

## Noise reduction with Franzis Denoise Projects

We have to deal with a lot of noise in astrophotography.

Fortunately, Telescope Live offers us the possibility to obtain high-quality images for all our observations, requests.

The use of high-end telescopes and CCD-camera's, perfect focusing & tracking settings in locations with no light pollution, guarantee optimal astro-imaging conditions.

Accurate calibration (using bias, darks and flat frames) of these images by Telescope Live reduces acquisition noise to a minimum, resulting in high-quality images ready to download and process.

Nevertheless, there will always be remaining noise in these images due to possible gradients, airglow, satellite or plane tracks, flaws or 'shot noise' in general (and the latter can't be avoided).

Shot noise comes from random fluctuations of photons that the sensor captures. It's this variation that leads to 'noise' in the photon count. This noise appears in your images as speckles, sandpaper-like structures and results in a grainy appearance in otherwise smooth-toned areas. It's more apparent in the darker areas of your images and makes it hard to distinguish faint details in deep-sky objects.

Generally, we need to capture as much light (i.e. 'signal', photons) as possible from the object we want to observe and limit all sources of noise: we always strive to optimize the signal-to-noise ratio (S/N). An image with a high S/N ratio can be more aggressively processed to bring out all faint details.

A higher S/N ratio can be obtained by taking longer exposures and/or stack several exposures. When we average exposures, noise is reduced by the square root of the total number of these exposures. E.g. stacking 9 sub-frames will have 3x the S/N ratio of a single frame. Hence, the more data (exposures, sub-frames) we have, the higher the S/N ratio and this will already reduce noise significantly in your final stacked (integrated) image.

Astro-imaging software such as PixInsight, Astro Pixel Processor, MaximDL, Affinity... use different outlier rejection algorithms to remove noise and/or artefacts during stacking/integration. You need several sub-frames to do so (the more, the better): it examines the pixels in every sub-frame and statistically evaluates if it's a 'real' signal, or rather an artefact, noise.

I always try to collect as many exposures as possible for each object, e.g. with multiple one-click observations, combination of pro datasets and one-clicks or advanced requests... (I recommend using min. 5 exposures / filter)

After processing and integration of these multiple exposures in Astro Pixel Processor (in my case), using outlier rejection and gradients removal tools, the integrated image shows a limited amount of noise and artefacts (with the data we have collected).

But, there will always be remaining noise in these pictures, e.g. luminance noise, colour noise, banding, colour clouding... Different photo editing programs such as Photoshop, Affinity, GIMP or more dedicated programs such as Topaz Denoise AI and Franzis Denoise Projects can be used to further tackle this remaining noise.

Those who have used photo editing programs know that the process of removing noise from pictures also decreases sharpness, details tend to disappear and colours can become less vivid. So, skillful and

careful use of these software programs is required. If you overdo denoising, the image can have a poor, 'plastic' look!

I use Franzis Denoise Projects Professional for handling noise. This high-end photo editing software can remove seven types of noise. The artificial intelligence algorithm automatically selects a suitable noise reduction level, ideal for the specific image you are editing.

It can be compared to Topaz Denoise AI, but has more interesting features to offer (tools as healing, cropping, masking, eroding, tools to remove sensor errors, scratches...)

Franzis Denoise Projects can be used as a stand-alone program or as a plug-in in Lightroom or Photoshop. I use it as a plug-in in Photoshop 2021 (to allow working with layers & masks). It's user-friendly with an easy to navigate interface (see the attached pictures).

