

RxLive 2.10 Workflow

1. Setup the camera



SVS Camera GigE Connection Guide

Camera is not found in RxLive:

- Check physical connections: power, ethernet
- Camera: Make sure ethernet cable is connected to port opposite to the power cable
- Turn off firewall



Start SVCapture

- Located at Start -> Programs -> Raytrix -> Camera Tools
- If the camera is not found by SVCapture, there must be a hardware network problem. Please contact us with details.
- Check IP configuration of camera and PC network card. Should both be static, **same subnet**.
- If SVCapture can connect to camera, check if image transmission works

If no image transmission is possible in SVCapture:

- Set jumbo frames of PC network card to 9k
- Restart SVCapture, check again

If still no image transmission is possible in SVCapture:

- Use a different PC network card
- Let us know the details of your setup, including network settings.

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Follow the „Camera Connection Guide“ in setting up the camera.

If you encounter problems not covered by the troubleshooting section, please contact the Raytrix support team:

support@raytrix.de



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2. Adjust the lenses focus distance



1.) Set the main lenses focus distance to roughly match the distance of the object you want to capture.

This setting will be fine tuned in a later step and doesn't have to be exact at this stage.

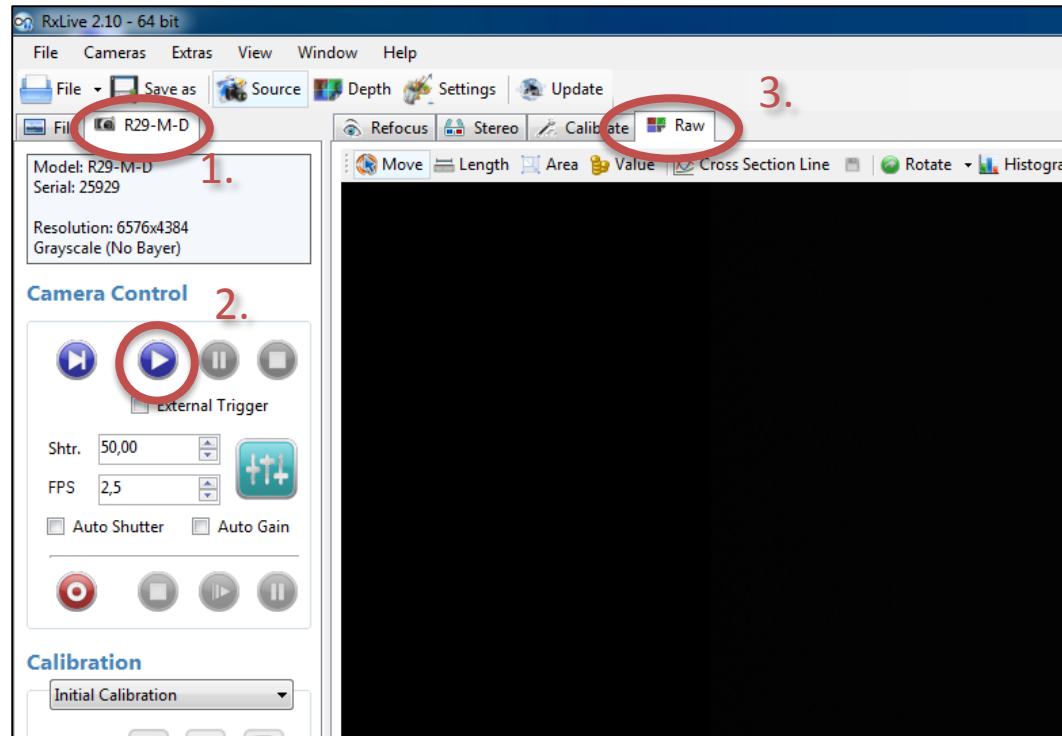


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3. Select the camera and start image capture



1.) Select the camera you've connected

2.) Start image capture

3.) Switch to the „Raw“ tab

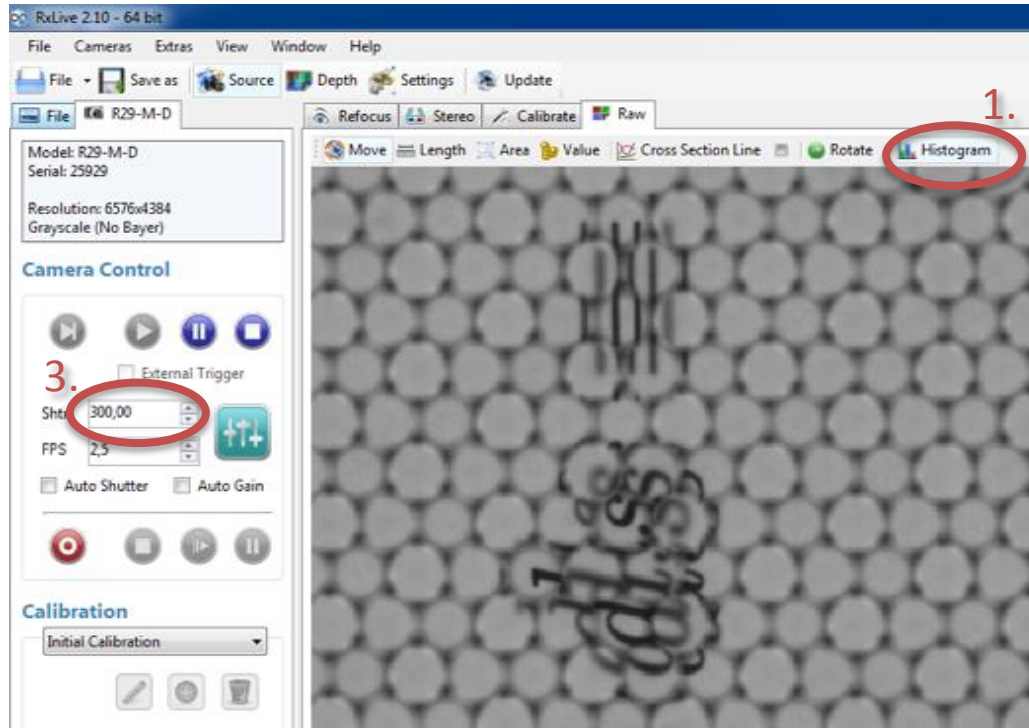
First you will have to select the camera you've connected and start image capture. Since the camera isn't calibrated yet switch to the „Raw“ tab to start with the calibration.



