Invigon

Laser Light Inspector Use Case: Laser Focus Analysis

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Abstract

This document describes some features available in the Laser Light Inspector software to analyze laser focus images.

Information

Target Version	Laser Light Inspector 8.192.1
Corresponding files	-

Inhalt

Source Image

- 14Bit gray level image (see Figure 1)
- is converted to 16Bit during acquisition

Figure 1: Source image showing an intensity distribution of a laser in focus.

Image Analysis

Some analysis procedures will be described here. First, the manual determination of the noise level of the source image will be explained. Afterwards the steps to reduce the noise level will be showed. In a next step the mean value of the background will be subtracted from the image using the offset tool. At the last section the use of 16bit color tables are shown. These color tables can be used to show details of 16bit images on 8bit monitors.

Determination of the noise level

- use of rectangular ROI to select an area of the background
- use of contrast tool at this ROI: Source: 700-900, Destination: 0-65535
- activation of histogram tool: change order of tool processing: histogram tool after contrast tool
- one can see a Gaussian distribution at the histogram window (see Figure 2)
- the FWHM width of the distribution is about 13 bars
- the distance between two bars corresponds to 4 gray values due to the conversion from 14bit to 16bit
- in conclusion the noise level is about: FWHM=4*13 = **52 gray levels**
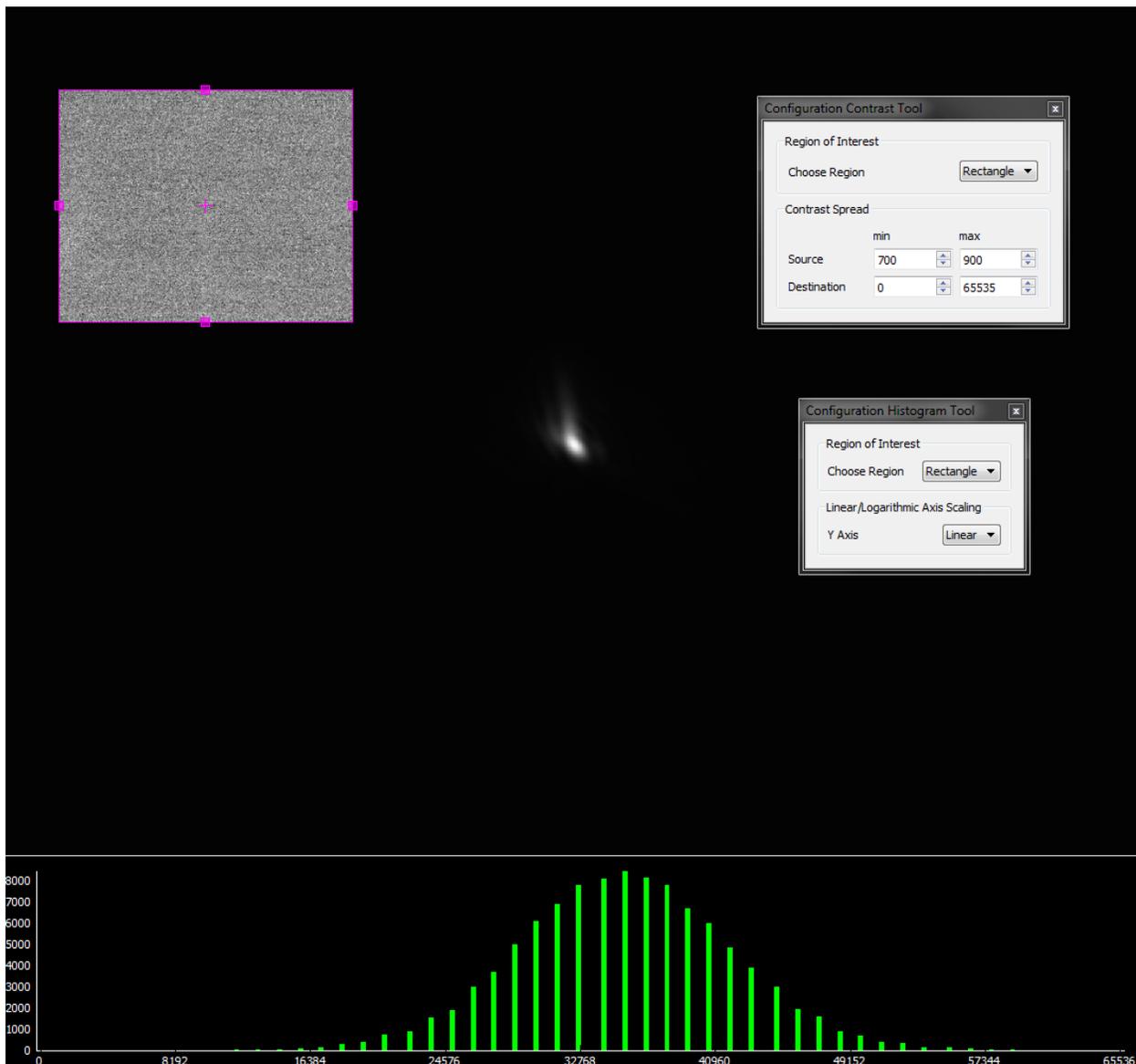
Figure 2: Noise level determination by using the contrast and histogram tool.

