



# Triaxes<sup>®</sup> StereoTracer<sup>™</sup>

VERSION 7.0

## USER GUIDE

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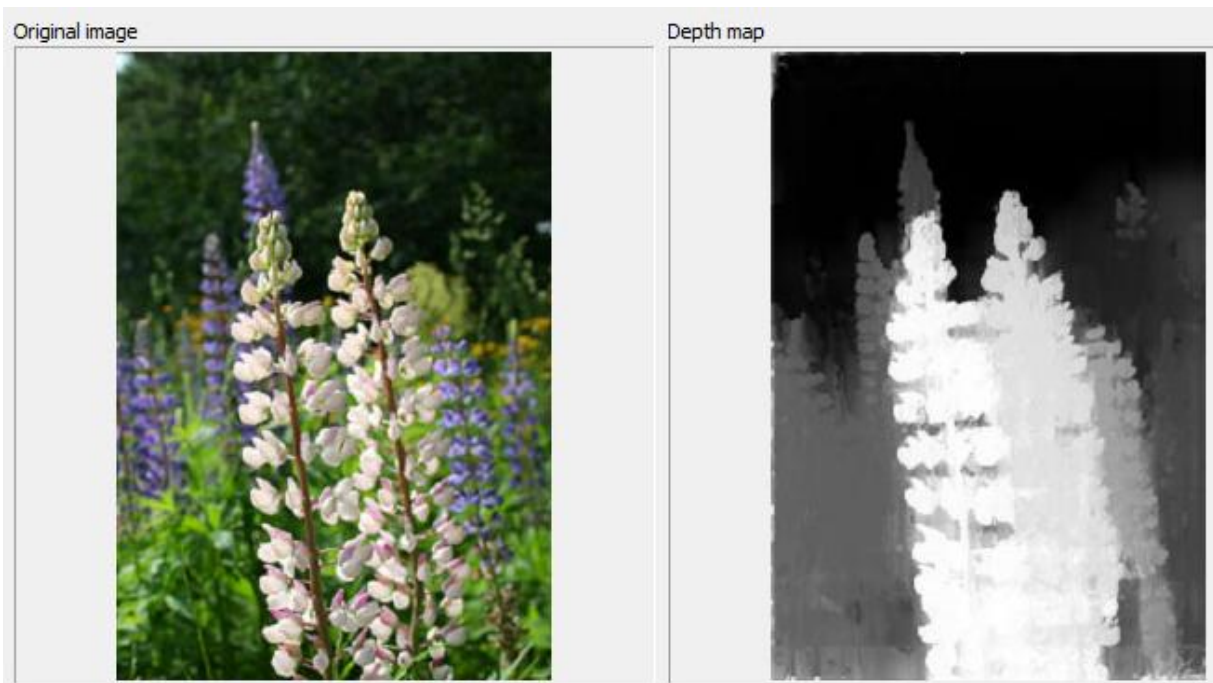
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# 1. Introduction

## 1.1 Preface

Triaxes StereoTracer is designed for rendering multiview images out of one original image or a stereo pair by using so called *depth map\** to create a stereo (3D) image. StereoTracer generates a number of frames, which all have slightly different viewing angle. This process models the shooting of a scene from different points across the horizontal line. The resulting series of frames is used for creating a 3D (stereo) image in the 3DMasterKit application or any other program for 3D generating.

**Note:** A depth map (*disparity image* or *Z-image*) is a gray-scale image which resolution is equal to the original image.



A depth map serves to convert the original image into a three-dimensional one. Brightness of a pixel in a depth map shows the distance from the same pixel in the original image to the viewer. The lighter areas in depth map correspond to the areas nearer to the viewer, the darker ones correspond to more distant areas. A white pixel in a depth map means that the pixel of the original image has the smallest distance to the viewer (foreground), a black pixel in a depth map means that the pixel of the original has the biggest distance to the viewer (background).

A depth map can be created automatically from a stereo pair in StereoTracer or manually out of one original image by means of any graphic editor.

The procedure of a multiview series generation includes several operations:

- open source images (original image + depth map or stereo pair)
- create and correct the depth map (if necessary)
- generate a frames series
- save generated multiview frames for further encoding or export them to Triaxes 3DMasterKit

## 1.2 System requirements

Minimum hardware and software requirements:

- OS: Windows® XP/Vista/7/8 (Windows 7/8 64-bit is recommended)
- 1 GHz CPU (Core i3 and higher is recommended)
- 1 GB RAM (4 and more is recommended especially if you need to process large images)
- 100 MB free disk space to install StereoTracer application.

You may need additional disk space to store your images.

## 1.3 Licensing and technical support

By installing, copying or otherwise using Triaxes StereoTracer (SOFTWARE PRODUCT) or any UPDATES, you agree to be bound by the terms of the “Triaxes” End-User License Agreement (“EULA”). The EULA is a legal agreement between you (either an individual or a single entity) and Triaxes for the “Triaxes” software product(s) accompanying the EULA which include(s) computer software and may include “online” or electronic documentation, associated media, and printed materials (“SOFTWARE PRODUCT”).

To get technical support, please, contact the distributor you purchased Triaxes StereoTracer from. Besides, you can ask your questions by sending an e-mail message to [support@triaxes.com](mailto:support@triaxes.com). Please, specify your activation user name and program edition, while contacting Triaxes Technical support group.

For sales and licensing information contact Triaxes Sales Department: [info@triaxes.com](mailto:info@triaxes.com).

Welcome to our web-site: <http://www.triaxes.com>.

This site contains news about Triaxes software and here you can download updates for the programs, samples and tutorials. Besides, the site contains useful articles about stereo, lenticular technology and the use of the Triaxes software. Also, there is information about distributors and answers to frequently asked questions (FAQ).