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4. Adjusting the shutter speed



The default shutter speed probably won't provide you with a well illuminated image. Displaying the histogram can help you find a good shutter speed.

1.) Display the intensity histogram (2.).

3.) Adjust the shutter speed so you have a well illuminated image. Regularly check the histogram to avoid overexposure.



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5. Adjust the aperture



In light field photography the main lenses effective aperture has to match aperture of the micro lenses.

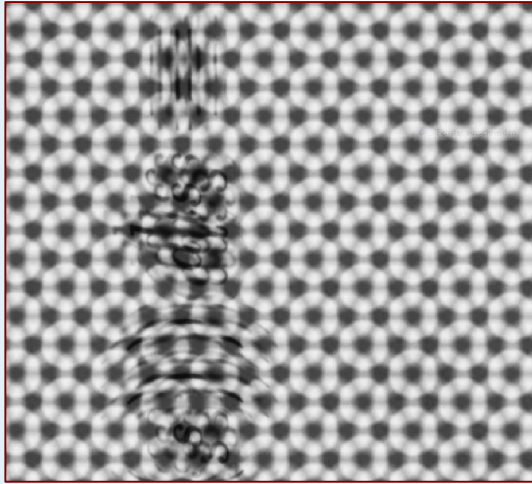
1.) Adjust the main lenses aperture until the micro lens images touch without overlapping.

You can zoom into the image by holding the right mouse button.

See the next slide for example images.

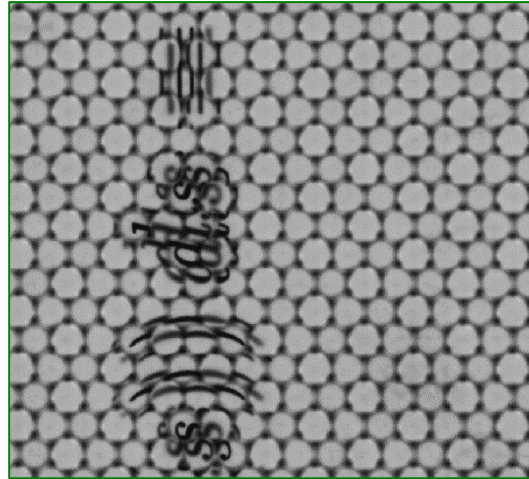


5. Adjust the aperture



Micro lens images are overlapping.

Close the aperture!



Micro lens images are touching without overlapping.

Aperture optimal!



Micro lens images aren't touching.

Open the aperture!



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6. Fine tune the main lenses focus distance



The furthest object that can be measured in a light field will have a two times redundancy in the raw image.

You can use this to fine tune the main lenses focus distance.

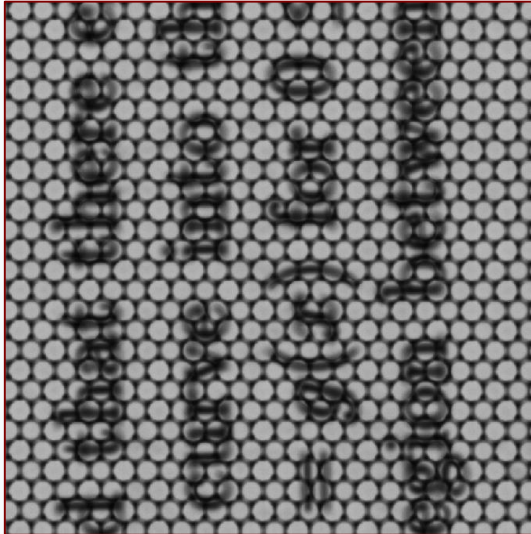
1.) Zoom in on the furthest away part of the scene you still want to capture.
(Move the mouse while holding the right mouse button)

2.) Fine adjust the focus distance. One lens type should be sharp with 2 times redundancy.

See the next slide for examples.

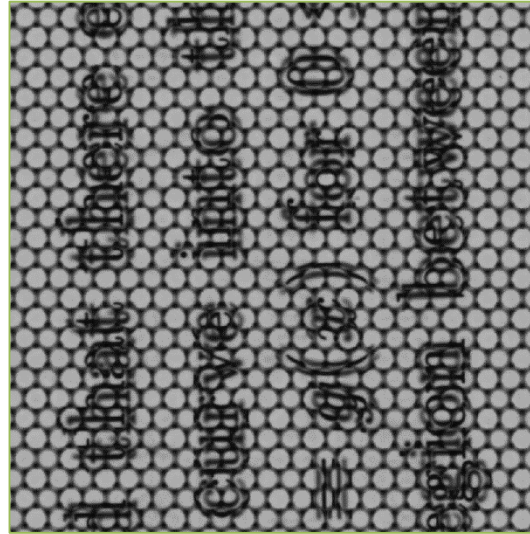


6. Fine tune the main lenses focus distance



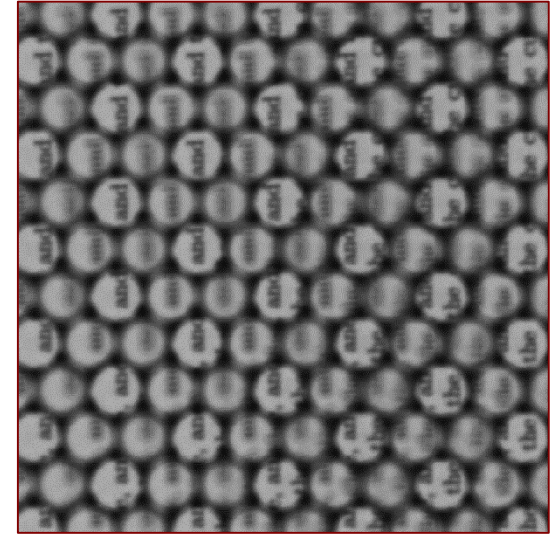
No sharp micro lens images. No redundancy.

