How To:
Use The De-rind Tool

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Wavesharp 2 - Using the Derind Tool

Introduction

Wavesharp 2 contains a Derind Tool which offers with user an opportunity to remove portions of the Gibb's effect diffraction structures common to sharpened planetary images. This section of the user guide will provide a concise how-to summary for using the Derind Tool. The tool contains a variety of controls which perform two primary functions; firstly constructing and appropriate mask to delineate the diffraction structures in the image that need to be controlled, and secondly, a section to define the radial extent of the mask around the perimeter of the planets limb allowing the user to avoid applying corrections to portions of the limb that do not require treatment. Both of these functions have unique controls which allow the user flexibility in reaching a desired final image.

Prior to beginning to use the derind tool it is important to understand that the tool is NOT blurring the image and/or changing the brightness of portions of the image as is often done to control rind in planetary images. The derind tool in Wavesharp creates a mask which defines where and how much sharpening will be performed on the various portions of the image beneath the mask. By restricting sharpening near the limb the user has the opportunity to prevent enhancement of the rind from the outset. However, because the Derind tool restricts sharpening from the outset it will NOT work on previously sharpened images. Thus, for those users who adopt image derotation to increase the number of frames in the stacks they are working with in post processing you must: 1) apply derind at the outset to the lightly sharpened images that constitute the input frames in WinJuPOS and then, 2) Again apply derind on the derotated stack if any additional sharpening is to be performed.

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Additionally, the Derind tool has much use in controlling artifacts generated around moons and moon shadows, especially in Jupiter images, including, but not limited to; bright rings caused by excessive sharpening, derotation artifacts formed around moons and shadows, as well as those surrounding moons against the background sky. Details of how to operate the Derind tool can be quite different depending on the planet being imaged. This initial discussion will focus on a Jupiter example and will be followed by additional information in later sections concerning use of the tool on Mars and Saturn.

To begin understanding how to use the Derind tool we will start with a sharpened and denoised image of Jupiter that has been deliberately over-sharpened to bring up a more obvious rind on portions of the limb. The example image was sharpened, denoised and color corrected using the appropriate Wavesharp 2 tools for these purposes. They are shown in Figures 1a and 1b for completeness.

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Figure 1a: Main Wavesharp Panel and Wavelets settings for the example image.

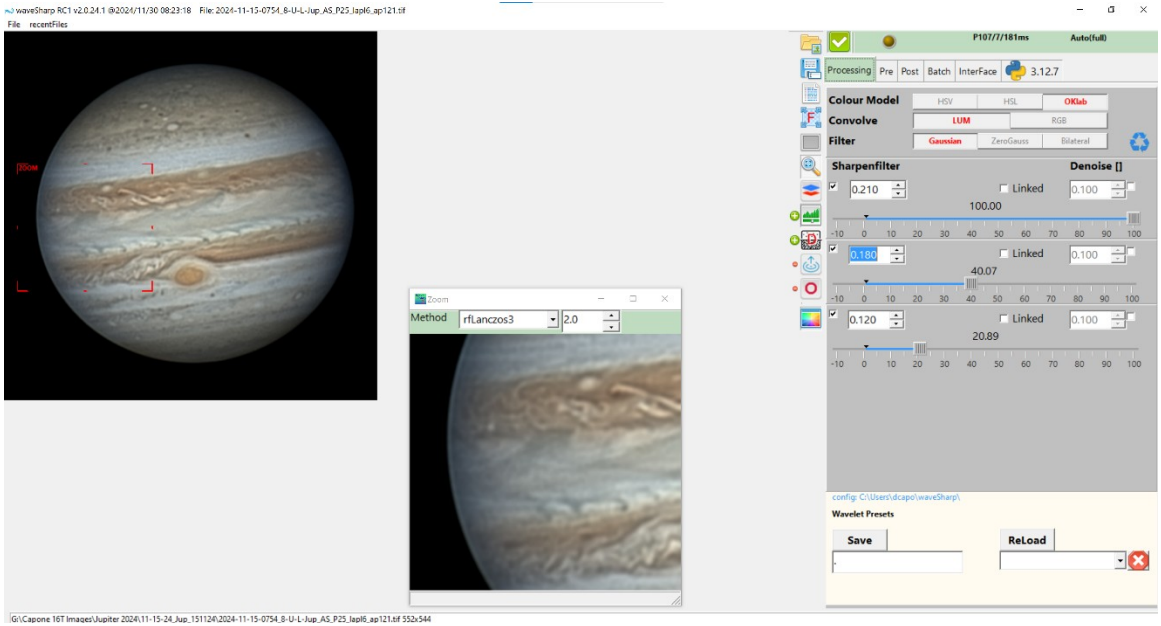

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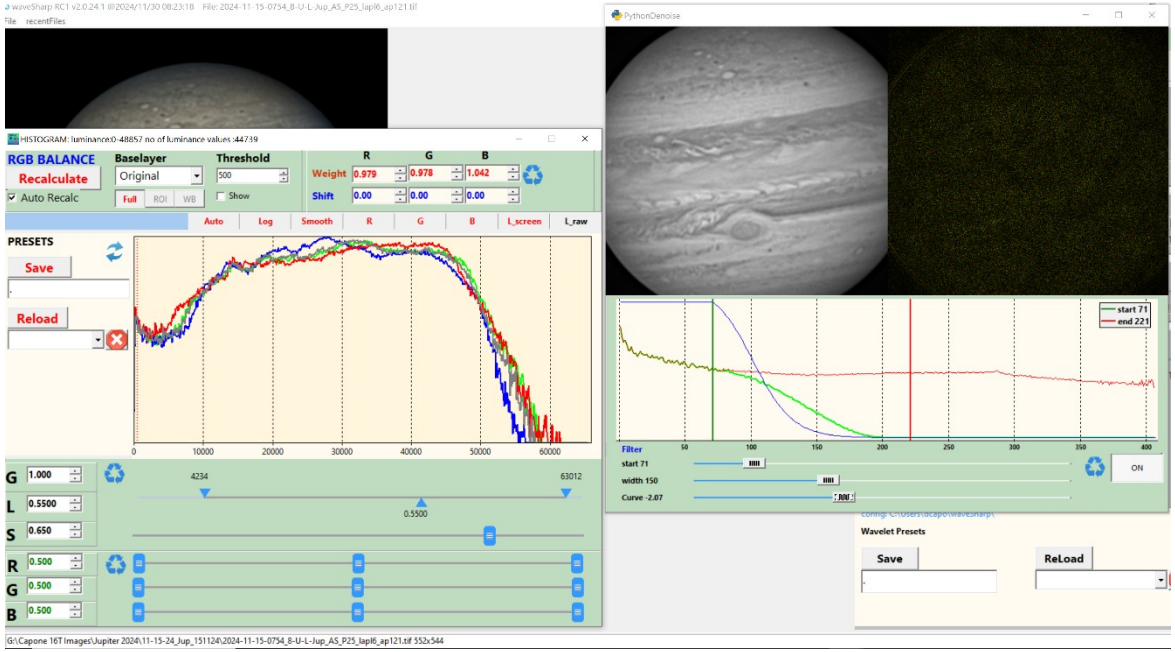
Figure 1b: Histogram and Denoise settings for the example image.



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Launching the Derind Tool

Figure 2 shows the location of the icon which launches the Derind Tool (marked with the red arrow). Selecting the Derind Tool with this icon launches the tool window shown to the right of the image as a green control box. The Derind tool box can be moved around the screen to a convenient location for the user. To move the tool right-click the top of the tool window and then move as needed with your mouse. I have also opened the Zoom window to the left of the Derind Too box for use as we explore the application of Derind to this image. In the Zoom window you can clearly see the rind that has been generated on the sun-lit portion of the limb by the sharpening being applied.

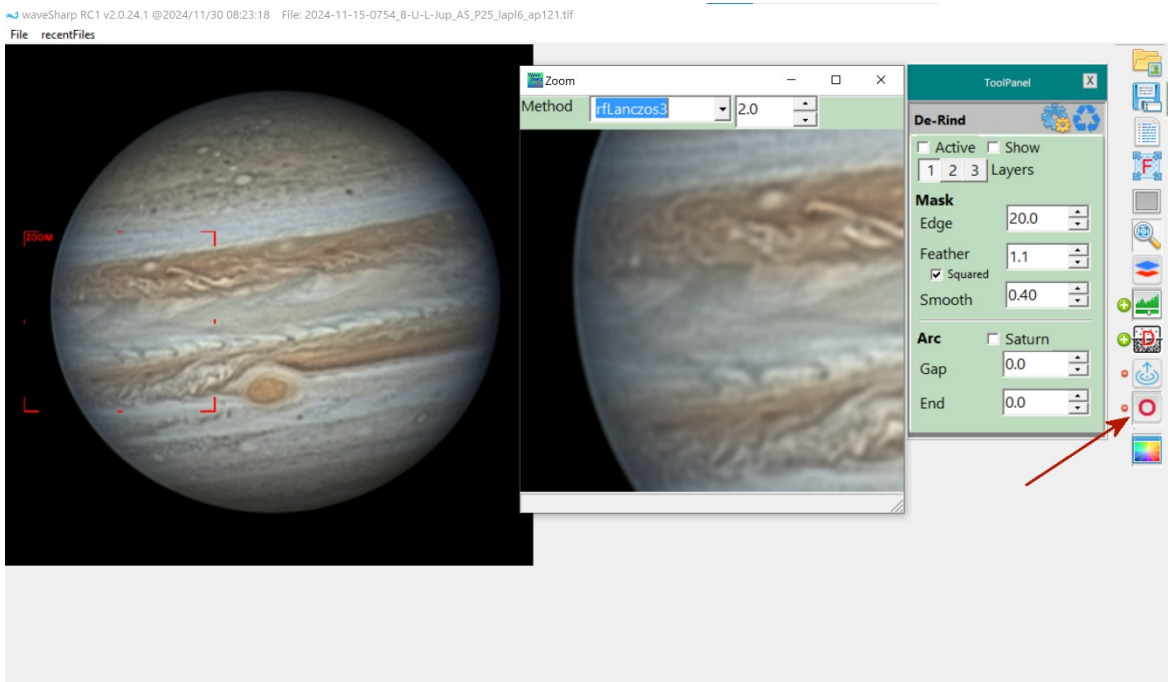

Figure 2: The Derind Control Window

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The derind tool is activated by selecting the icon in the vertical tool bar marked with the red arrow in Fig. 2. This tool is activated by choosing the “active” checkbox in the upper left corner of the tool box. The immediate impact on the image by activating the tool is shown in Figure 3a.