## 1.4 StereoTracer Demo mode

Triaxes StereoTracer works in Demo mode, until you *activate* it.

Please, note, that in Demo mode all generated frames are covered by logo-text “*Triaxes StereoTracer Demo*”. You may freely use StereoTracer Demo for evaluation, or any other noncommercial purposes. Also you may distribute copies of Triaxes StereoTracer Demo free of charge.

## 2. Getting Started

This section explains how to install and start using Triaxes StereoTracer.

### 2.1 Installation

1. Download Triaxes StereoTracer installation file from the product page ([www.triaxes.com](http://www.triaxes.com)) or its mirrors.
2. Launch Triaxes StereoTracer Setup. For that, unzip the StereoTracer and launch the program *setup-StereoTracer-x.x-en.exe* (where x.x is the version number).
3. Triaxes StereoTracer setup window will appear. Read the recommendations and warnings. Click **Next**.
4. The license agreement will appear. Read the agreement and if you accept the terms, checkmark the “*Yes, I agree with the terms of this license agreement*” checkbox. Click **Next**.
5. Select the installation folder for Triaxes StereoTracer application. To select an installation folder, click **Browse** and find the folder to which you would like to install Triaxes StereoTracer. Click **Next**.
6. Select a program group. Click **Next**.
7. Select install options. Click **Install**.
8. When setup is finished, and all the necessary files are installed on your computer, Triaxes **StereoTracer has been successfully installed** dialog will appear, and the program is ready to be run. You do not need to reboot your computer.

### 2.2 Uninstallation

In order to uninstall StereoTracer, please, execute the menu command:

**Start >> Programs >> Triaxes >> StereoTracer X.X >> Uninstall StereoTracer.**

Follow further instructions to complete uninstallation.

### 2.3 Running StereoTracer

You can launch StereoTracer by several ways:

- Execute the menu command: **Start >> Programs >> Triaxes >> StereoTracer x.x >> StereoTracer**
- Click **StereoTracer** icon on the desktop.

## 2.4 Activation

It is necessary to activate StereoTracer in order to use it in full-mode, that allows you to get technical support and information about updates. The program runs in Demo mode, until it is activated.

To activate Triaxes StereoTracer, please, do the following steps:

1. Launch Triaxes StereoTracer. The **Activation** dialog will appear.
2. Click **Open key** in the **Activation** dialog and then select the file with the activation key.
3. Click **Activate** to finish the activation process.

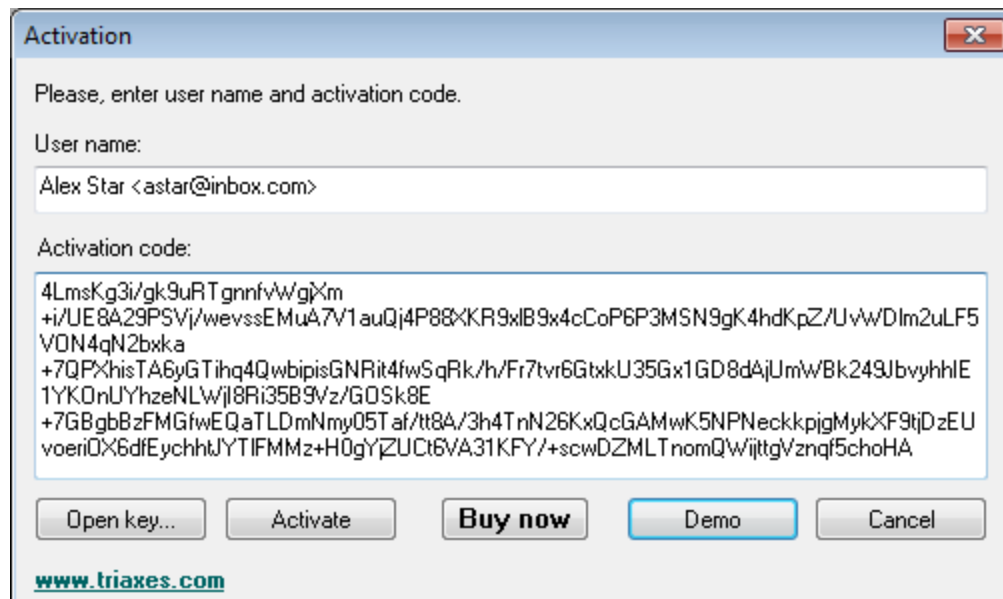


Figure 2.1 **Activation** dialog

After the activation is completed the **About** dialog (**Help | About**) will start displaying the user name (Fig. 2.2).

Please, refer to the **Activation guide** for details (C:\Program Files\Triaxes\StereoTracer-x.x\Activation.pdf).