Choose a longer focus distance!



Sharp micro lens images. Low redundancy.

Focus distance optimal!



Sharp micro lens images. High redundancy.

Choose a shorter focus distance!



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7. Put the calibration filter on the lens

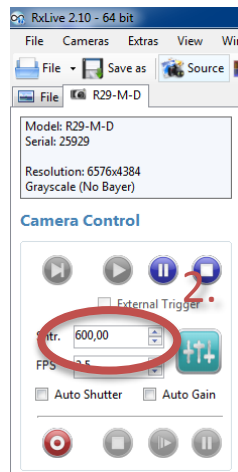
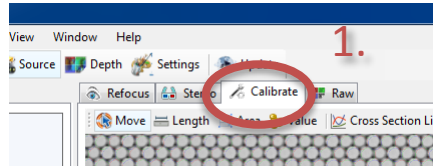


The next calibration steps require a homogeneous gray image.
The calibration filter will provide this.

1.) Put the calibration filter on the lens.



8. Re-adjust the shutter speed



The calibration filter only transmits 18% of the incoming light. Unfortunately this requires you to re-adjust the shutter speed.

Since you are going to take a gray image soon, please make sure not to overexpose.

Consult the histogram at the bottom of the image.

1.) Switch to the calibration tab.

2.) Re-adjust the shutter speed until you have a well illuminated image. Try to use 2/3 of the dynamic range and don't overexpose.

If in doubt enable „Auto Shutter“ and wait for RxLive to adjust the shutter speed.

See the next slide for examples.



8. Re-adjust the shutter speed



Underexposed



Right exposure



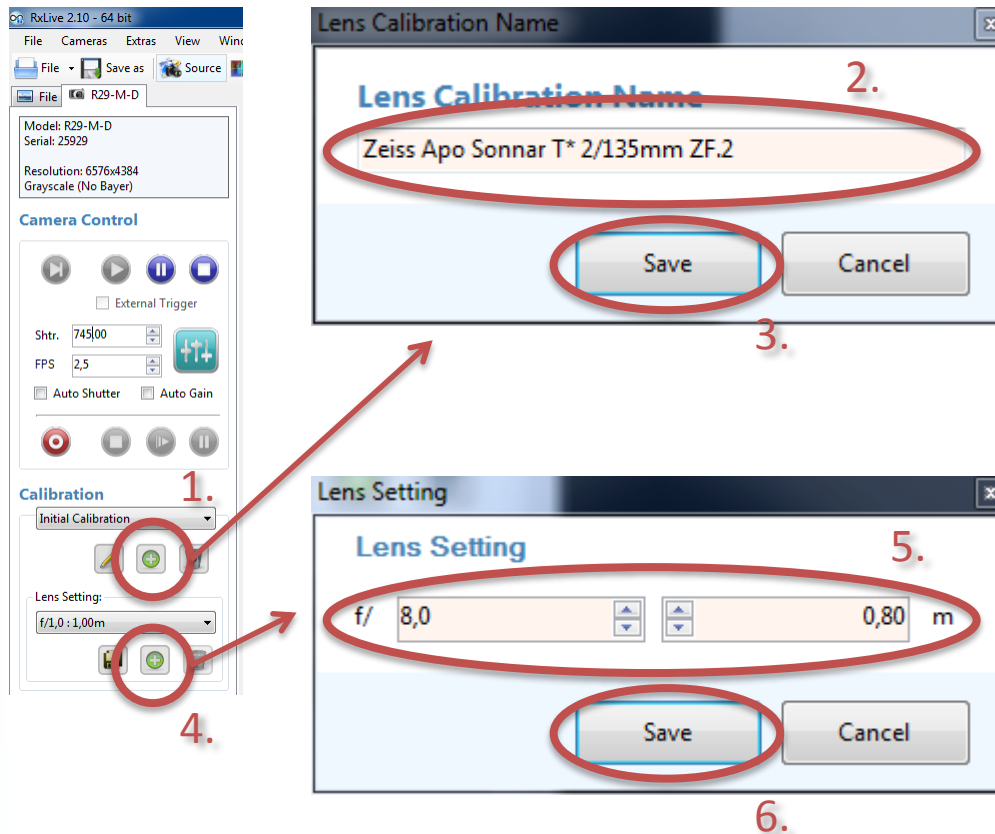
Overexposed



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9. Create a lens profile



1.) Create a new lens calibration.

2.) Enter the lenses name.

3.) Save the new calibration.

4.) Create a new lens setting.

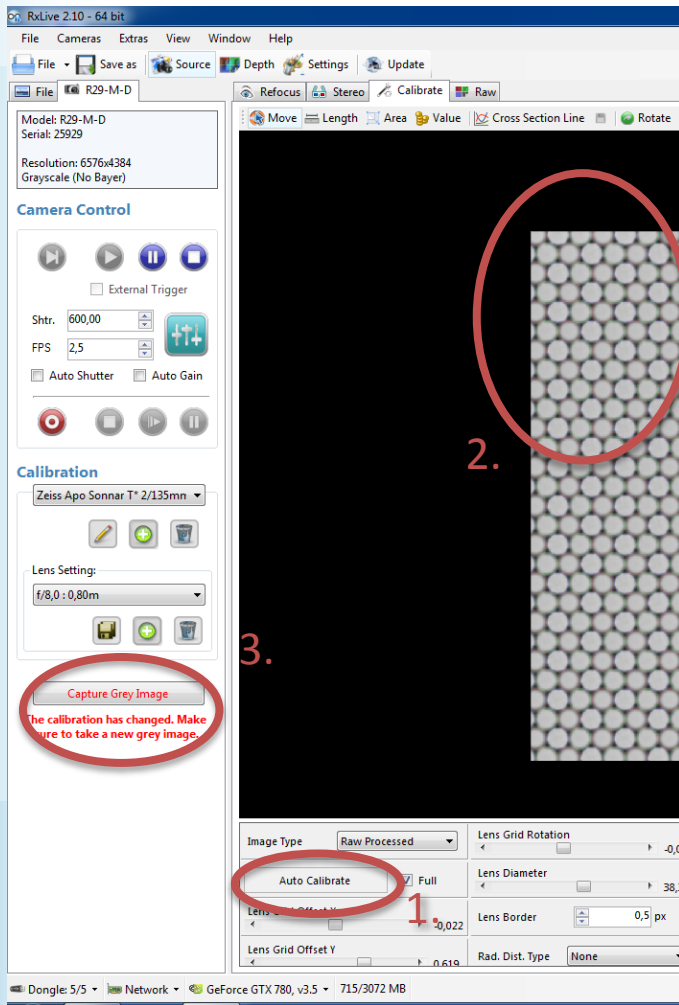
5.) Enter the lenses aperture and focus.