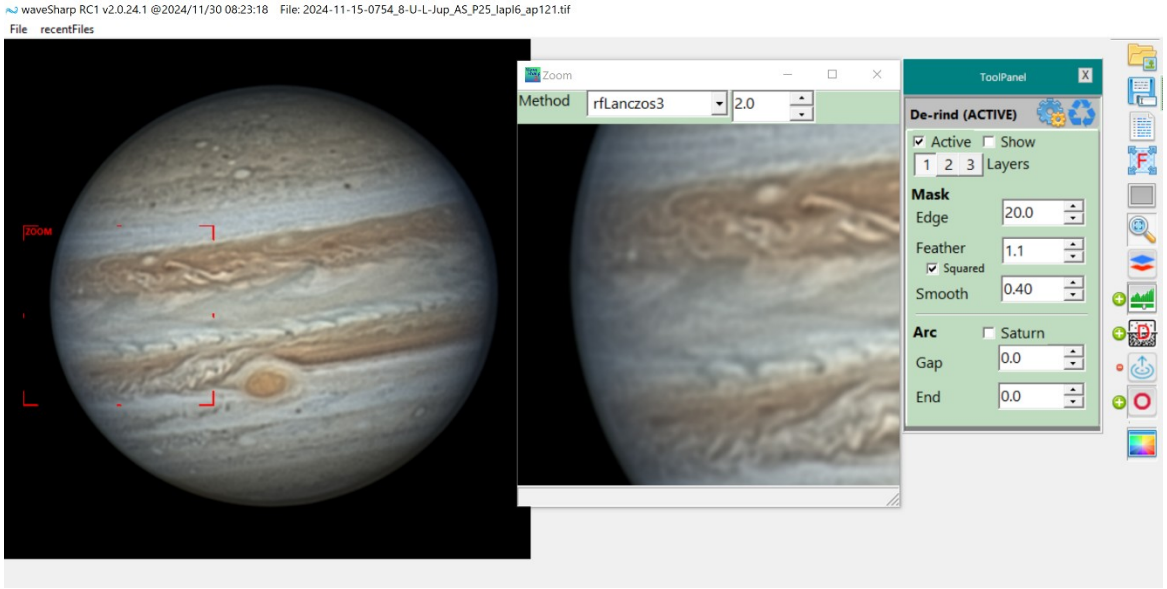

Figure 3a. Activating the tool bar yields an immediate change in the appearance of the sunlit limb in the image.

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The controls are listed in the tool box in the order in which they are typically applied to an image, however final adjustments of these parameters are often required and initial settings should not limit the user as processing continues towards an optimum final result. As can be seen in Figure 3 there still exists a rather sharp discontinuity just inside the limb which needs to be dealt with. To accomplish this it is often necessary to visualize the mask we are creating using the tool. Checking the “Show” box will bring the mask into view. The mask created with the default settings is shown in Figure 3b.

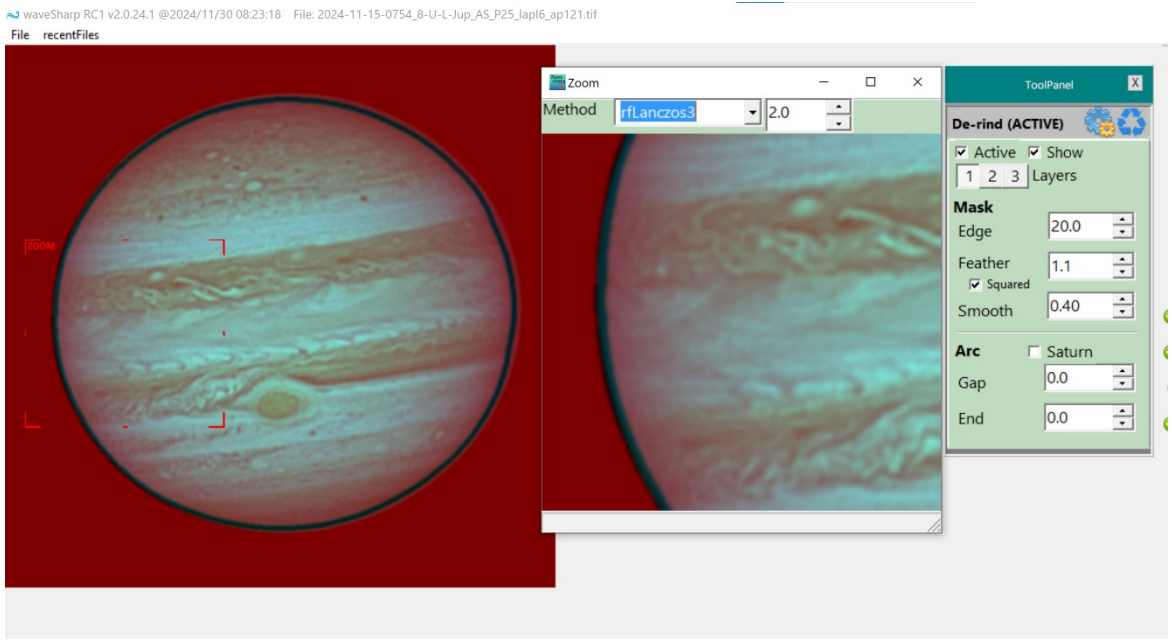

Figure 3b. – Show allows the user to visualize the shape and extent of the mask created using the settings.

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Having the mask visible allows the user to clearly that see the origin of the sharp disconnect on the limb is the inside edge of the currently applied mask. The goal in the case of Jupiter is to adjust the shape and density of the mask to control the bright ring while simultaneously eliminating the discontinuity interior to the limb. Also note, that the currently applied mask extends completely around the planet limb. During all times except opposition the Gibb's effect typically impacts only the sunlit portion of the limb. We will use the Gap and End tools to restrict the radial extent of the mask so as to apply treatment to only those areas requiring such treatment. (Note: This is especially critical for Mars images as will be shown later.)

Before proceeding, let's examine one of the other tools from the vertical tool window that can be especially helpful while using the Derind tool. This is the drop back menu item which removes the background form the image and allows for clear delineation of where the sharpening is having the maximum effects on the image. This dB tool is shown in Figure 4a.

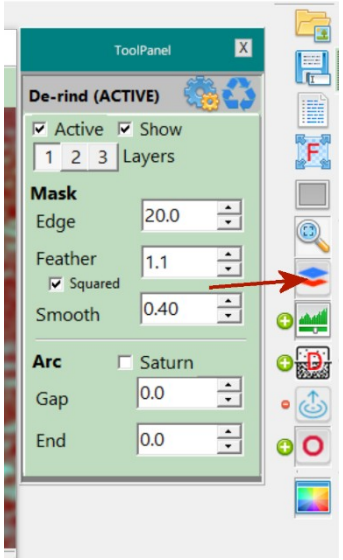

Figure 4a. The location of the dB icon is marked with a red arrow.

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The impact of the dB tool icon on the image is clearly evident in Figure 4b. Of particular note, the start of the Derind mask is currently well inside the bright diffraction ring introduced by the sharpening.

The dB tool allows the user to clearly visualize position the inside edge of the Derind mask as you move it to a position that begins just outside the bright diffraction ring. This will be accomplished using the Edge control.

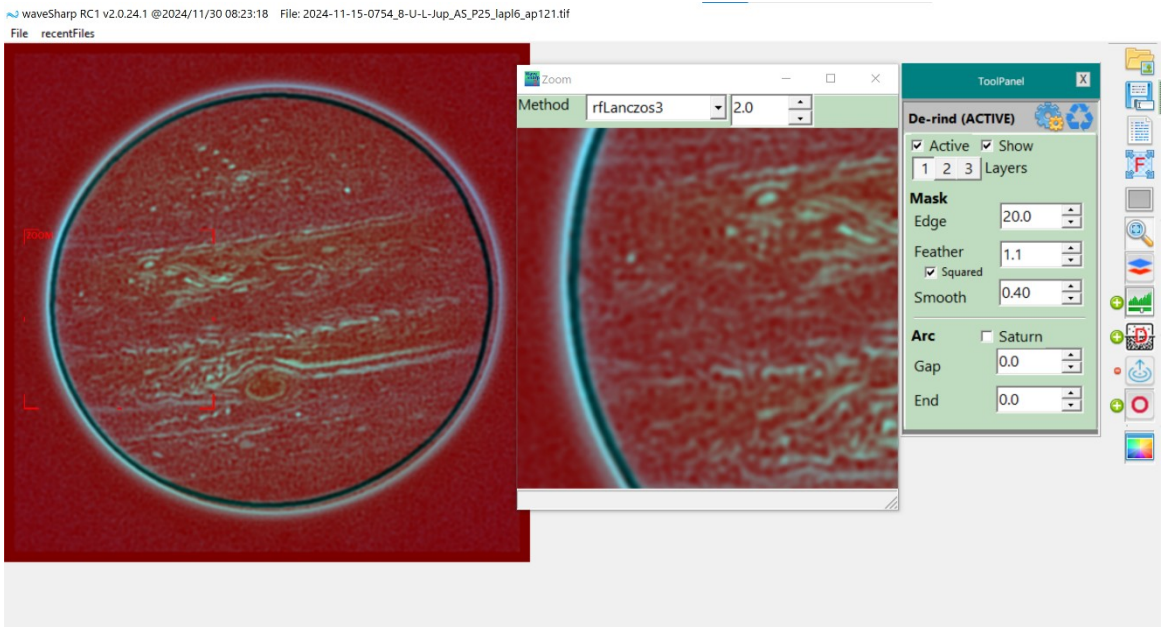

Figure 4b. Impact of the dB tool on the image.

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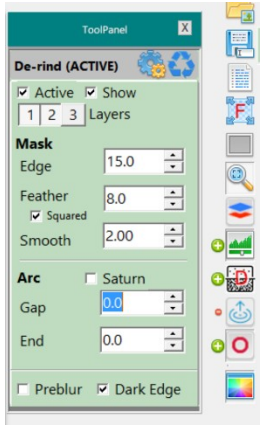
Prior to this, take note of the gear wheel in the banner of the Derind Tool. Selecting this gear wheel brings up two advanced features shown in Figure 4c.

Figure 4c. The Advanced tool bar has Dark Edge turned on as the default setting. There is also a pre-blur setting that can be turned on when needed by the user. Dark edge is especially useful on Mars images to suppress the occasional bright diffraction ring well outside the limb of sharpened Mars images.