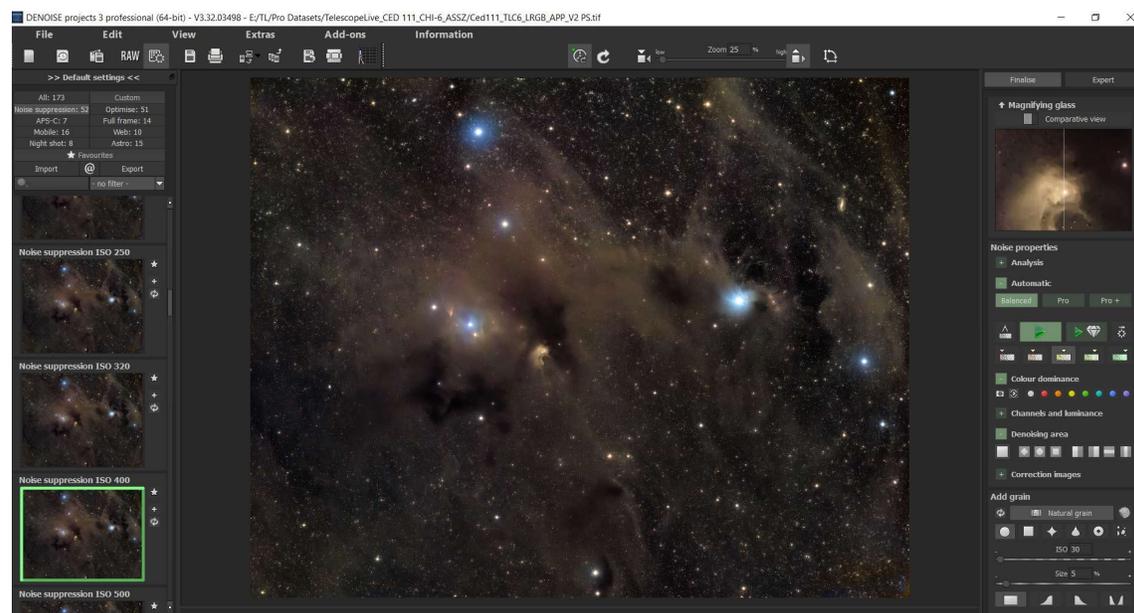
The moment you load an image onto the program, the automatic AI-based algorithm begins to run. The program provides you details regarding the amount of noise your picture has, once completed the algorithms.

This is (a bit confusing) given by an ISO-value: the higher this ISO-value the more noise was reduced in the picture.

If this (automatic denoising) result doesn't please you, you can of course manually modify these settings. Usually, some settings need to be modified for optimizing our astro-images: lower ISO-setting, use of the 'expert tools' to enhance sharpness or restore details, erode details (to make stars smaller...). This can be more briefly discussed in a future contribution...

I find Franzis Denoise Projects a powerful tool to help remove noise quickly, while keeping a good level of detail, sharpness and colour throughout the pictures.

You can download a free trial version of Franzis Denoise Projects and try it out!

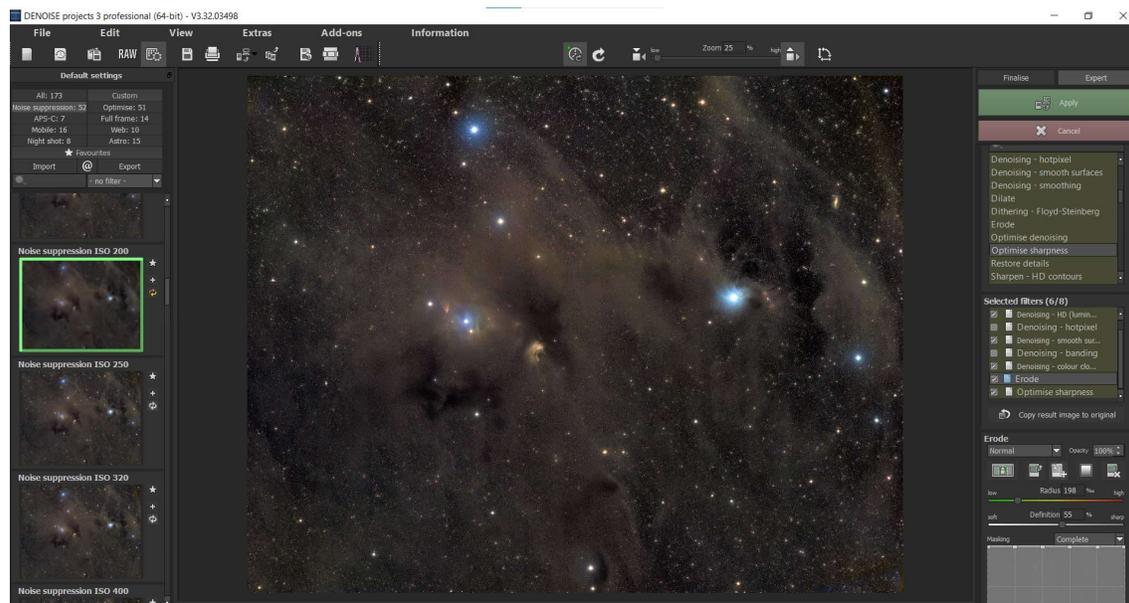


Main menu of Franzis Denoise Projects Professional.

On the left you see the 'ISO-value' which corresponds to the amount of noise removed by the AI-based algorithms.

On the top right you have a magnifying tool to easily see the effect of the denoising actions.

Image of Cederblad 111, captured with CHI-6. Pro Dataset curated by Scotty Bishop.



On the right, a selection of extra 'expert' tools are shown to further optimize the images. I often use the 'erode' tool to reduce the star size (without generating artefacts).