6.) Save the new lens setting.

None of those values are used in any calculation. Their purpose is to identify a calibration when using multiple lenses and settings.



10. Calibration



The micro lens images have to be aligned with the calibration grid.

You can use the auto calibration of RxLive to achieve this.

This step is necessary for a correct 3D calculation and 2D refocusing.

The gray image captured under 3. is used to deignette the micro lens images. If you don't capture one, you will see micro lens structure in the refocused image.

1.) Run the auto calibration

2.) Make sure the auto calibration was successful and the lens grid and micro lens images align.

Check the corners in particular.

3.) Capture a gray image. This will also save your calibration.



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11. Remove the calibration filter



You have completed the calibration!

The calibration filter is no longer needed, remove it.

1. Remove the calibration filter.

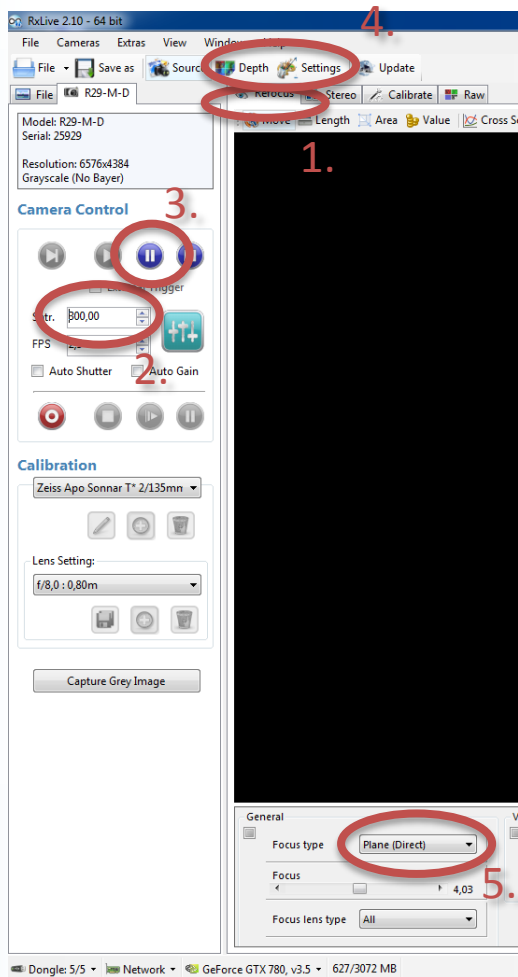


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12. Start the depth calculation



The next goal is to find parameters for the 3D algorithm that suit your application.

1.) Switch to the „Refocus“ tab

2.) Since you have removed the calibration filter, adjust the shutter speed again (or enable „Auto Shutter“).

3.) (optional) Stop continuous image capture. This will stop RxLive from continuously running the depth calculation once it's enabled. Making it more responsive. Consider this step optional if you have a lot of processing power to spare.

4.) Display the „Depth“ and „Settings“ windows.

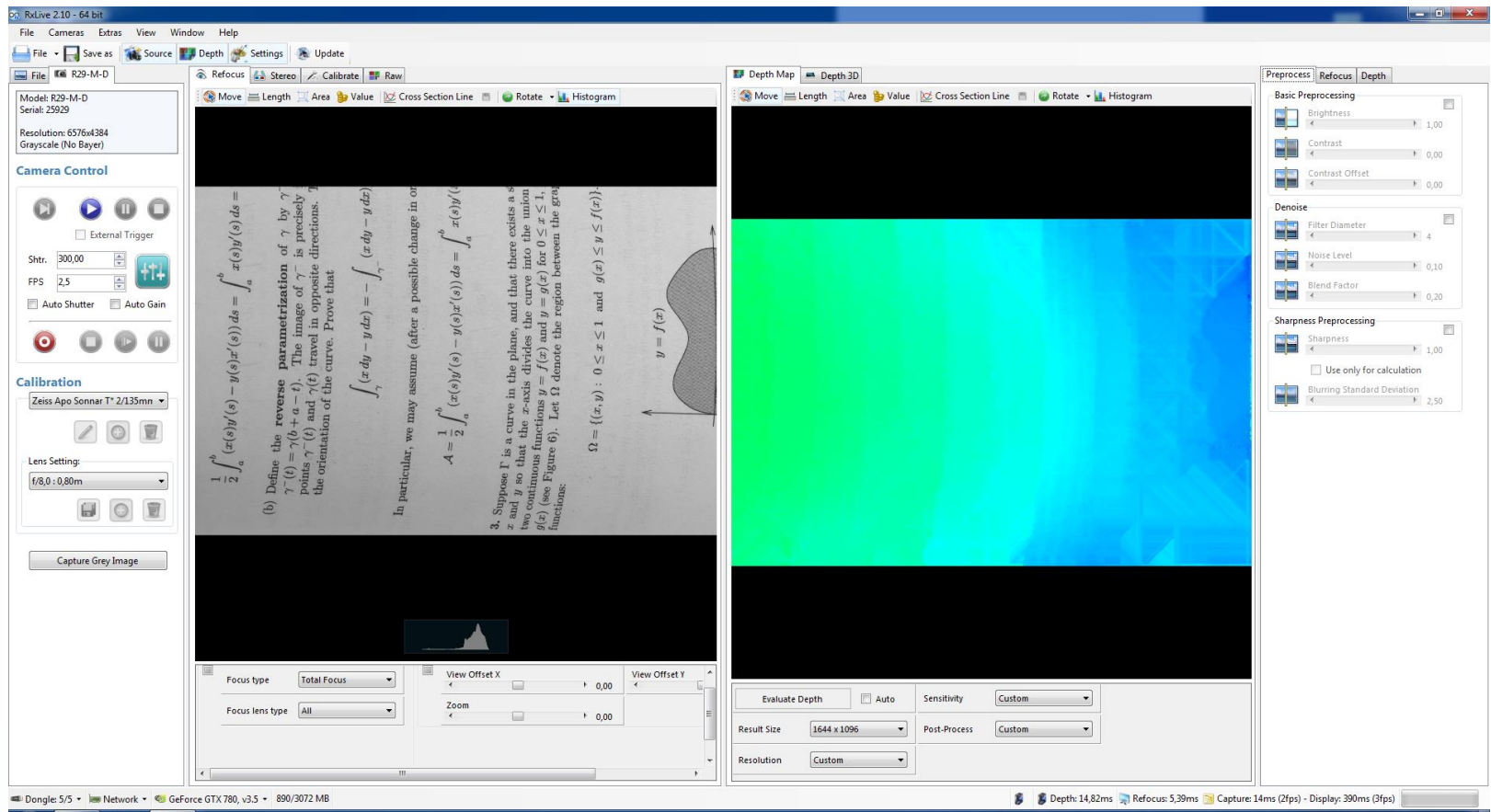
5.) Switch „Focus type“ to „Total Focus“. Doing so will start the depth calculation.