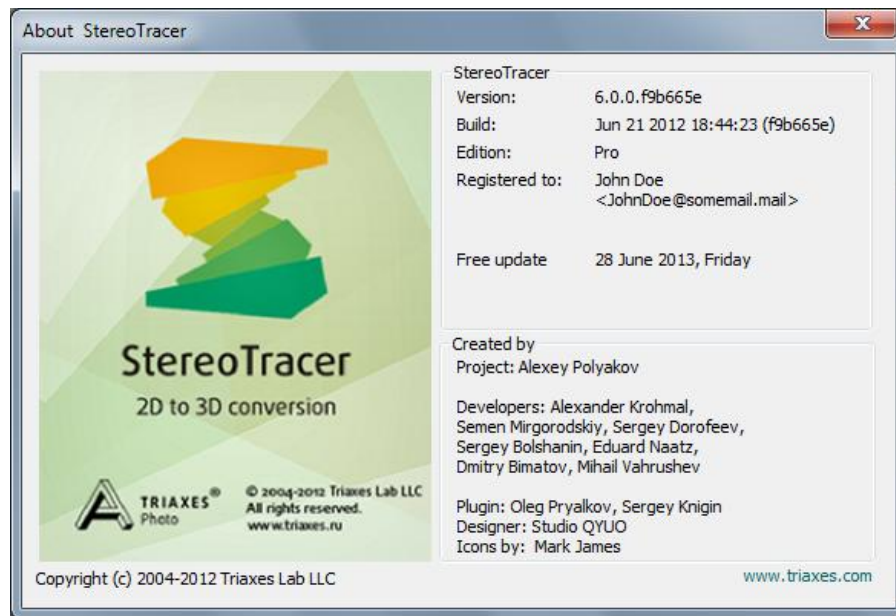


Figure 2.2 **About** dialog

## 2.5 StereoTracer Editions

Triaxes StereoTracer is available in the following editions:

Edition	Features
StereoTracer Home	<ul style="list-style-type: none"> <li>• Multiview rendering from one 2D original image and a depth map, created in an external graphic editor.</li> </ul>
StereoTracer Photo	<ul style="list-style-type: none"> <li>• Multiview rendering from one 2D original image and a depth map, created in an external graphic editor.</li> <li>• Multiview rendering from a stereo pair, based on a depth map, calculated for one frame of a pair, left or right (it's up to you).</li> </ul>
StereoTracer Pro	<ul style="list-style-type: none"> <li>• Multiview rendering from one 2D original image and a depth map, created in an external graphic editor.</li> <li>• Multiview rendering from a stereo pair, based on a depth map, calculated for one frame of a pair, left or right (it's up to you).</li> <li>• Multiview rendering from a stereo pair, based on depth maps, calculated for both frames of the pair. It's possible to get real "look behind" effect due to this feature.</li> </ul>



### 3. Using StereoTracer

This section describes StereoTracer graphic user interface (GUI), its features, and instructions for multiview rendering.

#### 3.1 StereoTracer workspace

The outward appearance of the StereoTracer program workspace:

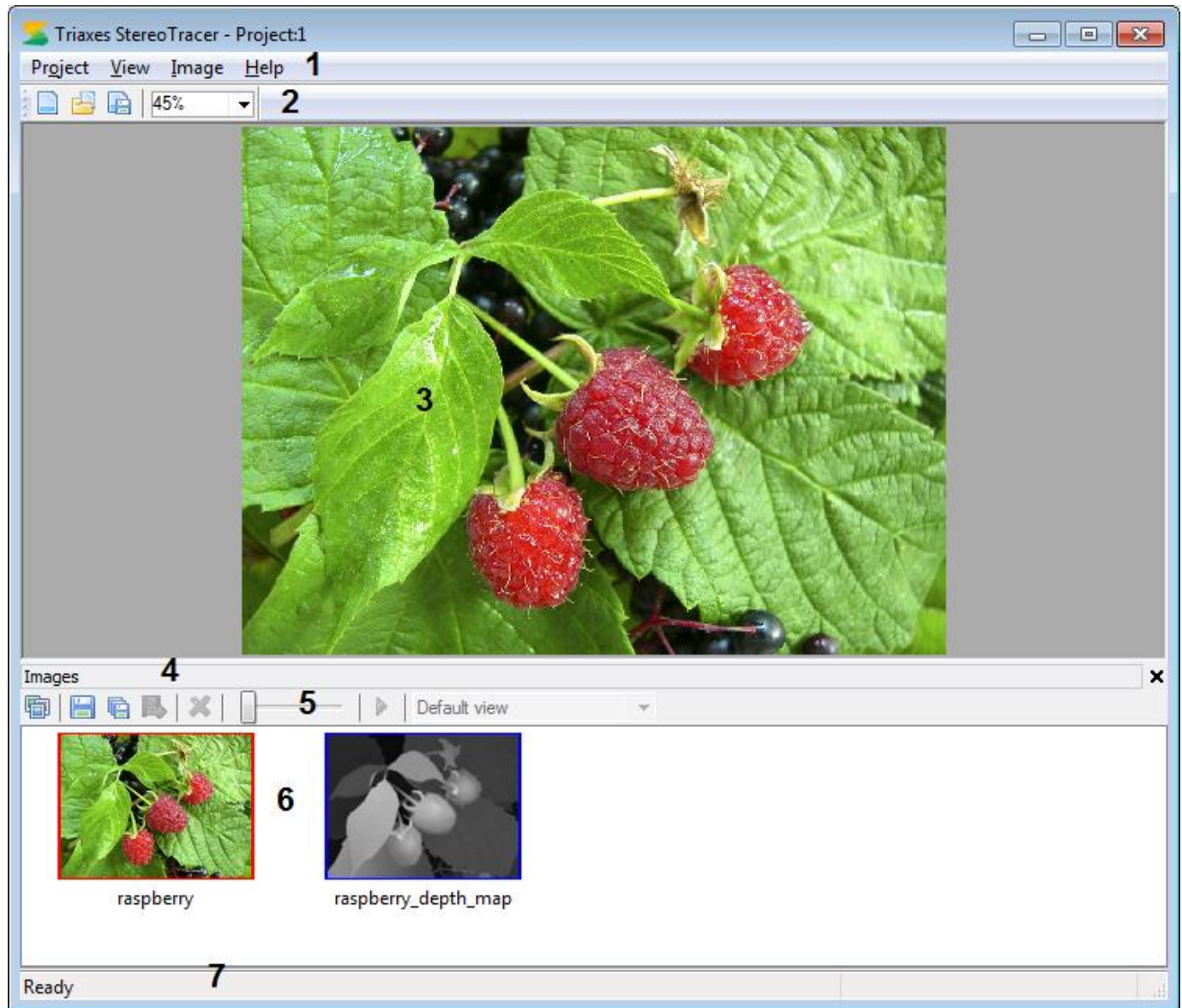


Figure 3.1 General view of the program

Indication:

- 1 – menu line
- 2 – toolbar
- 3 – StereoTracer working area
- 4 – **Images** window

5 – **Images** window toolbar

6 – list of images





7 – status bar

There is a detailed description of the elements below.