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Using the Derind Tool (Jupiter example)

Optimum results on Jupiter is typically accomplished by initially setting the inside edge of the mask directly outside the edge of the bright diffraction ring made evident with the dB tool. The input parameter for the edge control has been adjusted to accomplish this in Figure 5. Setting Edge at a particular distance from the center defines the outer extent of any modifications to the sharpening being applied to the image. Sharpening at distances closer to the center as well as beyond the edge of the mask proceed as defined by the wavelet settings in the main panel. Sharpening beneath the mask can be visualized by the density of the green-shaded portions of the mask. The higher the density of the mask the more reduced is the sharpening of the image in that location.

All of the parameters for the Derind tool are presented as examples to give the user a starting point for getting good results. The parameters interact with each other and the final settings are very much a function of the user's preferences for the final image.

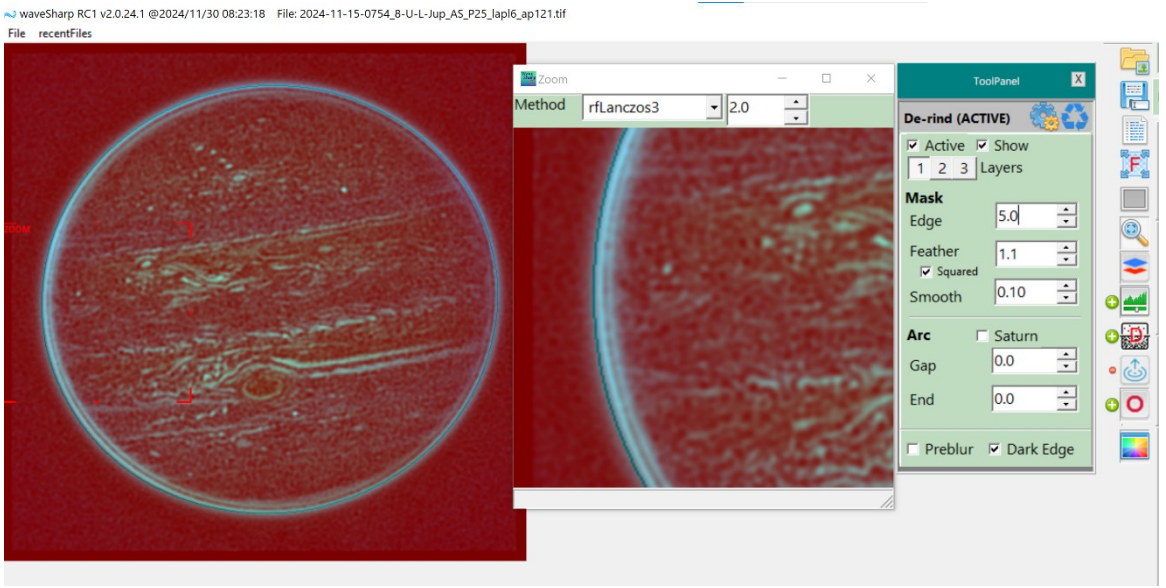

Figure 5. The Edge parameter is reduced to move the inside edge of the mask to a position just outside the bright ring.

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With the Edge parameter set I typically turn off the dB tool for the remainder of the Derind process.

The next step is to adjust the mask using the Feather tool which extends the mask radially inwards while simultaneously decreasing the density of the mask. A good starting point for the Feather parameter is to increase the value until the inside edge of the mask is not covering the entire bright ring. This is shown in Figure 6 with the dB tool turned off.

The final setting controlling the radial extent of the mask is the Smooth control. Unlike Feather which only extends the mask inward towards the center, the Smooth control broadens the extent of the mask both inwards and outwards. I find the smooth control is most effective at eliminating any discontinuities in the final image that might otherwise be present. In many instances you will find that Feather can be left at the default setting and the entire blending task can be accomplished with just the smooth parameter. This is usually the case under those circumstances in which seeing and/or sharpening have not produced a clearly defined bright ring.

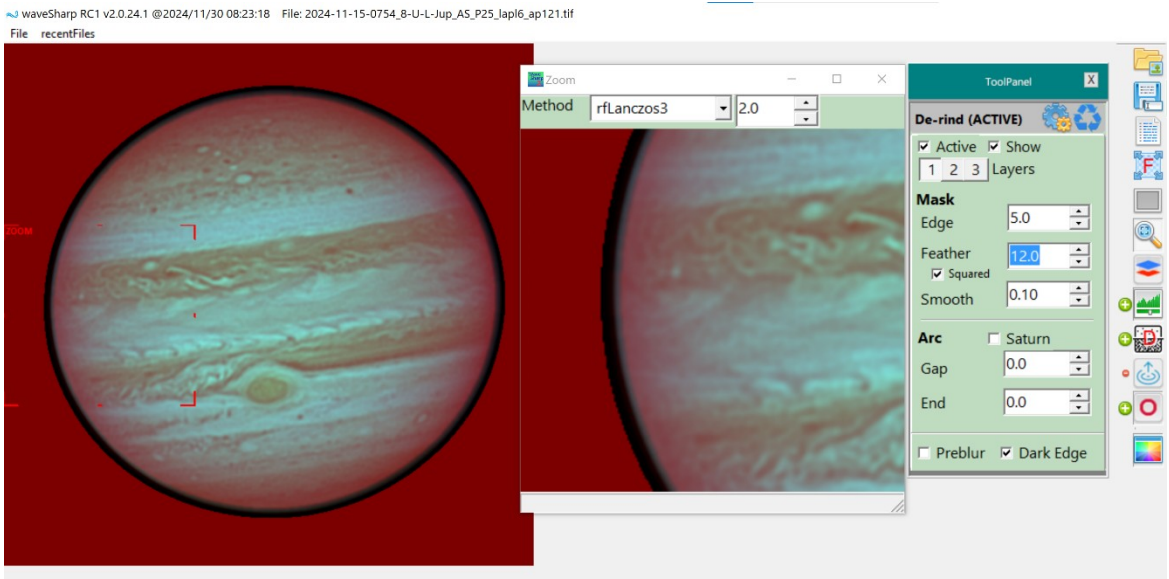

Figure 6. Feather is adjusted so that the mask now covers the entire bright diffraction ring.

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It is usually difficult to discern the complete impact of the mask with Show turned ON. I find toggling both the Show checkbox and the Active checkbox is the best way to finalize the image being processed with the tool. Figure 7a and Figure 7b show this above image with Show and Active turned OFF, respectively.

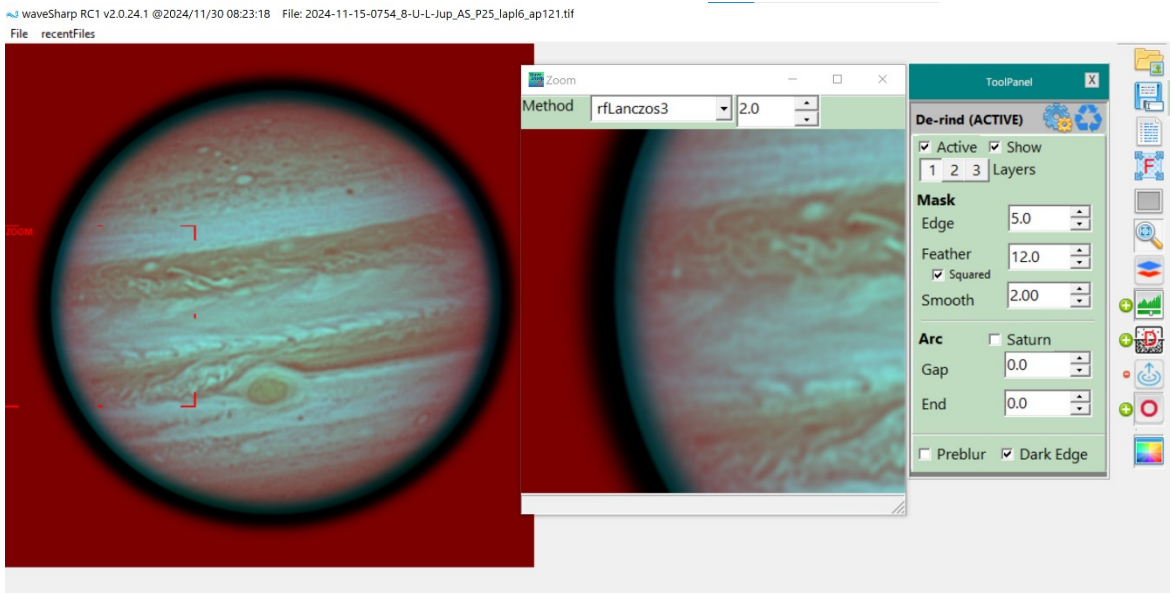

Figure 7. Setting the Smooth control blends the shape of the mask in both the inward and outward directions.

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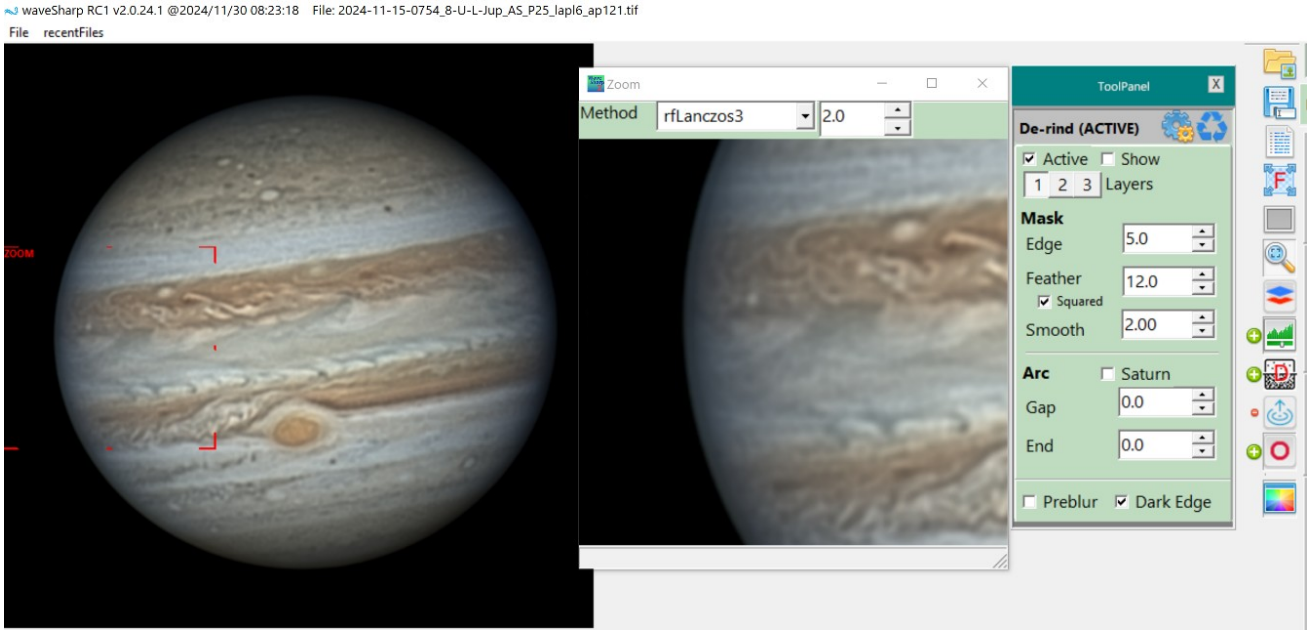