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12. Start the depth calculation



At this stage RxLive should look like this, with the depth map and the „Settings“ window on the right hand side.

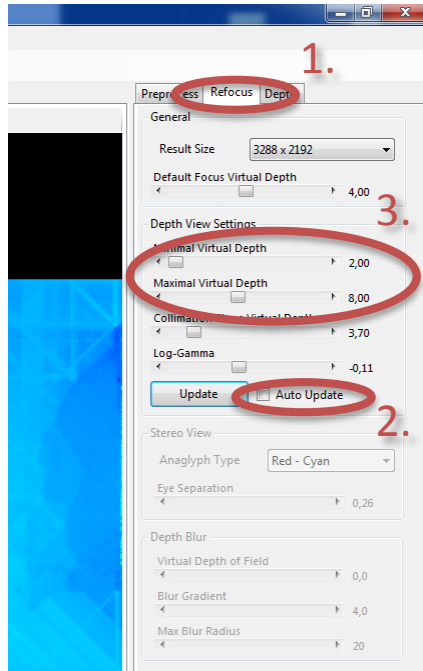


13. (optional) Turn off auto adjustment of the color scaling

On default RxLive will auto adjust the depth map's color scaling, presenting the furthest depth value as blue and the nearest as red.

This will help distinguishing small differences in height when the camera's depth of field isn't exhausted.

However, changing color scaling can be annoying when adjusting depth algorithm parameters.



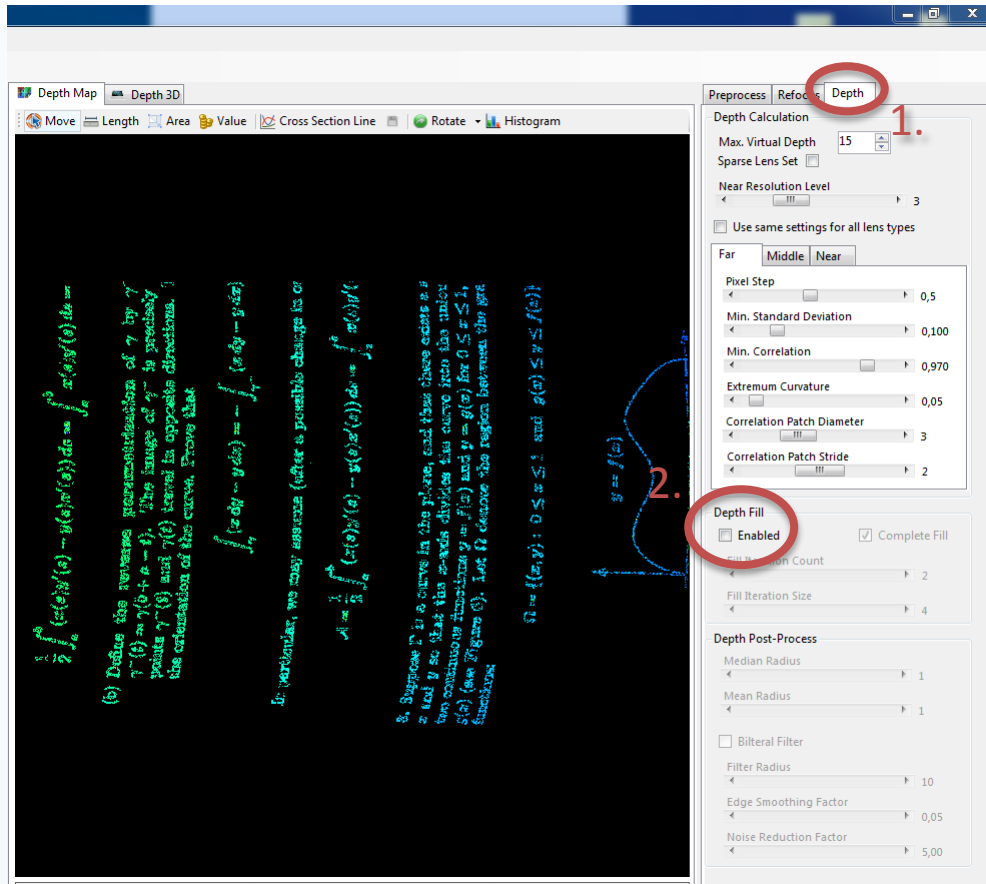
1.) Switch to the „Refocus“ tab in the „Settings“ window

2.) Disable „Auto Update“

3.) Virtual depths below „ Minimal Virtual Depth“ or beyond the „Maximum Virtual Depth“ are displayed as gray. Adjust both until no gray is displayed or set both to their extrem values, 2 and 15.