### 3.2 Toolbar and Status bar

Toolbar is located in the upper part of the screen just below the system menu. It is possible to show or hide it from the screen executing menu command **View | Toolbar**.

Table 1 StereoTracer Main Toolbar Control Element Description

Control Element	Function	Hot key
	Create a new project	Ctrl+N
	Open a project	Ctrl+O
	Save a project	Ctrl+S
	Image View Scale	

Status Bar is located in the lower part of the screen. It shows the menu command prompts, and the current state of the generation. It is possible to show or hide it from the screen executing the menu command **View | Status bar**.

### 3.3 Images window

The original image, its depth map and the generated series are placed into the **Images** window (Fig. 3.2), which is located at the lower part of the main window (Fig. 3.1).

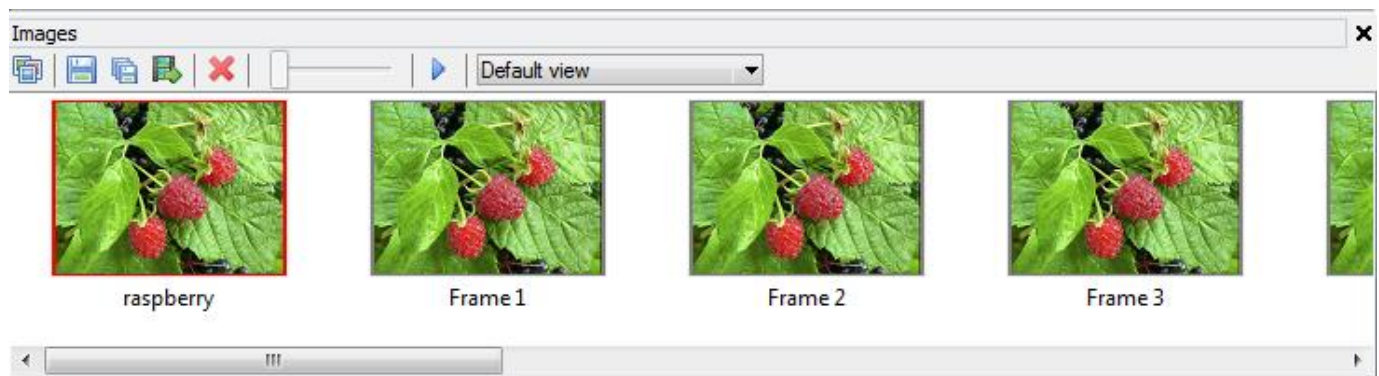









Figure 3.2 **Images** window

The **Images** window contains control elements and images. Source images are marked with red (original photo) and blue (depth map) frames. Generated frames are inserted between them.

To show or to hide the **Images** window use the menu command **View | Images window**.



Table 2 *Images* window toolbar description


Control Element	Function	Hot key
	Start multiview generation	Alt+G
	Save the generated series of frames	Ctrl+Shift+S
	Save the current view	
	Delete generated frames from the list	
	Transparency of the right frame in respect to the left one	
	Start the animated show of the generated multiview series, second pressing — stop the animated show	
	Select the viewing mode	

## 4. Main operations

### 4.1 Creation of a new project

Menu command: **Project | New**

Hot key: **Ctrl+N**

Toolbar button: 

After executing this menu command, the following **Select source images type** dialog will appear:

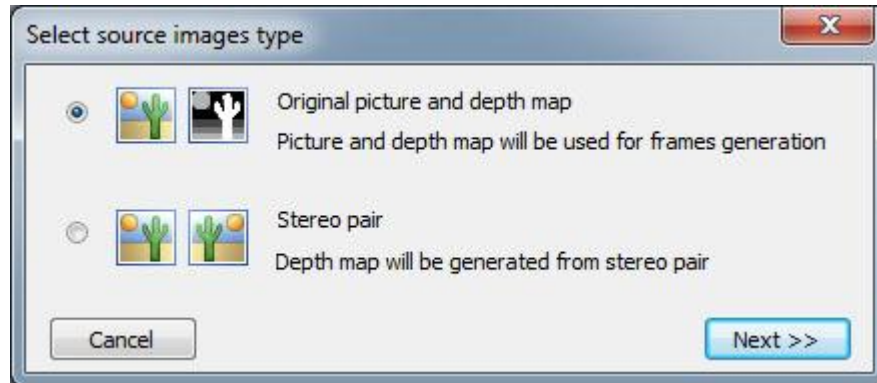


Figure 4.1 **Select source images type** dialog.

There are two source images types, from which it is necessary to choose one:

- 1) **Original picture and depth map** – an original 2D image and a depth map, created in a graphic editor, are opened in the project.
- 2) **Stereo pair** – two images are opened in the project: left and right frames of a stereo pair. A depth map will be created automatically by the Triaxes technology.

After the type of source images is chosen, press **Next** - **Open source images** dialog will appear.