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Noise level reduction

The noise level can be reduced by using the noise reduction tool.

- activate the noise reduction tool
- adjust the order of the tools in the tool chain:
  - contrast-tool → noise reduction tool → histogram tool
- configure the noise reduction tool:
  - Filter: Gaussian, Mask Size: 21, Double Standard Deviation: 4 pixel

Now the **noise level is reduced by a factor of about 6** (see Figure 3). The contrast spread stays the same.
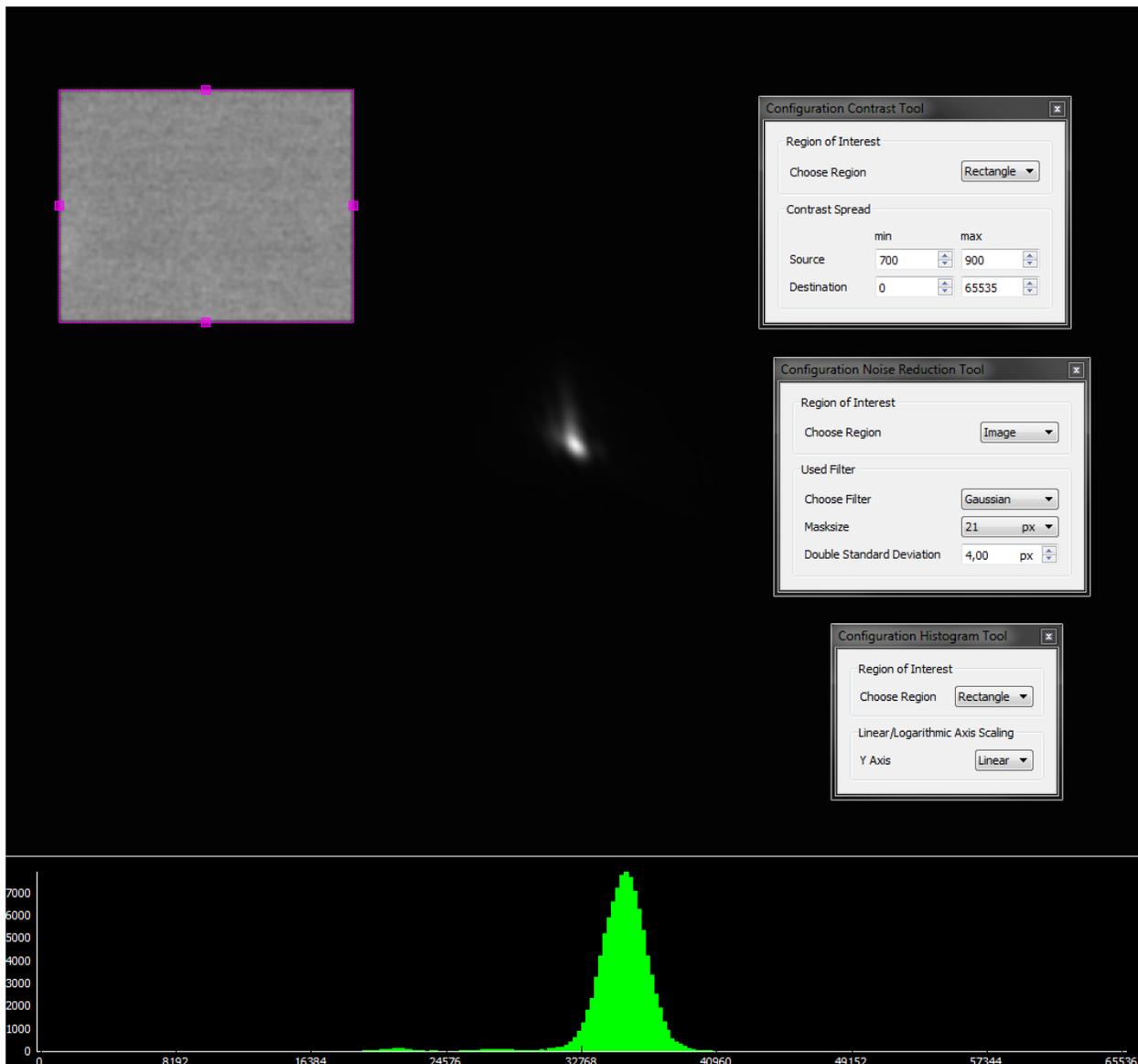
Figure 3: Noise level reduction with noise reduction tool.