Figure 7a. Show turned OFF

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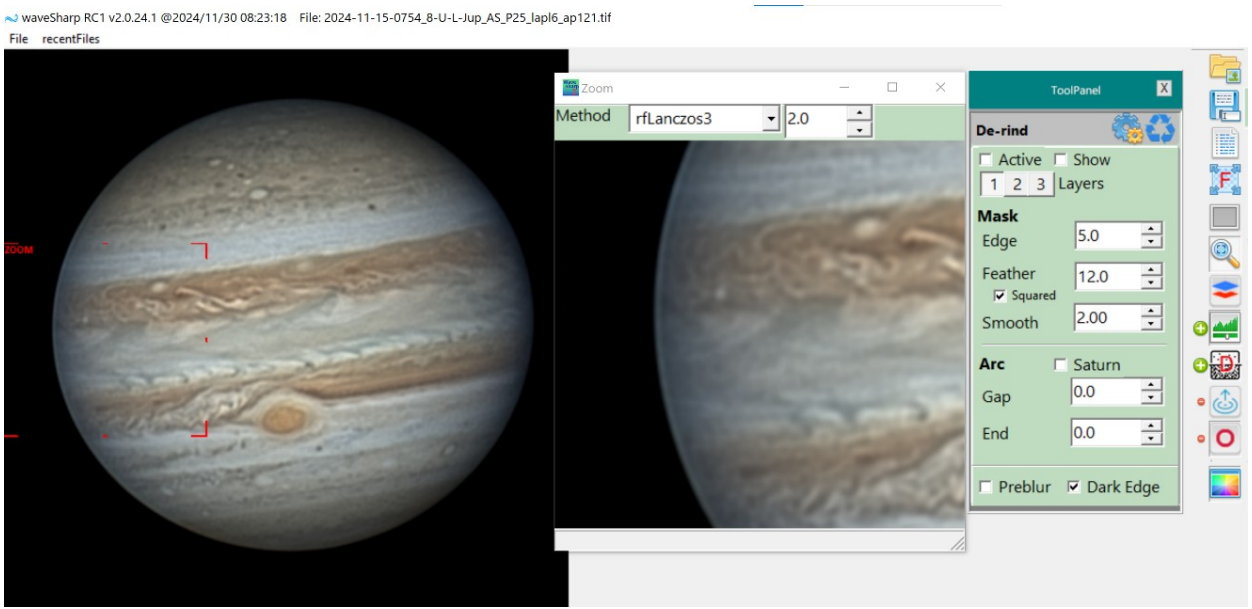

Figure 7a. Active turned OFF

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Typically, except at opposition, a rind only forms on the sunlit limb of the planet. Masking the terminator side of the limb can often have negative impacts on this portion of the image. We will now restrict the circumferential extent of the mask using the Gap and Edge values.

As suggested by the name, the Gap control opens a gap in the mask. The larger the value of Gap the larger the extent of the gap present in the mask. In Figure 8, a typical starting point for Gap is shown

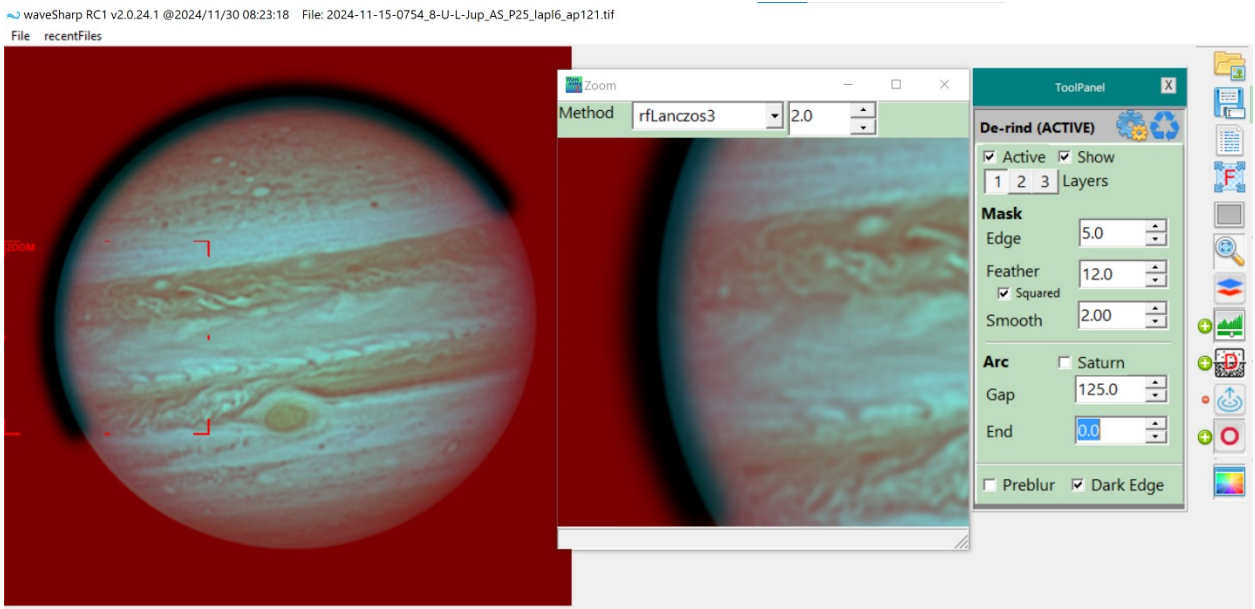

Figure 8. The Gap parameter opens a gap in the mask in which no adjustments to the degree of sharpening will occur.

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We will want this mask positioned over the sunlit portion of the limb. Rotation of the mask is accomplished using the End parameter. Values of + or – rotate the mask in the CW or CCW direction, respectively. This is demonstrated in Figure 9.

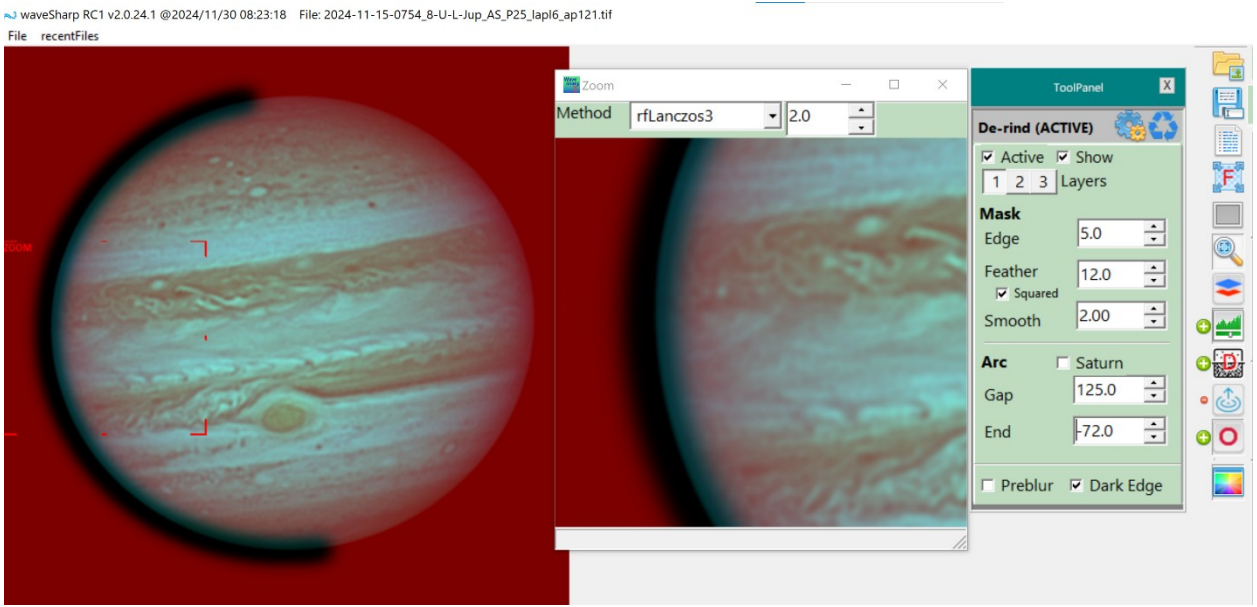

Figure 9. Application of a negative value of End rotates the mask in the CCW direction by an amount proportional to the value that is input by the user.

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The final image can be best adjusted by toggling Show and Active ON or OFF as needed to affect the final image results. This is shown in Figures 10a and 10b.