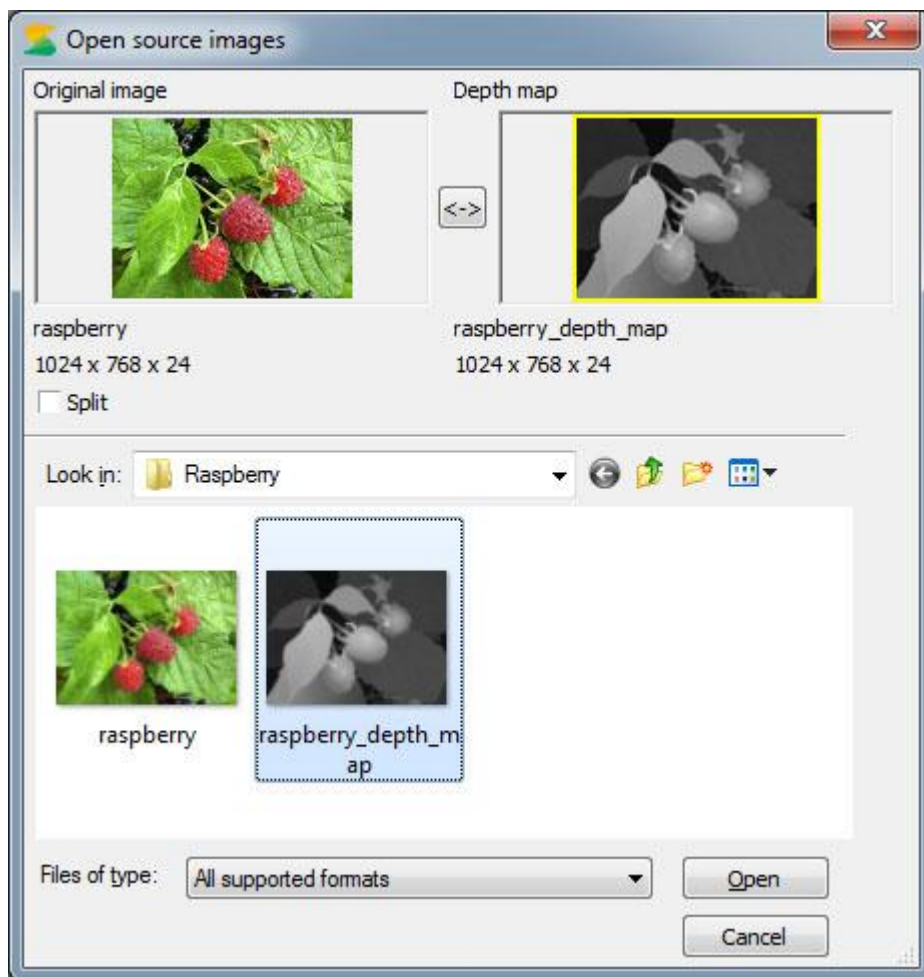


Figure 4.2 **Open source images** dialog

This dialog is for opening an original photo and a depth map image or a stereo pair (depending on the type of the project), which then will be added into the project. In the upper part of the dialog there are two areas for selected images preview: the active area is highlighted with the yellow frame. Below the preview areas there is a **Split** checkbox. This checkbox can be used also in case of side-by-side frame (the left and the right frames are stored in one image file, the image is split vertically into two parts if checkbox is marked). If this mode is not active, the original image and the depth map image or two frames of a stereo pair will be selected separately. To specify the source image or the left frame of a stereo pair, click on the left preview area and select the needed file from the list. To specify the depth map image or the right frame click on the right preview area. The image will appear in the active preview area.

If the **Split** mode is set, it will be necessary to select only one file with images: the original image and its depth map or two frames of a stereo pair, that will be automatically displayed in the corresponding positions.

**Note:** original and depth map images as well as two frames of a stereo pair should have the same pixel resolution and the same color mode (for instance, both in RGB24).


### Supported for opening formats:

Format	Description
bmp	A file format for storing bitmap images without data compression and losses in their quality.
jpeg	A file format for bitmap storing images with some compression and some losses in their quality. The file size is in average 40 times smaller than a .bmp file. Quality loss can be expressed in slight color corruption and appearing artifacts peculiar to the jpg compression. The quality level approximately corresponds to 7-8 (Medium-High). It is not recommended to save lenticular encoded images in this format.
gif	A storing file format for graphic images with an indexed colour palette.
png	A spread storing format for bitmap graphic information using some compression without losses in quality.
tiff	A file format for storing bitmap images with some compression but without losses in their quality. A .tiff file is in average two times smaller than a .bmp file.
mpo	A file format for storing bitmap images used in Fuji FinePix REAL 3D W1 3D camera. It contains 2 images in .jpg format with special technical information.

## 4.2 Project saving

Menu command: **Project | Save**

Hot key: **Ctrl+S**

Toolbar button: 

The current project can be saved to the file with the .stp extension. The work with the saved project can be continued later. Using the **Project | Save as** menu command you can save a project with a different file name.

## 4.3 Project opening

Menu command: **Project | Open**

Hot key: **Ctrl+O**

Toolbar button: 

Opening of the saved project.in stp format.

## 4.4 Generation of the multiview frames series

Menu command: **Image | Generate frames**

Hot key: **Alt+G**

Toolbar button on the **Images** window: 

After executing this menu command, the following **Frames generation options** dialog will appear:

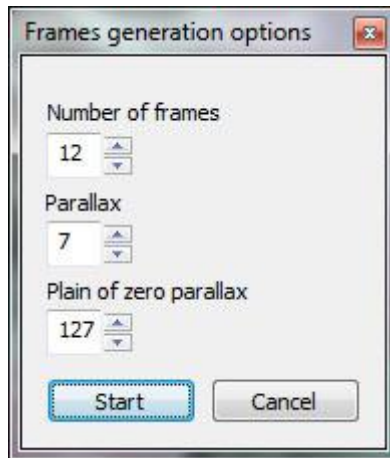


Figure 4.3 **Frames generation options** dialog

It is possible to set the parameters of generation. There are the following parameters in the dialog:

- 1) **Number of frames** is the number of frames, which will be generated.
- 2) **Parallax** is the value, which characterizes the distance of the object's projections on the plane for the left and right eyes (disparity). It's specified in the percentage from canvas width.