14. Disable the depth fill



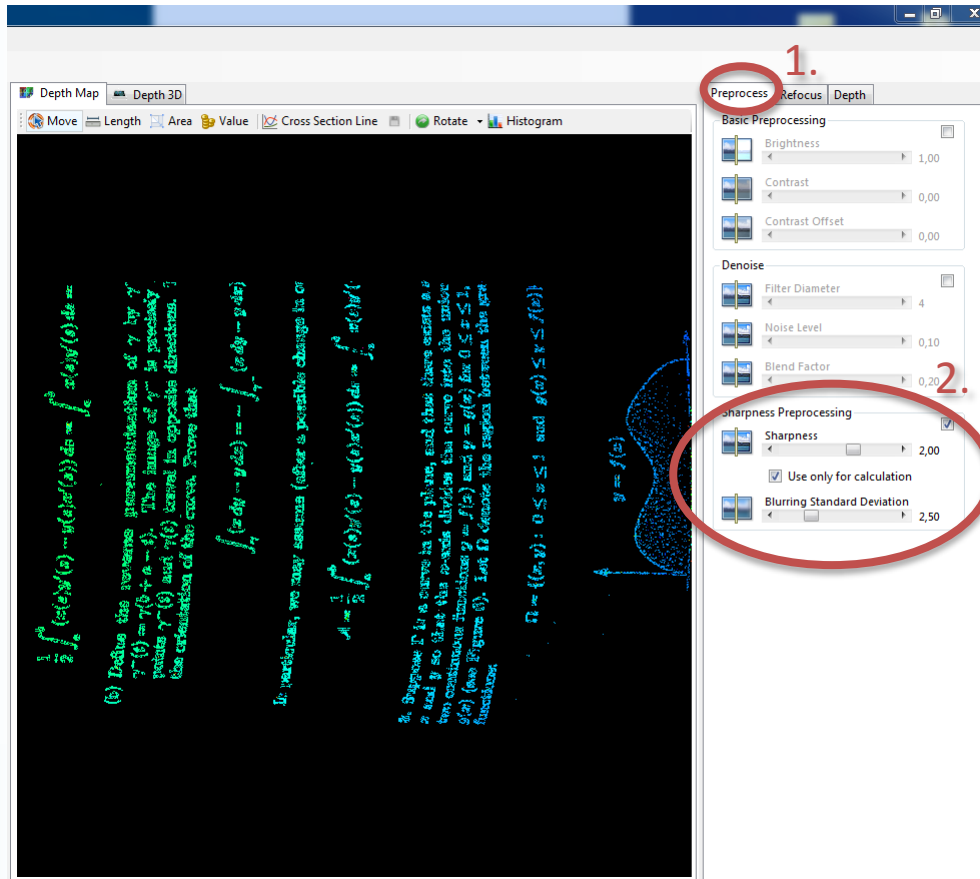
It's useful to look at the „raw“ depth calculation without the depth map being filled to judge the parameters.

1.) Switch to the „Depth“ tab.

2.) Disable „Depth Fill“.



15. Sharpness



Sharpening the image before running the depth calculation can improve the density of depth values greatly, especially in low contrast areas.

It also has the potential to increase the noise in the depth map. Apply with care.

1.) Switch to the Preprocess tab

2.) Turn on „Sharpness Preprocessing“.

Select „Use only for calculation“

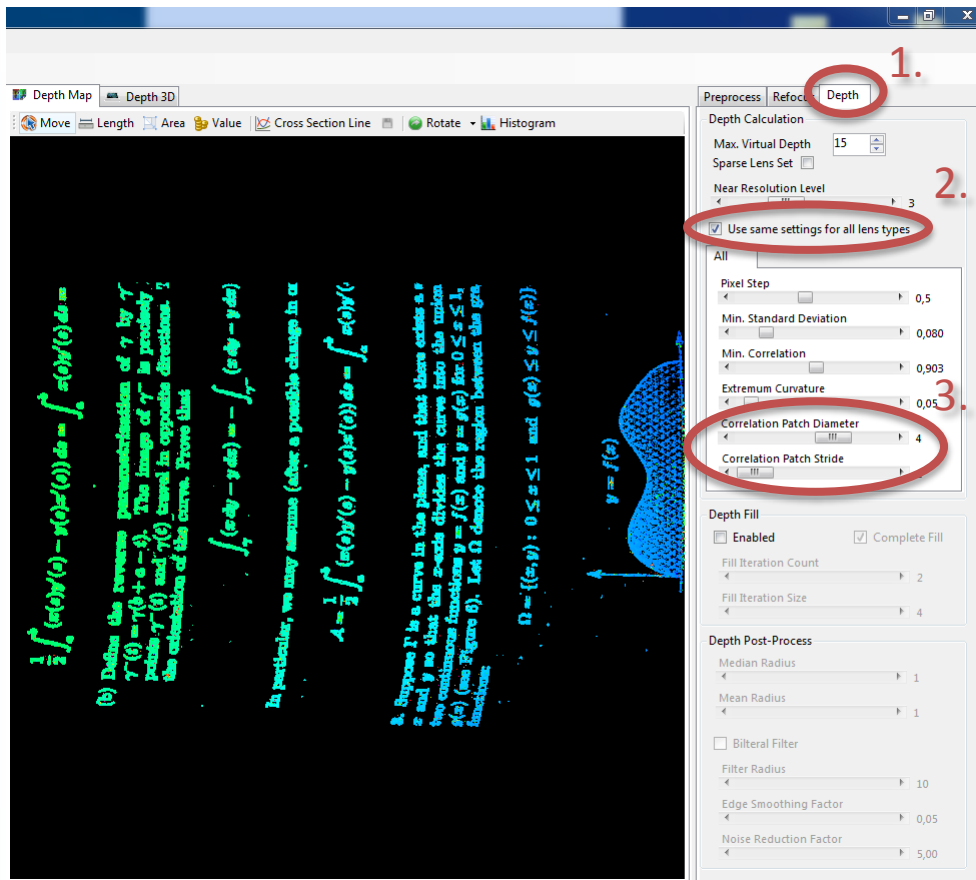
Try setting „Sharpness“ to 2 and adjust from there.



