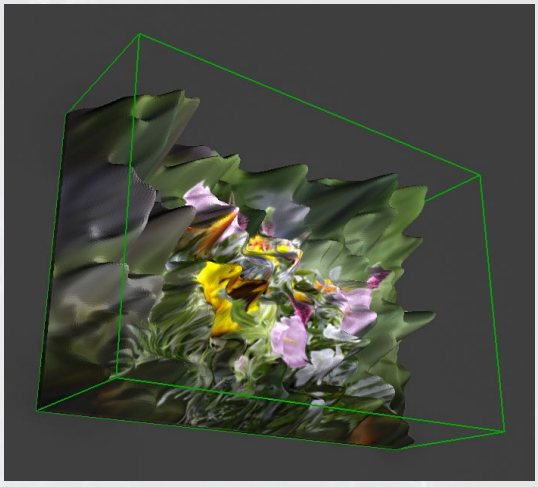




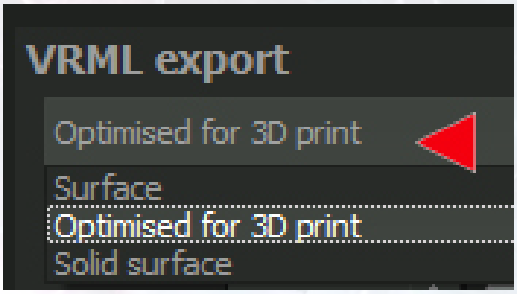
An export function to the standardized **VRML** format (**V**irtual **R**eality **M**odeling **L**anguage) is available for **further processing** of the focus stack as a **3D object**. Clicking on the **VRML area button** displays this module.

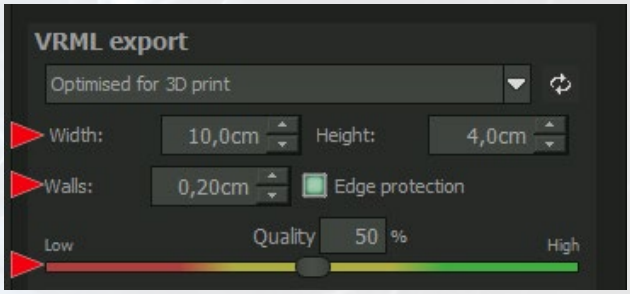
By clicking on the **Save VRML file** button, you confirm the save in the selected folder with **Select folder** (graphic on the right).





After exporting, the 3D object is automatically opened in your installed VRML viewer and can be moved around the room as desired, for example with the mouse.





You can set the **type** (graphic on the left), **scale** and **level** of detail for the **VRML export**. The **quality** specifies how many triangles your 3D object should consist of. A low value creates an object with about 5000 triangles, while a high value creates up to a million triangles (graphic on the right).
These files can be used very well as templates for 3D printing.