Available range: from 0 to 25.

Default value: 7.

The bigger value corresponds to the bigger 3D effect, but it should be taken into account that the value bigger than 10 often causes artifacts on the generated images. **So, we recommend to use values from 5 to 10.**

- 3) **Plane of zero parallax** – this value characterizes the placement of the zero parallax plane.

Available range: from 0 to 255.

Default value: 127.


For 255 value the plane of zero parallax (disparity) is situated at the foreground ( on the depth map the foreground is colored in white), while the whole image is situated at the background. For 0 value the plane of zero parallax is situated at the background (colored in black), and all of the image's objects seem to be flying above the paper or screen. Usually the best results can be achieved with the values in the 100-160 range.

## 4.5 Saving the generated frames.

The generated frames can be saved as separate images in files or in one file with animation (formats GIV and AVI)

Menu command: **Image | Save frames**

Hot key: **Ctrl+Shift+S**

Toolbar button on the **Images** window: 

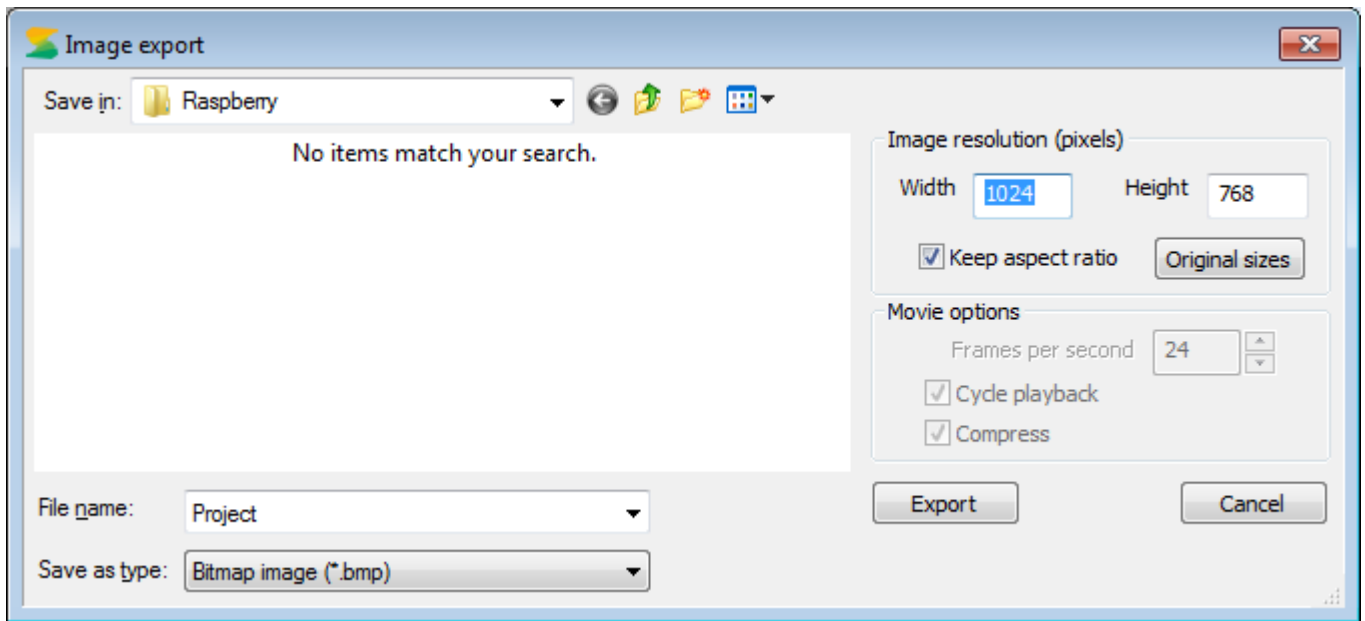


Figure 4.7 **Export images** dialog

The following file formats are supported:

Format	Description
bmp	Saving images without data compression. Images are saved without losses in their quality.
jpg	Image data are compressed with some losses in quality. The file is on average 40 times smaller than a bmp file.
tiff	Saving images with unnoticeable compression. Images are saved almost without quality loss.
psd	Saving images in Photoshop format. Images are saved without losses in their quality.
gif	Series of frames is saved in Animated GIF format. Derived file is convenient to arrange on web sites.
avi	Series of frames is saved to a movie. Derived file has got better quality than Animated Gif.
2dz jpeg	Saving images and depth maps side by side in one jpeg file.
j3s	Saving images in Dimenco 3D Digital Photo Frame format.

In the **Image resolution** (pixels) field you can change the size of an image (in pixels). The **Keep aspect ratio** checkmark means that, when **Width** or **Height** is changed, the resolution is automatically re-counted to save source relation of width to height. The **Original sizes** button allows you to restore ingoing sizes of images.

In the **Movie options** block you can specify the parameters of the created movie (active only for **gif** and **avi** file types): playback speed (frames per second), cycle playback and compression.

When **Cycle playback** is checkmarked the movie, which is comfortably played several times, is created. Such movie contains frames from the first to the last one and back to the first one. If




**Cycle playback** is not checkmarked – the movie with frames only from the first to the last one is created (with lesser file size).

When the **Compress** box is checkmarked (active only for **avi** file type) compression by standard video-codec is applied.

#### 4.6 Current view saving

Menu command: **Image | Save current view**

Toolbar button on the **Images** window: 

The feature is for saving an image, displayed in the program's working area. It allows you to save an anaglyph image, stereo pairs for the parallel and cross eyed view and a frame from the generated series or a depth map, depending on the current viewing mode.