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16. Correlation patch diameter and stride



During the 3D calculation the algorithm compares patches of the micro lens images. Their size and spatial resolutions have a strong influence on the depth algorithm's performance and the depth density.

1.) Switch to the Depth tab

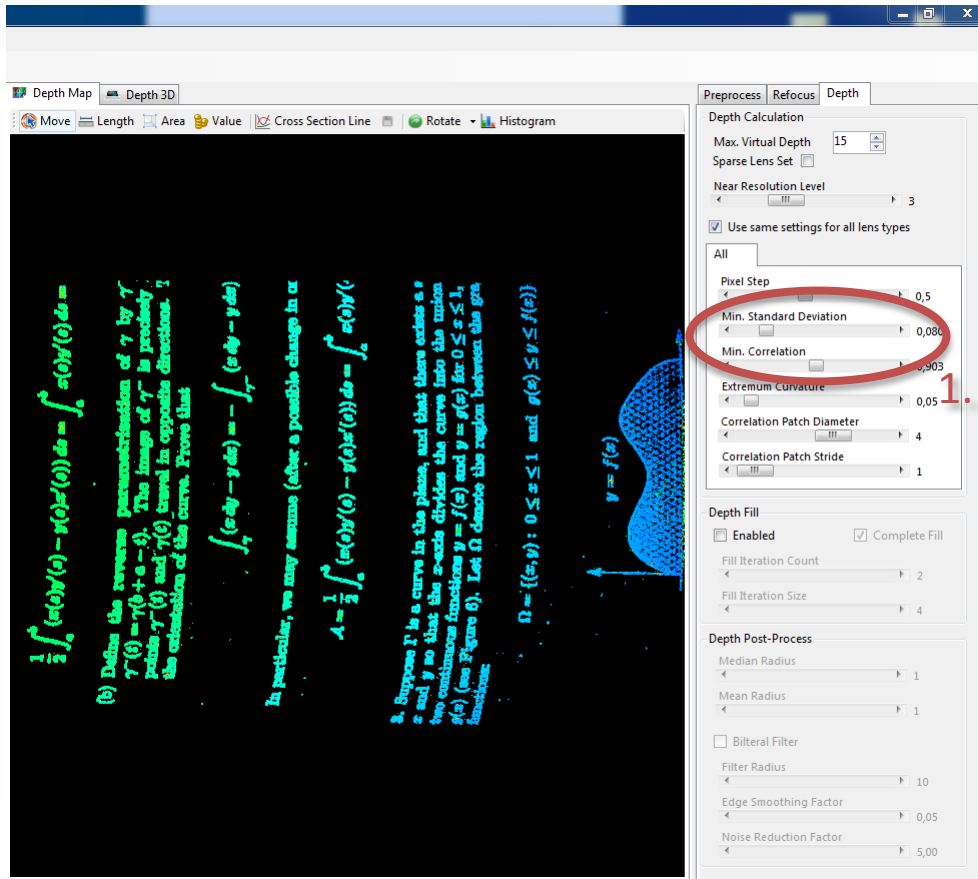
2.) Select „Use same settings for all lens types“

3.) For generally good results set the diameter to 4 and the stride to 1

If performance is an issue use a diameter of 3 and a stride of 2. If the depth map is noisy and performance isn't a major concern, you can try a diameter of 5.



17. Standard Deviation and Min. Correlation



Two parameters determine if a depth calculation is considered successful:

The correlation of the patches matched in the 3D calculation and the contrast of a micro lens image.

Their standard deviation is used as a proxy for the contrast. Calculations, not meeting the set requirements, will be dismissed.

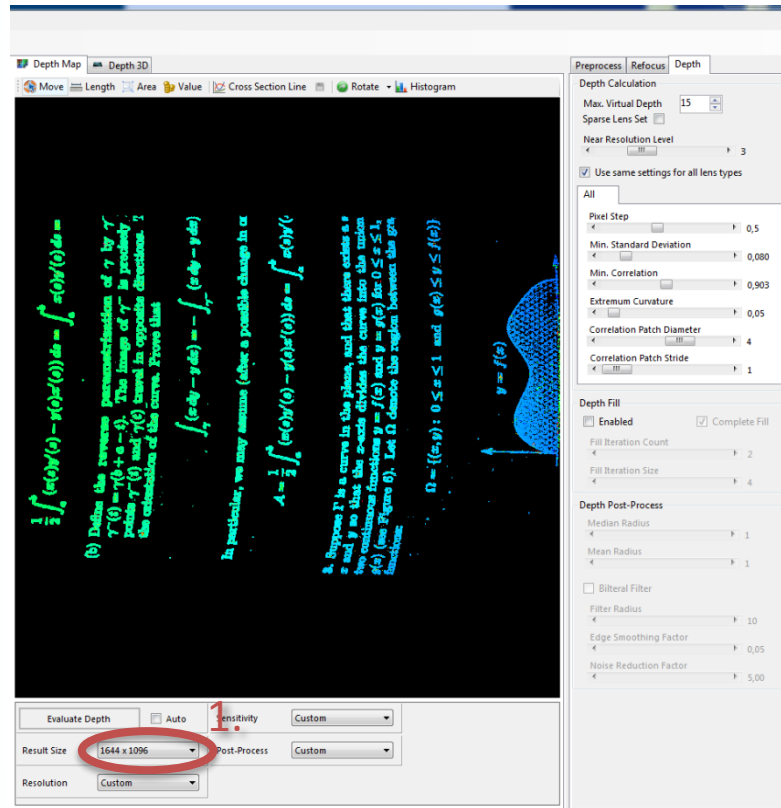
1.) Set „Min. Standard Deviation“ to 0.080.

Set „Min. Correlation“ to 0.903 and adjust from there.

As a rule of thumb a low contrast image requires a low „Min. Standard Deviation“ and noise is best filtered by a strict „Min. Correlation“. In a high contrast image loosen „Min. Correlation“ and filter noise via high „Min. Standard Deviation“.