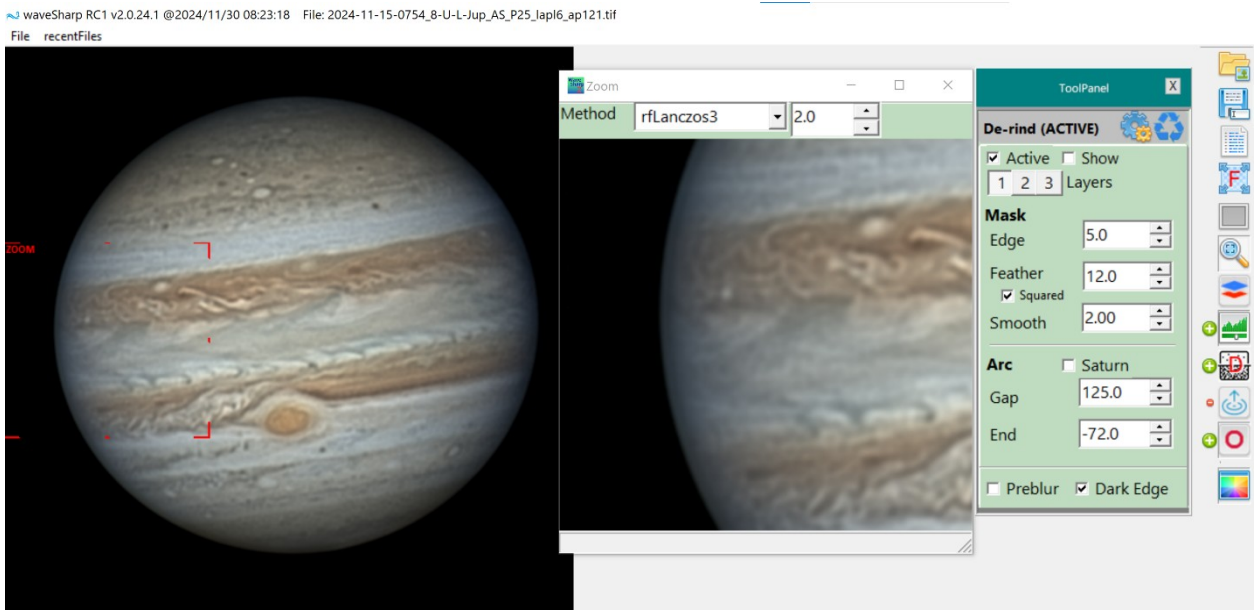

Figure 10a. Figured 9 results with Show turned OFF.

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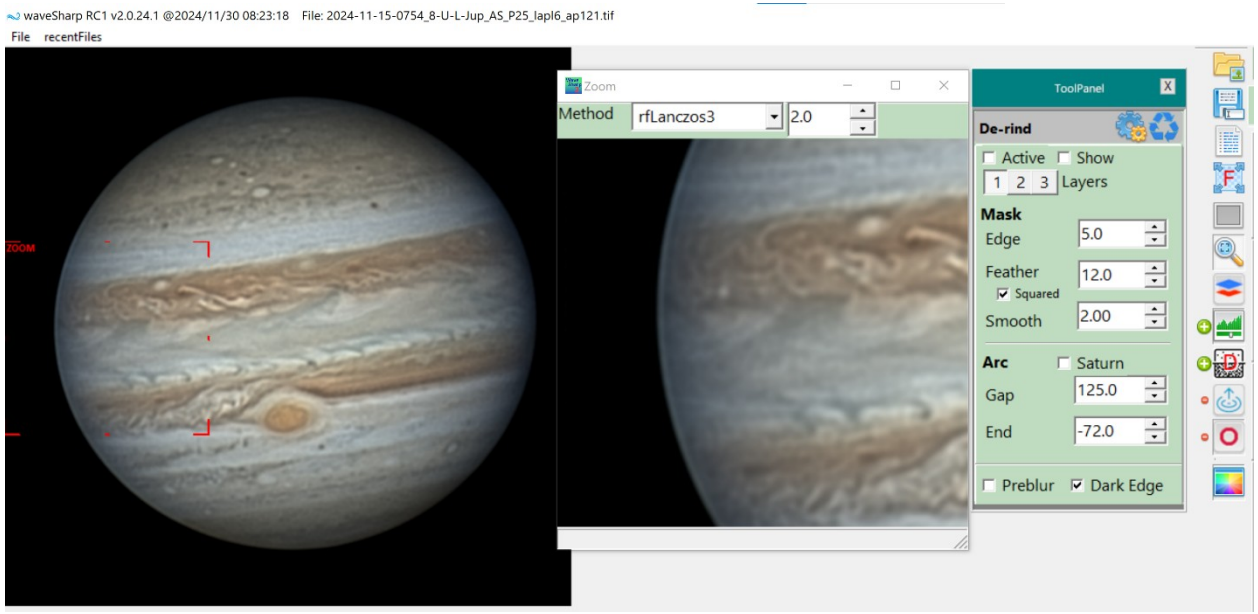

Figure 10b. Turning the Active setting to OFF yields a good comparison with the original unmasked image.

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One final control that has been left until now is the Layers control. The numbers 1, 2, and 3 allow the user to apply the mask to only Layer 1 (the default setting) or by selecting the appropriate number either or both of the other two sharpening layers applied to the image. Figure 10c shows the effect of selecting Layer 2 in addition to Layer 1 to the image shown in Figure 10a. In this case, some additional smoothing of the transition between the limb and the rest of the disk is accomplished.

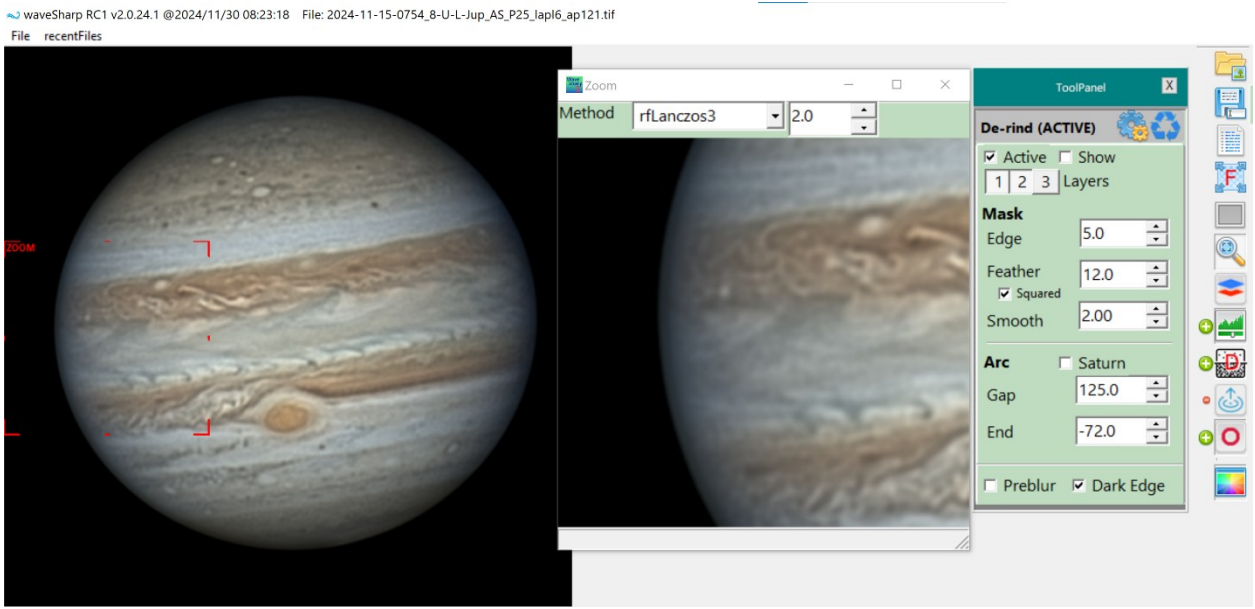

Figure 10c. The mask can also be applied to Layer 2 in addition to Layer 1.

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Using the Derind Tool (Mars example)

Mars presents unique challenges to the user under many different imaging circumstances. The strength and intensity of the Gibb's effect rind can often be quite severe which poses a distinct challenge in using the Derind tool. It is usually more difficult to achieve good results than with Jupiter. As a result, we will discuss processing Mars images using the tool as a separate section in order to demonstrate the differences in using the Derind tool.

Launching the Derind Tool

In this section we use a 1.5x drizzled stack which has been severely sharpened as our starting point for the Derind Tool demonstration. In Figure 11 we show the derind tool as launched on this Mars image. Note: Mars is small enough to fit neatly inside the 2x Zoom window so the screenshot is focused on the zoom window and the Derind Tool for this section of the user guide.

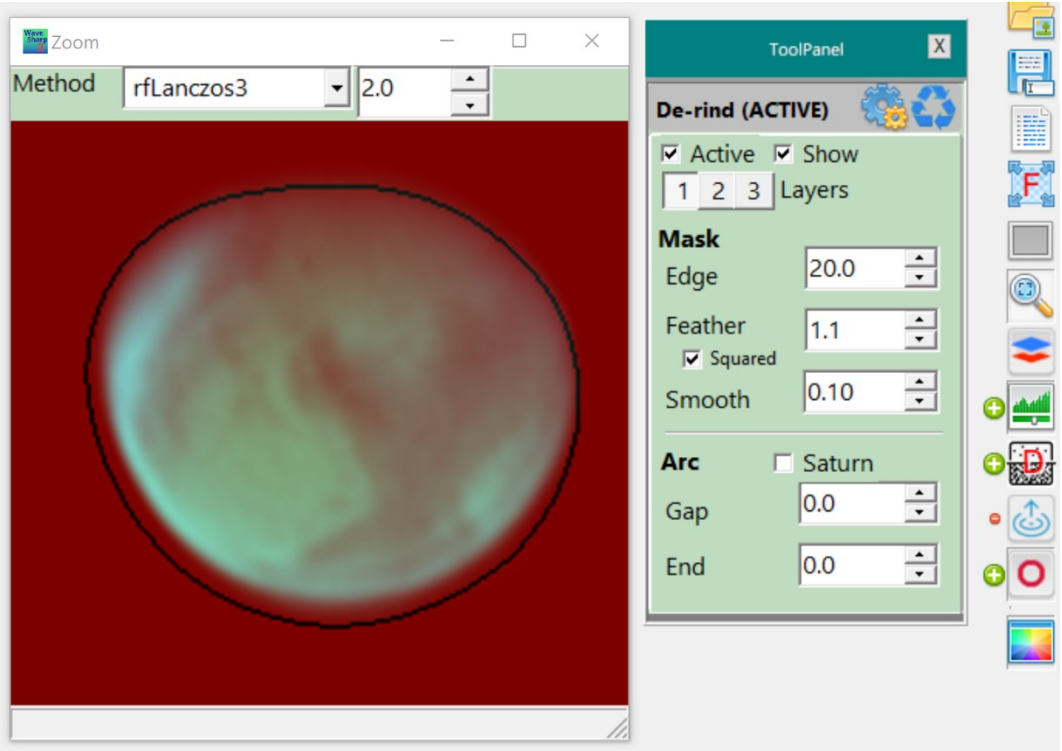

Figure 11. The Derind Tool launched with the default settings.

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As with Jupiter, our first adjustment is to set Edge so as to place the inside edge of the mask just outside the bright ring. This is shown in Figure 12.