#### 4.7 Export to 3DMasterKit

Menu command: **Image | Export to 3DMasterKit**

Toolbar button on the **Images** window: 


The feature is for quick transfer of the frames generated in StereoTracer to 3DMasterKit for the further 3D image encoding.

When the command **Image | Export to 3DMasterKit** is executed, StereoTracer automatically searches installed 3DMasterKit in the system, opens it and then transfers the generated multiview series to it.

Note! The feature is available with installed 3DMasterKit 3.6 or later version.

#### 4.8 Deletion of the generated frames

Menu command: **Image | Delete frames**

Toolbar button on the **Images** window: 

The generated frames are deleted from the project (source frames are not deleted).

#### 4.9 Setting transparency while previewing


To compare the images it is necessary to set the image depth map transparency with the help of the slider on the **Images** window.




The extreme left position of the slider corresponds to the full transparency of the depth map. Thus, only the original image will be displayed on the screen. The extreme right position of the slider corresponds to the full transparency of the image. Thus, only the depth map will be displayed on the screen.


#### 4.10 Playback of the generated sequence of frames (Animation)

Menu command: **View | Animation**

Toolbar button on the **Images** window: 

All generated frames from the frames list will be successively displayed on the screen. To finish the slide-show use the same command **View | Animation** or press up the button  on the **Images** window.

#### 4.11 Setting the image's scale

To zoom in/out the current image preview use the drop-down list on the Toolbar:  and choose the scale value (in percentage) or enter it manually.

#### 4.12 Anaglyph image creation

Anaglyph (from gr. anaglyphos – relief) – is the method of stereo visualization which consists of coloring two frames of a stereo pair into “supplementary” colors (e.g. one frame is red, another one is cyan). When viewing the image through anaglyph glasses, each eye perceives only one frame. Anaglyph glasses is shown on the following picture (red for the left eye, cyan – for the right).



Figure 4.8. Anaglyph glasses (image from www.stamptex.pl)

In StereoTracer there are three modes of the anaglyph image generation: **Grayscale**, **Sub-color**, and **Color**.



The usage of the anaglyph mode is possible only if there are generated frames in the images list. The anaglyph image is created from the first generated frame and one selected frame from the sequence. It is possible to choose the anaglyph mode by choosing the corresponding element of the drop-down list on the **Images** window.

The generated anaglyph image can be saved on your disk:

Menu command: **Image | Save current view**

Toolbar button on the **Images** window: 

**Note:** The quality of an anaglyph image depends on the original source photo colors. So, in some cases the **Color** anaglyph mode will give the excellent result, but in the case when original photos contain a lot of red or blue colors it would be better to use **Sub-color** or **Grayscale** mode.

#### 4.13 Creation of a stereo pair for the direct view

Direct view modes – cross eyed and parallel one are for evaluating 3D effect directly from the monitor screen, without any additional devices. Gotten 3D images are convenient to be posted on the Internet.

Cross eyed view ▼

Two images (stereo pair) — a source one and the one selected from the generated frames series appear in the main program window when choosing one of that modes from the drop-down list on the **Images** window.

When using the parallel method, frames of a stereo pair are located before eyes in the order they were taken — from left to right (Fig. 4.9 — a), and changing their places when the cross eyed method is chosen (Fig. 4.9 — b).

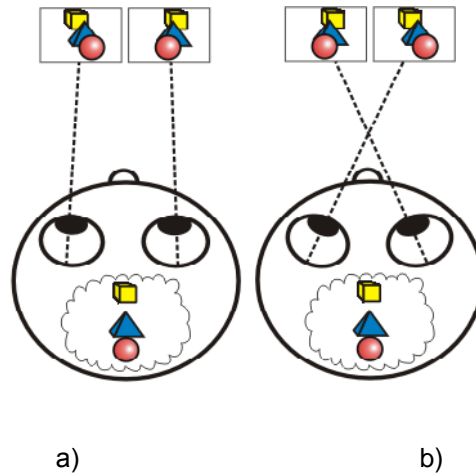


Fig. 4.9 Parallel and cross eyed viewing methods

When parallel method is used, you should look "through" the picture as if you watch an infinitely distant object. The sight lines of your eyes will be almost parallel, while the accommodation should be adjusted to the actual distance to the image.

To be able to see the stereo effect in the cross eyed viewing mode, you should look at the picture as if there was an imaginary object before the image itself. The sight lines will intersect in this case, accommodation should be adjusted to the actual distance to the image.

In more detail these two modes are described in the «3D Theory» document (C:\Program Files\Triaxes\3DMasterKit Demo-x.x\help).

The generated stereo pair can be saved on disk:

Menu command: **Image | Save current view**

Toolbar button on the **Images** window: 

#### 4.14 Use of the histogram dialog for the depth map correction

You can create or correct a depth map using the **Histogram** dialog. Click the right mouse button on the original image or the depth map and choose **Create depth map...** or **Correction...** menu commands in the context menu — **Histogram** dialog will appear (Fig. 4.10).

If you choose **Create depth map...** menu command — the current depth map will be replaced by a new one based on the original image.

If you choose **Correction...** menu command — the current depth map will be edited by a histogram and filters of the dialog.