18. Result size

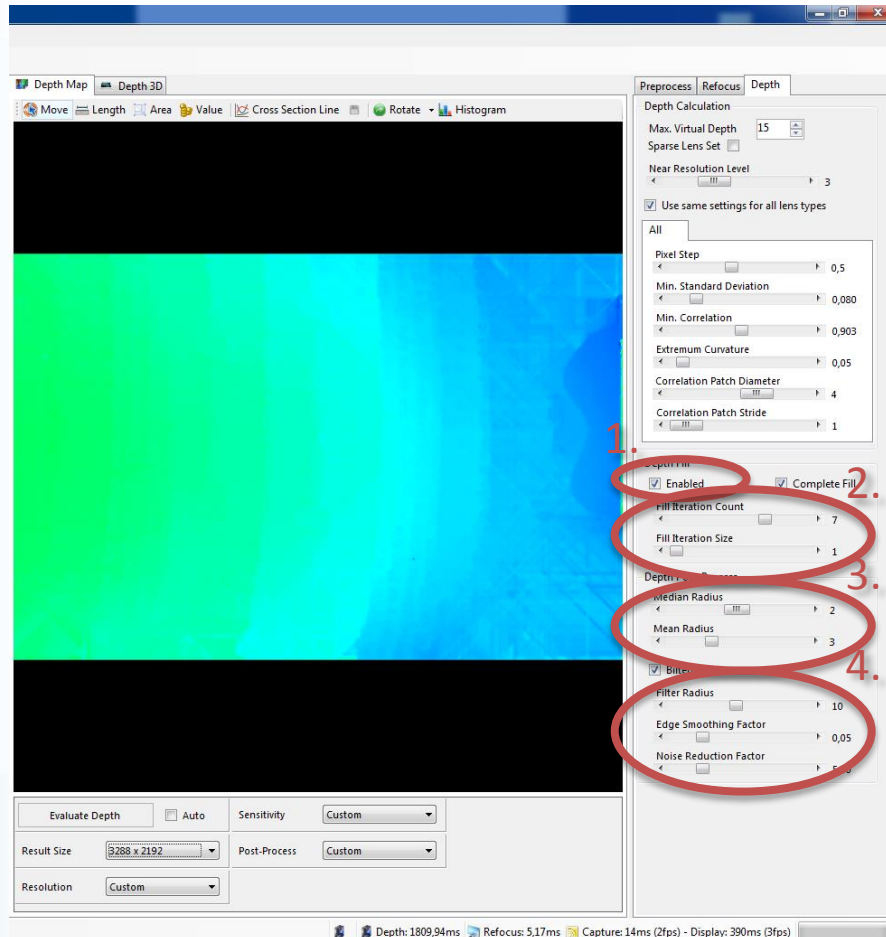


1.) Select a spatial resolution for the depth map. Higher resolutions cost performance.



19. Reenable depth fill

You can reenale the depth fill now.



1.) Enable „Depth Fill“

2.) (optional) Adjust „Fill Iteration Count“ and „Fill Iteration Size“. A high count with low size will yield better results at the cost of performance.

3.) (optional) Apply a mean/median filter.

High values will result in a smooth depth map but fine structure might be lost.

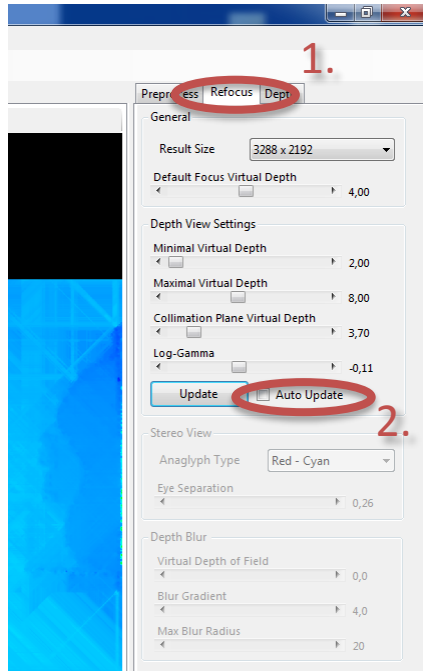
4.) (optional) Apply a bilateral filter. More „intelligent“ version of the mean/median filter, tries to preserve fine structure.



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20. (optional) Reenable the auto adjustment of the color scaling

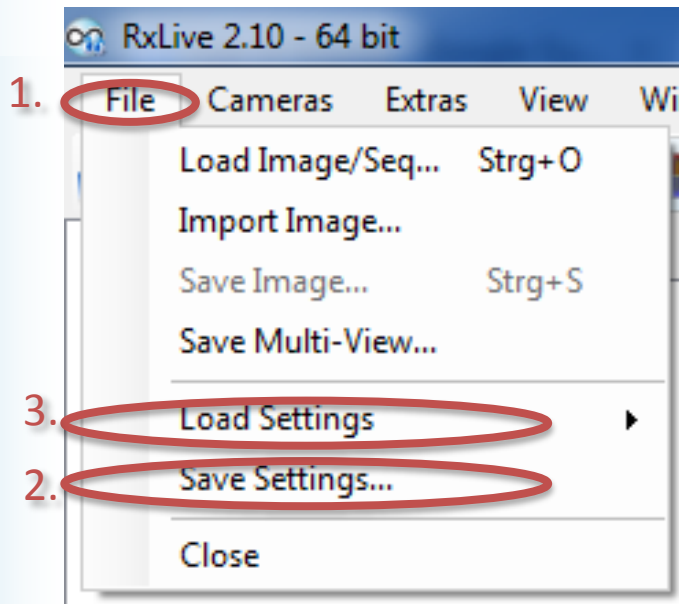


1.) Switch to the „Refocus“ tab in the „Settings“ window

2.) Enable „Auto Update“



21. Save and load settings



The parameters discussed can be saved to a .rxset file.

1.) Click „File“

2.) Select „Save Settings...“, enter a file name and save.

To load a .rxset file:

3.) Select „Load Settings“ -> „Load“



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3D camera solutions