Noise level reduction and (automatic) offset compensation

Now the noise level will be reduced by the noise reduction tool and additionally the offset of the background will be subtracted from the whole image afterwards.

- use of the last configuration
- activate the offset tool, additionally
- adjust the order of the tools in the tool chain:
  - contrast-tool → noise reduction tool → offset tool → histogram tool
- configure the offset tool
  - input region: rectangle, output region: image, automatic offset mode

Now the offset of the background, determined from the rectangular ROI, will be subtracted from the whole image (see Figure 4).
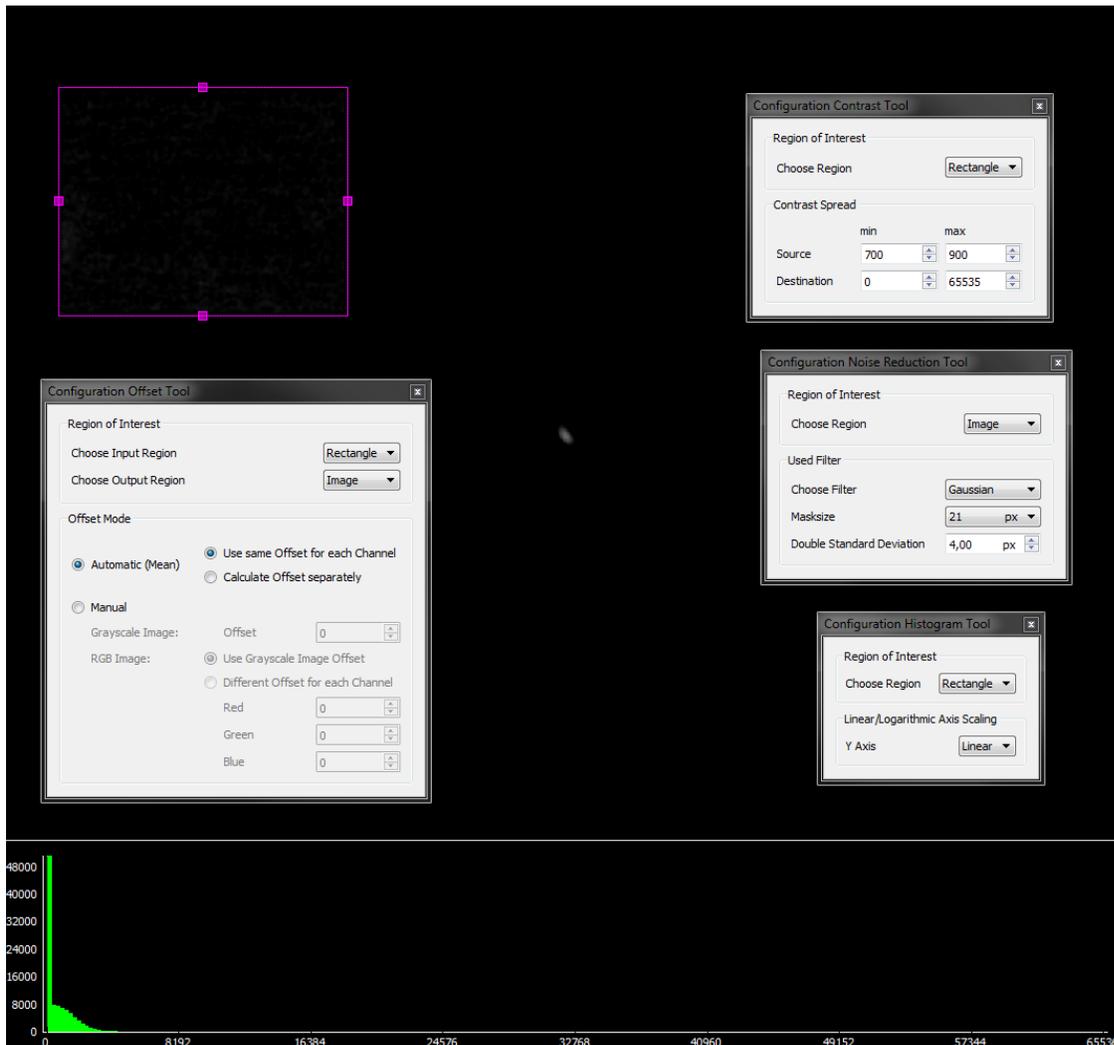
Figure 4: Noise reduction and background offset compensation.