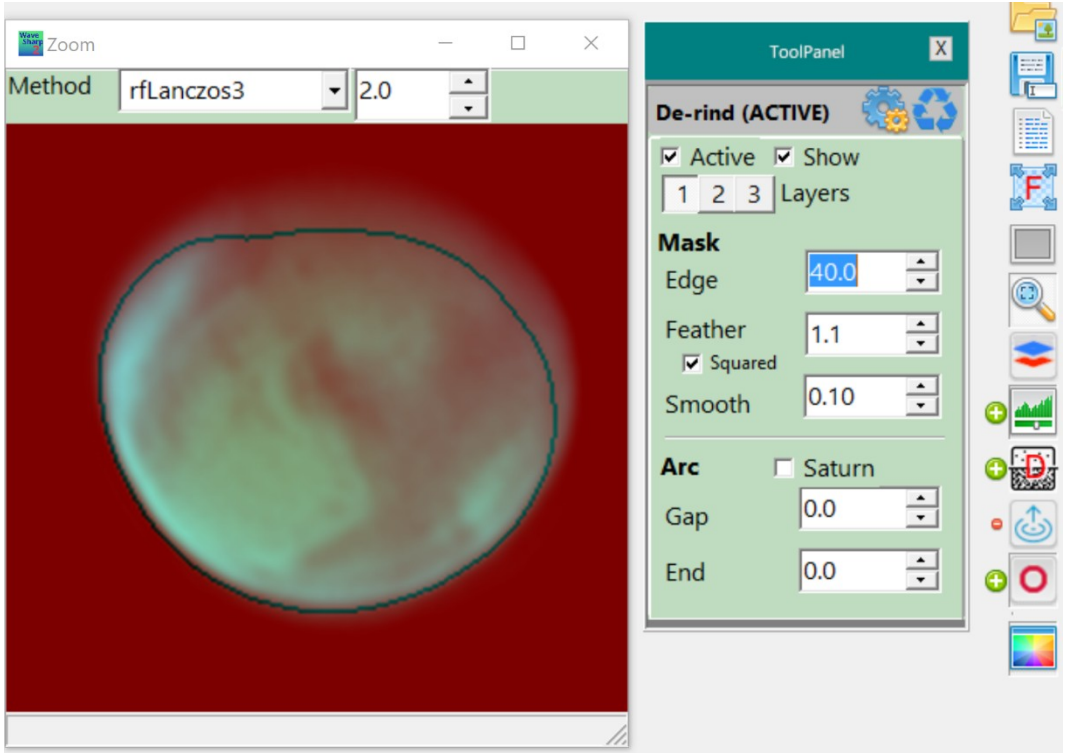

Figure 12. Edge is increased until the mask just touches the edge of the bright ring.

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We then adjust Feather so as to cover the bright ring with the mask. This is shown in Figure 13.

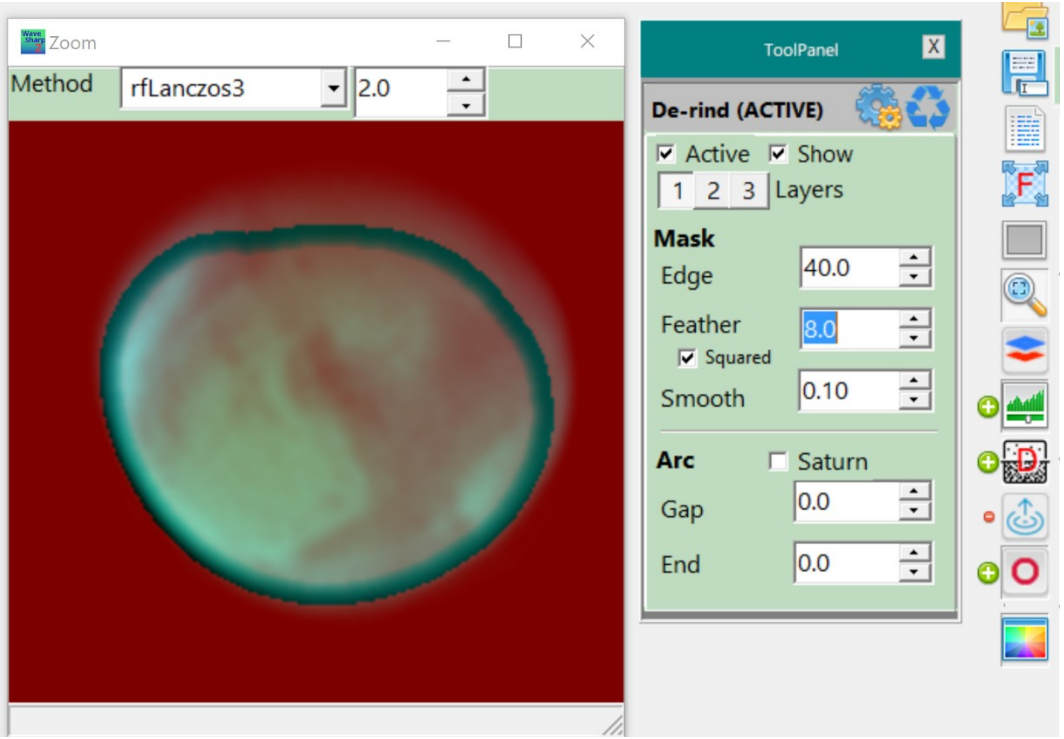

Figure 13. Feather is set so as to cover the bright ring with the mask.

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Now we see the first significant difference between Jupiter processing and Mars processing in that the mask is now well onto the disk at the terminator side of the planet. The deleterious impact to the final image is clearly seen when Show is turned OFF as in Figure 13b.

Unlike Jupiter, for which good results can fairly easily be obtained even without the use of Gap and End, there is little option for Mars during its gibbous phases. During opposition, at which time rind is typically found over most of the circumference of the limb, Gap and End will be needed to a lesser extent but only to a degree defined by your image itself.

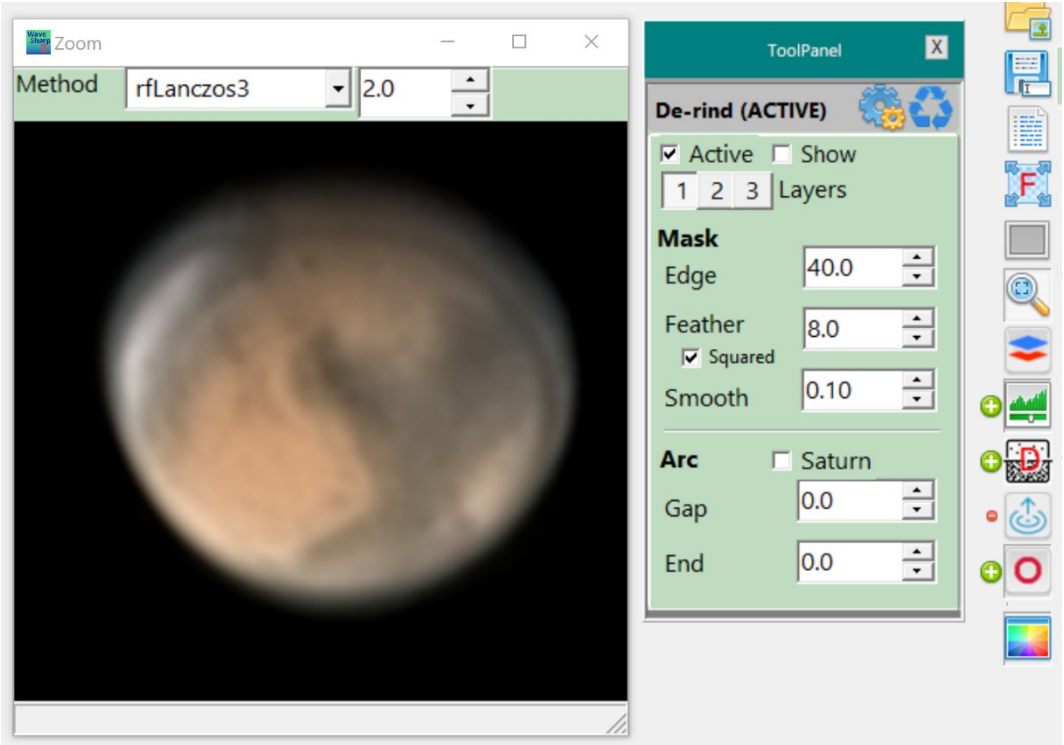

Figure 13b. Turning Show OFF yields a totally unacceptable result.

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Before dealing with Gap and End lets choose an appropriate starting point for the Smooth function. In the case of Mars a larger relative value of Smooth, as compared to the diameter of the disk is often the secret of getting good results with the Derind Tool. I show a typical starting value for Mars in Figure 14.

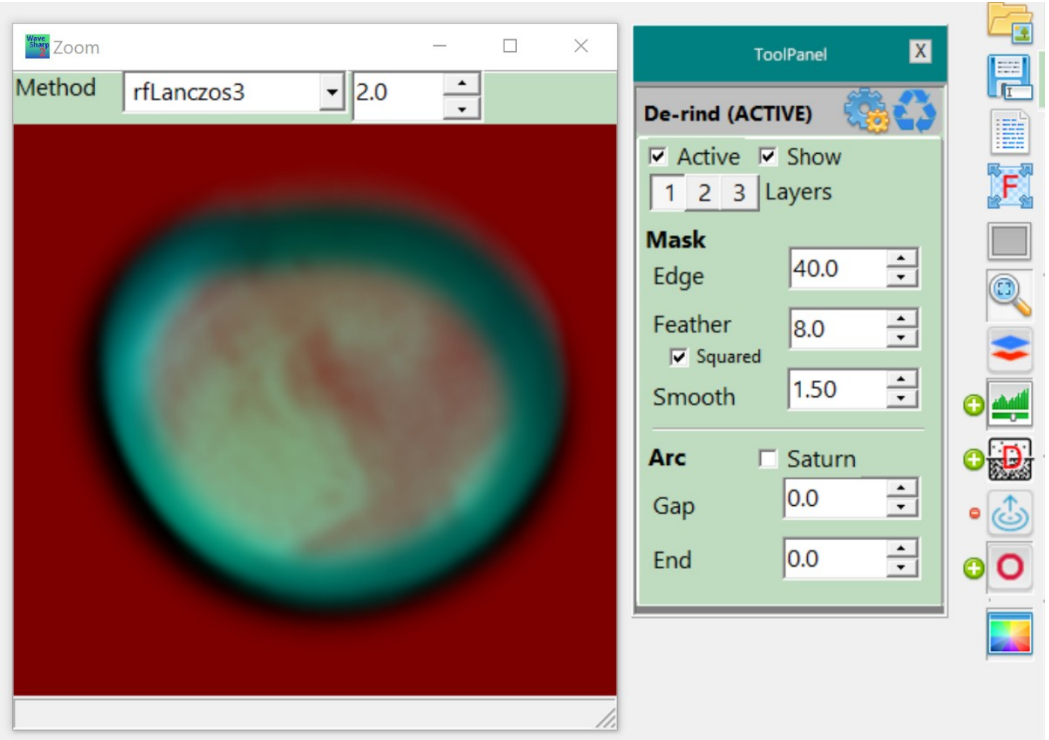

Figure 14. This setting of Smooth has spread the Mars over an extent as much as 20% of the planet disk.

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At this point, we open a Gap in the mask and position this Gap as needed with the End parameter. This is shown in Figure 15 and 16. The best gap is often not obvious until End is also adjusted.

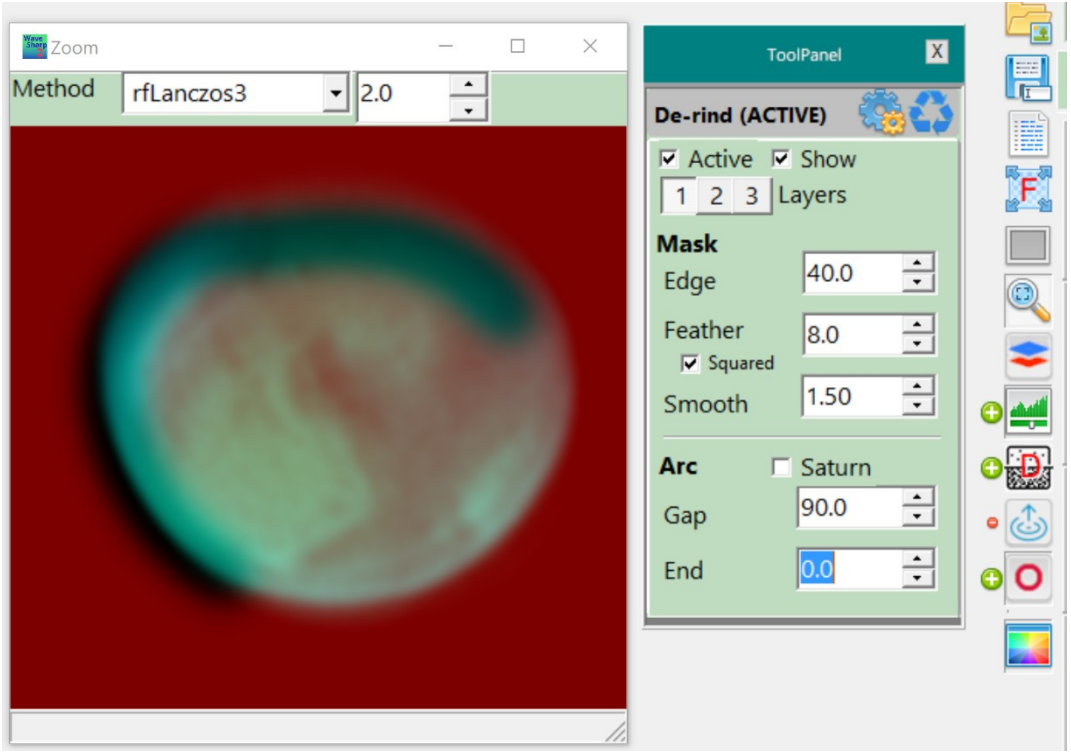

Figure 15. Open a Gap in the mask with a typical value of 90 (refine this value after choosing End)

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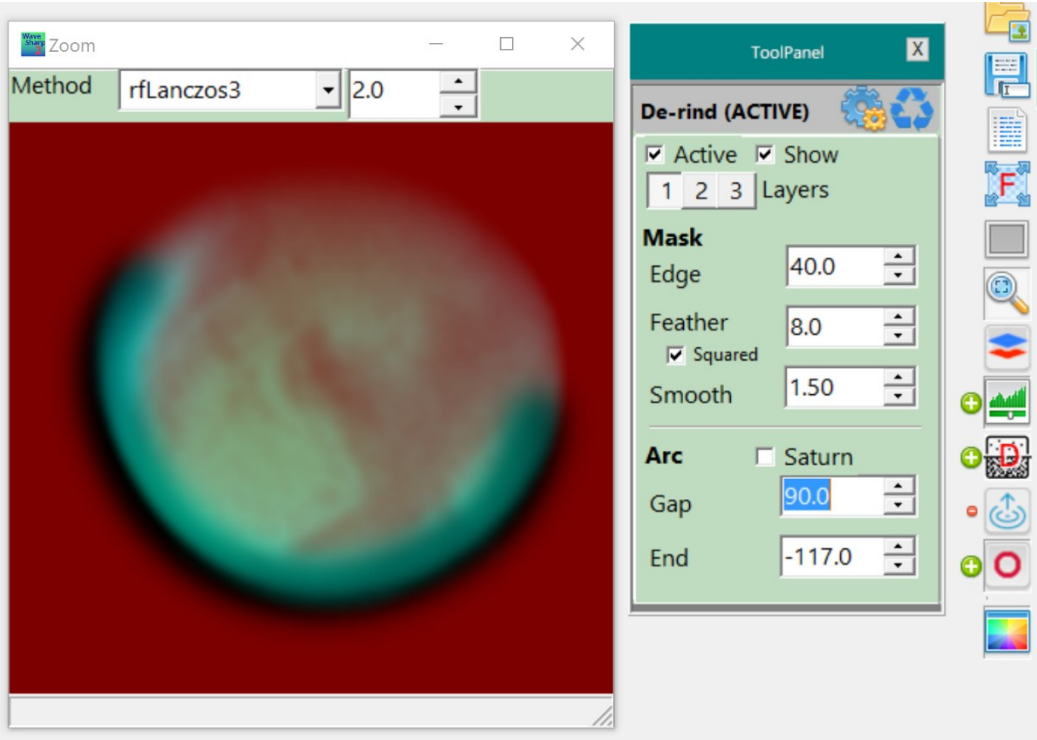

Figure 16. Adjust End to position the mask over the portion of the limb affected by a rind. We have rotated the mask in the CCW direction by applying a negative value of 117.

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For this image, target values for Gap and End will produce a mask that begins just at the edge of the northern polar hood and ends at the termination of the dark ring in the south. This optimization is shown in Figures 17a and 17b.

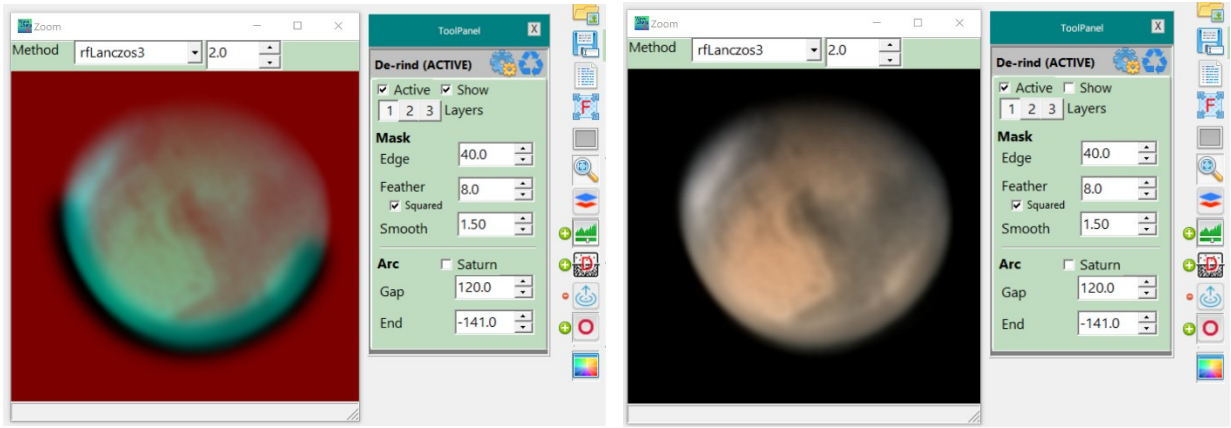

Figure 17a and 17b. Optimized Gap and End settings with Show ON and OFF.

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Evident in this image is a rather distinct boundary between the area under the mask and the rest of the disk. This is usually the case and requires one final set of adjustments to Edge, Feather and Smooth by toggling Show ON and OFF as changes are made to yield the best result possible. The result of this final optimization is shown in Figure 18a and 18b.

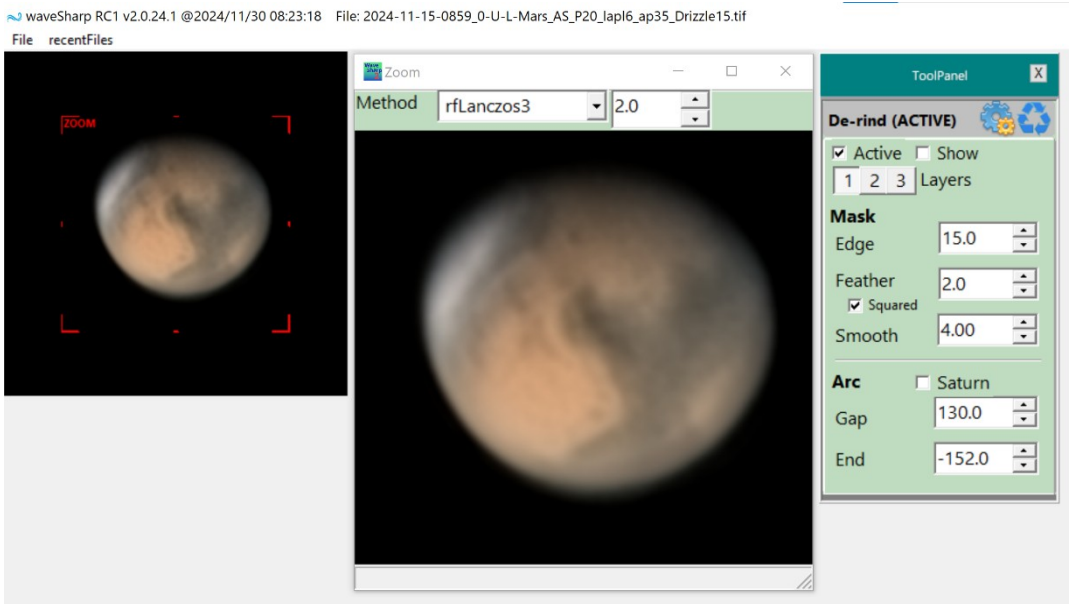

Figure 18a. – Final optimization of the Derind parameters with Show OFF

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There is tremendous flexibility contained within this parameter space and the user should explore these settings to establish a good set that works for your image scale, seeing conditions, etc.