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Pseudo color plot

With the use of 16bit pseudo color tables it will become possible to show details of high quality 16bit images on 8bit monitors. The pseudo color tables use the tree channels of the RGB color space to show the high contrast of the 16bit image.

Now the following tool chain will be used:

- Noise reduction tool:
  - ROI: Image, Filter: Gaussian, Mask Size: 21, Double Standard Deviation: 3 pixel
- Contrast tool:
  - ROI: Rectangle, Source: 700-900, Destination: 0-65535
- Select the 16bit color table
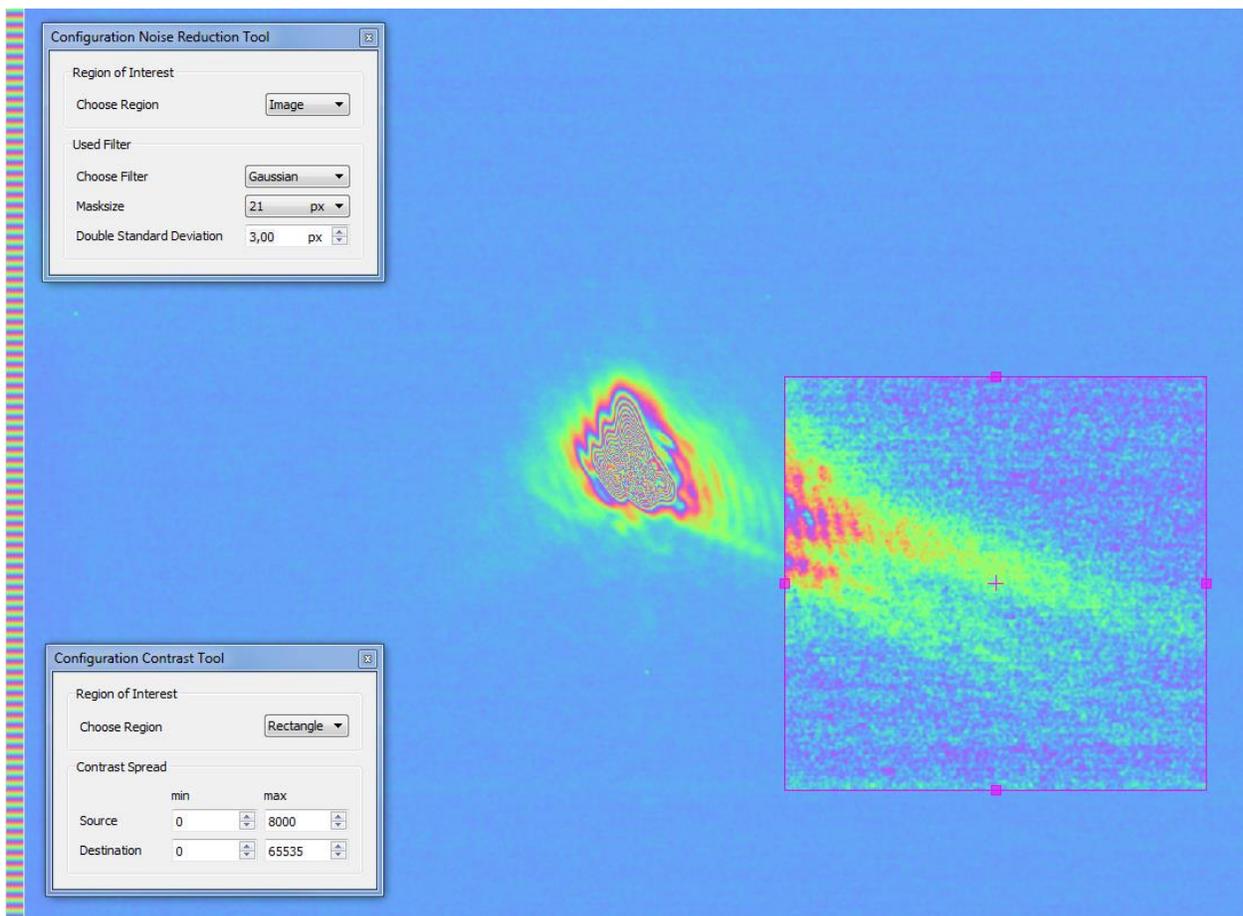
Figure 5: Intensity distribution of a laser beam in focus – 16bit image showed with a 16bit pseudo color table. The contrast was enhanced additionally at the rectangular ROI to show details of the beam tails.
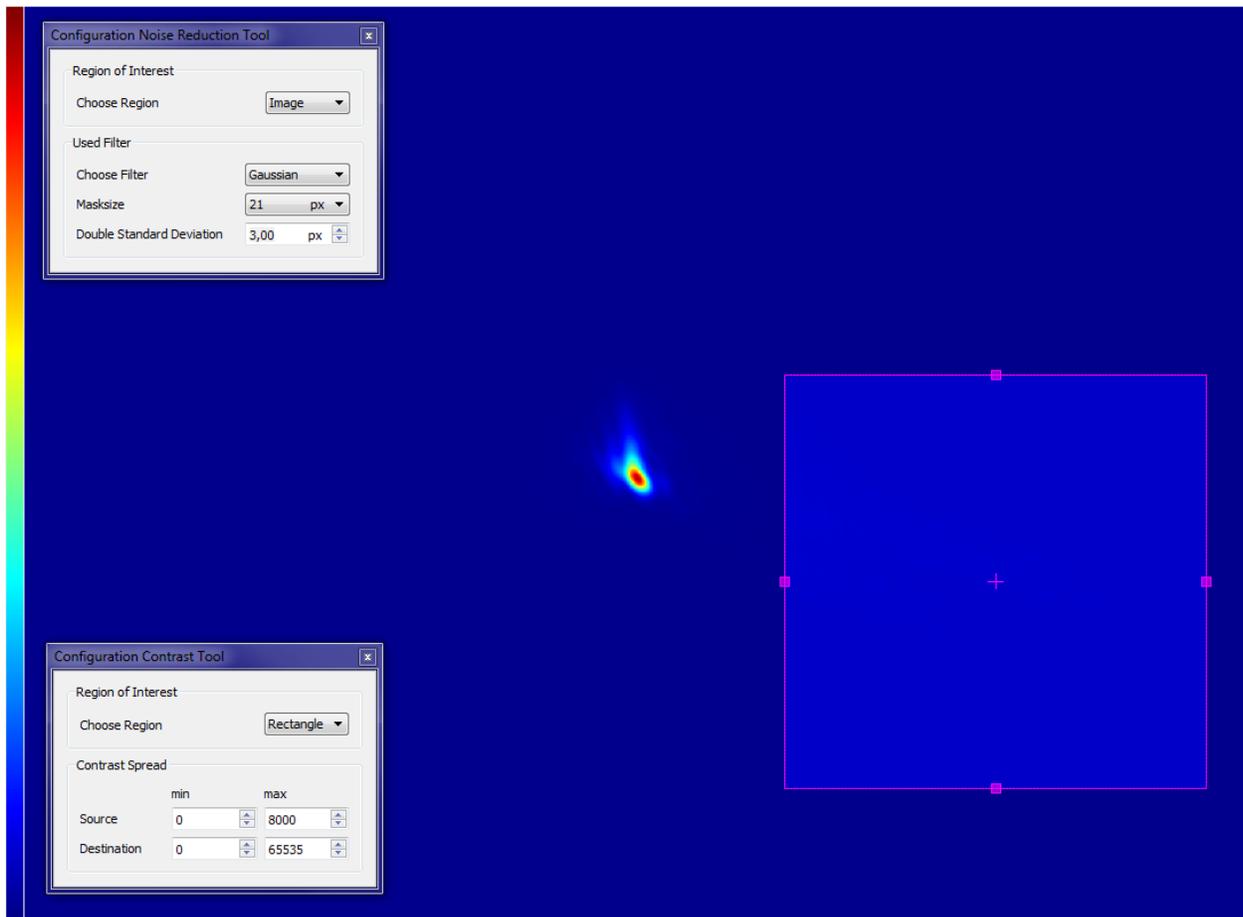
Figure 6: Same configuration as in Figure 5 with a standard 8bit pseudo color table used.