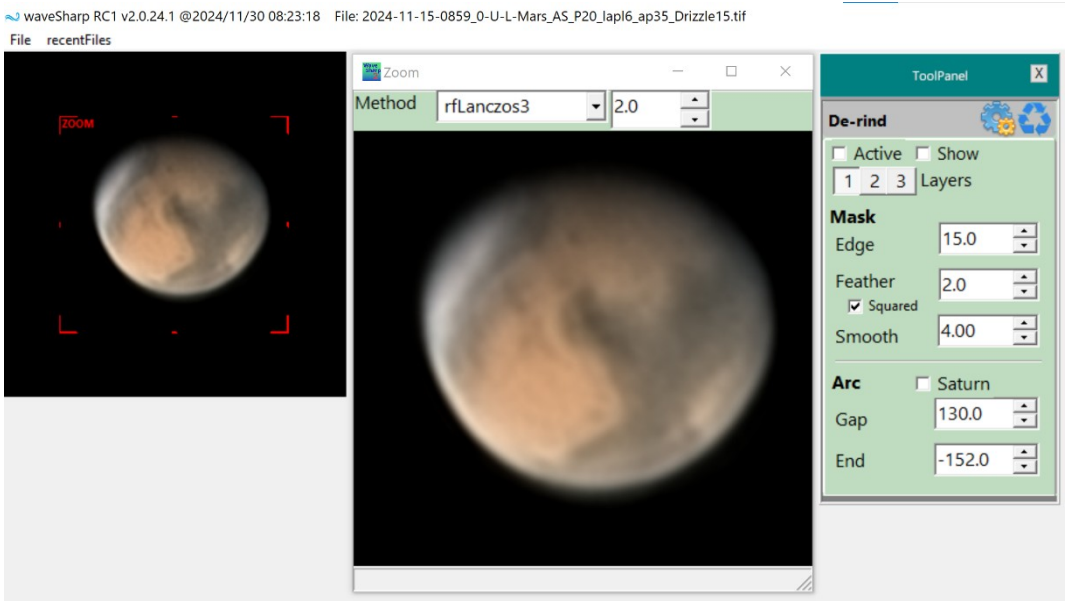

Figure 18b. With Active turned OFF we see a good comparison with the original image.

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Using the Derind Tool (Saturn example)

Saturn's rings present a unique challenge for the Derind Tool in that rind is not usually associated with the rings themselves. However, because of the presence of the rings we need to ability to open additional gaps to ensure the mask has minimal impact to the rings, especially where they intersect with Saturn's disk. The Saturn toggle box is used to accomplish this task. We have covered launching and optimizing the Derind Tool twice already so in this section we focus on just those aspect of the Saturn toggle box which modify the extent and location of the mask to avoid the rings.

In Figure 19, the result of applying the Derind Tool to Saturn is shown. While by no means the only mask that could be developed using the tool it does show a typical result, namely, the mask extends all the way around the limb and covers the rings as well.

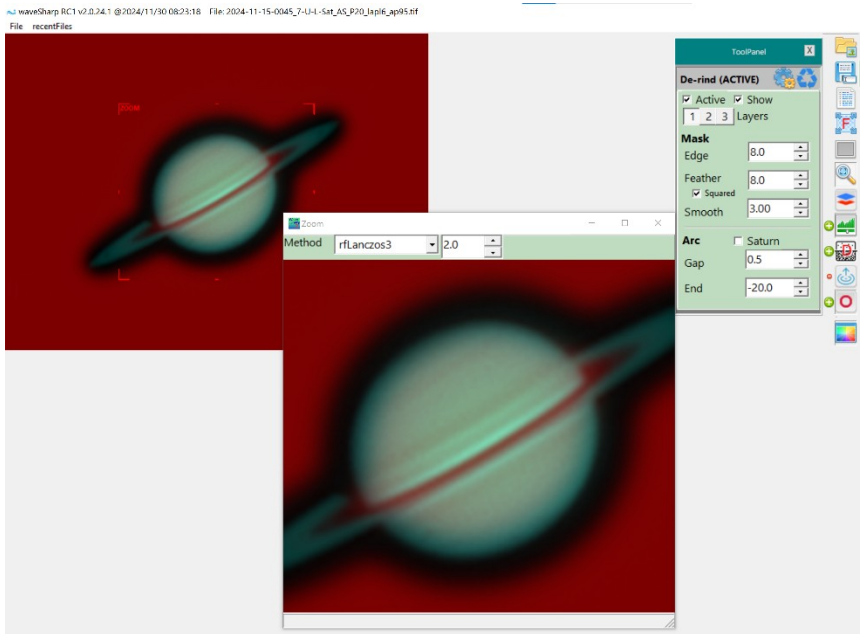

Figure 19. Typical Derind mask achieved for Saturn without the Saturn toggle activated.

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However, using the Saturn toggle allows for the rings to be excluded from the mask almost in their entirety. This is shown in Figure 20.

Unfortunately for the user, the gap across the rings is a function of Edge, Smooth, Gap and End and is both unique to each image and sensitive to small adjustments in these parameters. The changes are much more sensitive to those for either Jupiter and Mars and will require the user to perform specific optimization for their unique imaging circumstances.

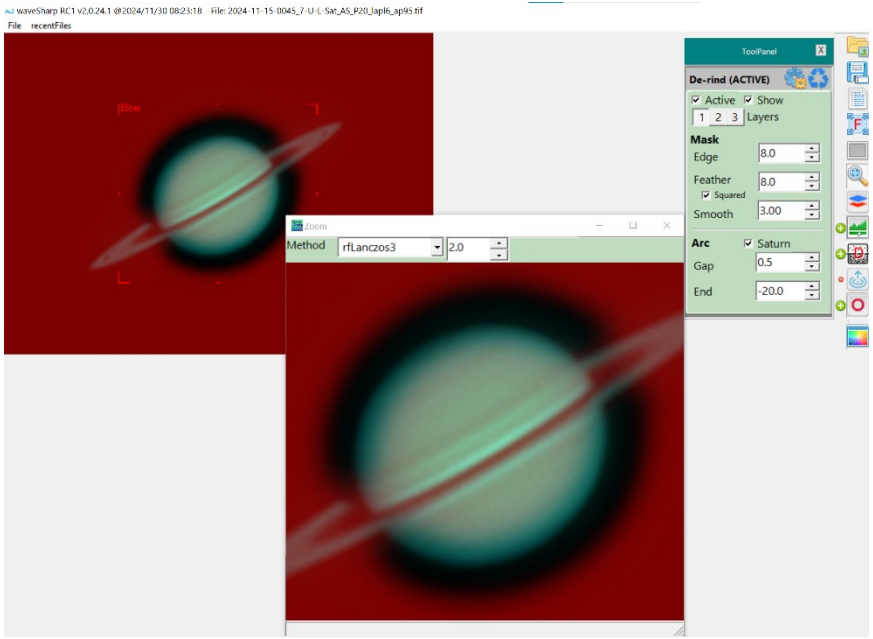

Figure 20: Using the Saturn toggle allows the user to exclude the mask from the bulk of the rings.

Wavesharp 2 - Using the Derind Tool

One final example is the limb artifacts that often occur in Saturn imaging when derotated image stacks are processed. One final example is shown in Figure 21 for a derotated image stack.

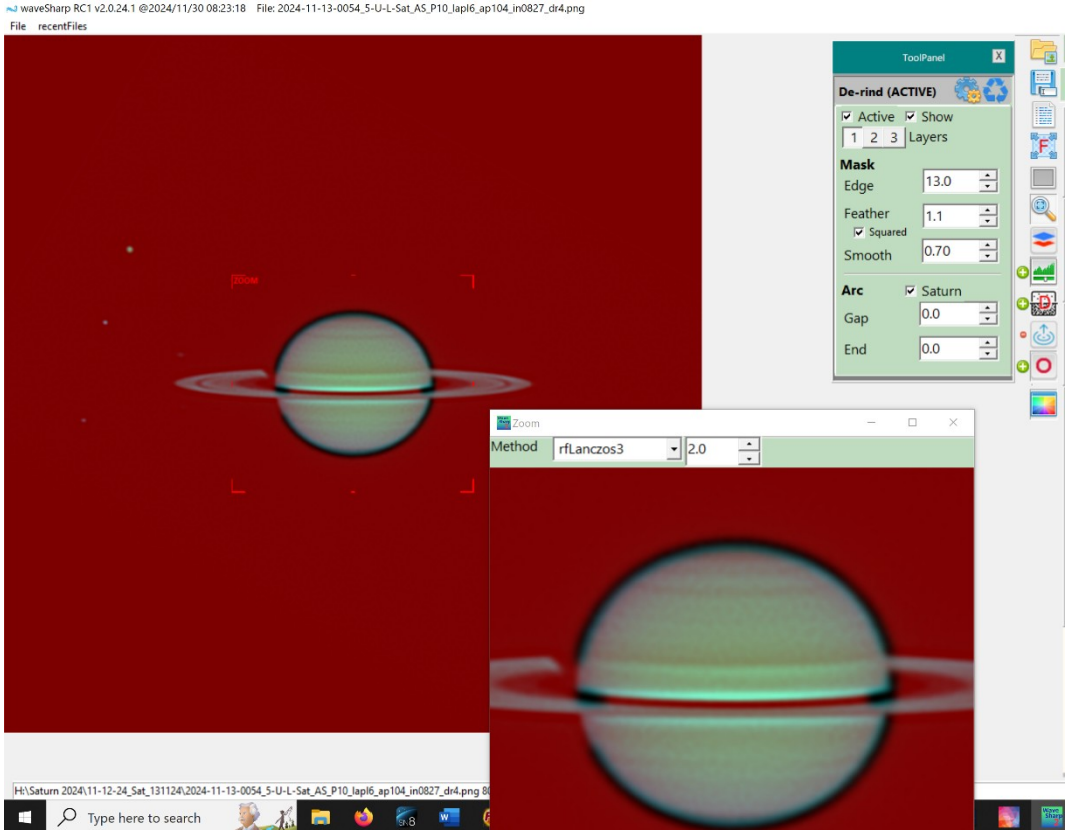

Figure 21. Using the Saturn toggle on derotated Saturn image stacks.