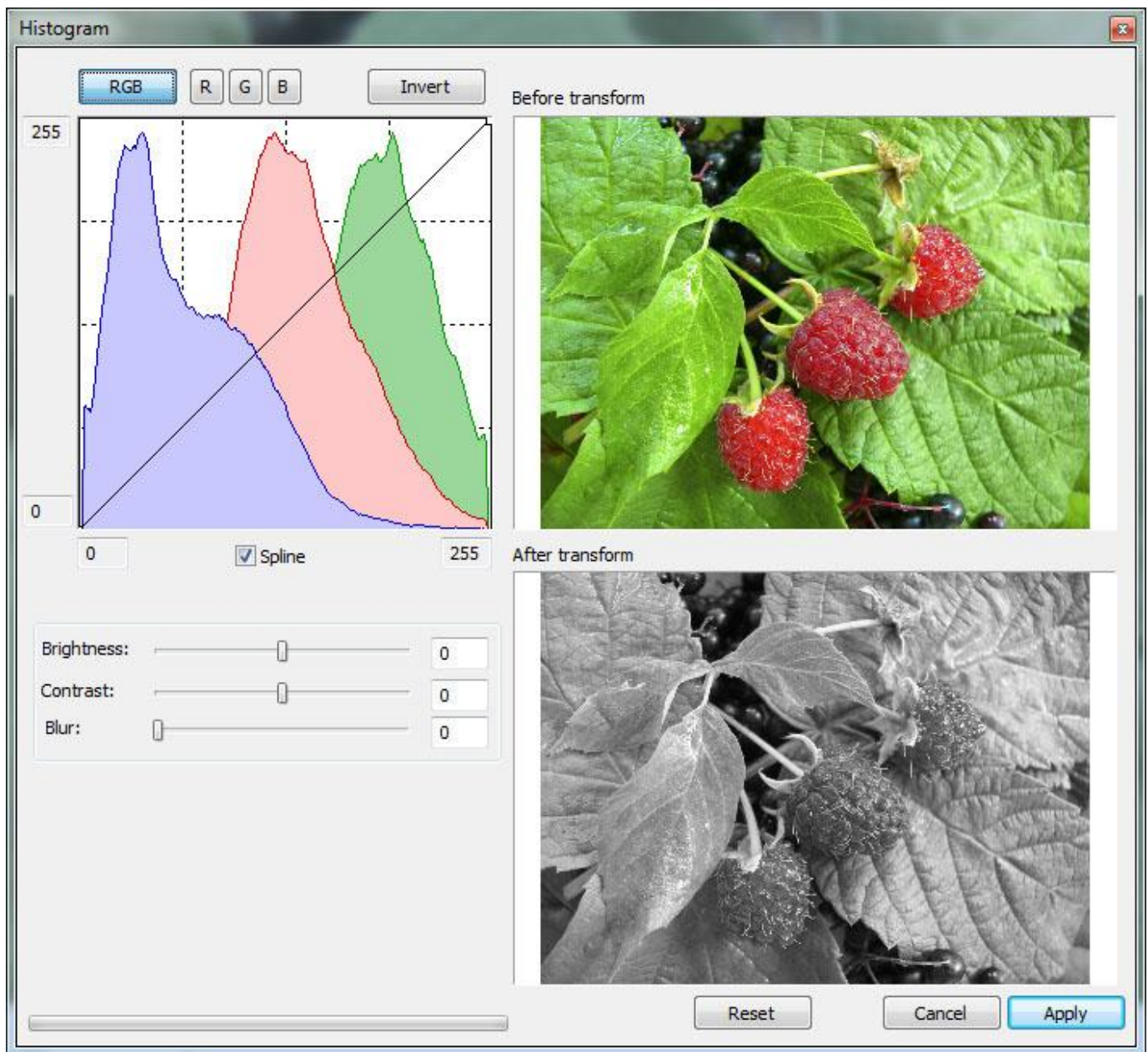


Figure 4.10. Correcting the depth map by the Histogram

**Histogram** (in the photography) is a graph of the semi-tones allocation that has two axes: the **x** axis represents the brightness, and the **y** axis represents the relative number of pixels with corresponding brightness values.

By the histogram you can find out the main idea of exposition correctness, image contrast and color depth, define the required correction when you take a photo (changing exposition and color balance, light or image composition) and also when processing is started.

Use the buttons above the histogram to correct it by separate color channels: **RGB** – all channels, **R** – red channel, **G** – green channel, **B** – blue channel. By clicking **Reset** button you can go back to the source histogram.

Set the control point by clicking the left mouse button. Remove the control point by clicking the right mouse button. Move the control point by left-mouse clicking on the graph and holding the point while you're moving it to the necessary place.

There are two ways to connect the controlling points: the spline and the broken line. Use **Spline** flag under the histogram to enable/disable the spline mode. Fields by the x and the y axes allow correcting manually the brightness of borders. Besides, they can be moved by clicking the left-mouse button on the required border.

Below the histogram there are **Brightness** and **Contrast** sliders to set brightness and image contrast.

You can also apply the **Blur** filter to the image, regulating the extent of blur by **Radius** slider (the value of the radius is specified in pixels). This feature is used to tone down sharp details when generating a sequence of frames – for better result the transition between the objects in the depth map must be more smooth. The **Blur** filter allows to avoid artifacts (imperfections) at the edges of the objects. So, if such defects as the vertical curved line are appeared in the generated images, use that feature.

In the depth map image, the more remote an object, the darker it should be. In case, the foreground objects of the original image are darker than the objects of the background, the feature **Invert** is used. The operation of Inversion will invert the depth map image so that the closer object will be lighter than the remote ones. Press the **Invert** button to apply that operation.

#### 4.15 Depth map editing by means of an external graphic editor

A depth map as well as a source image, except the ones created by means of a histogram, can be edited with the help of any external bitmap graphic editor. For that, it is necessary to click the right mouse button on the image's thumb-nail in the list of thumb-nails and select **Edit in external editor** in the appeared context menu. By the end of editing, save your image without changing the file name. As the result, the edited image will be automatically changed in StereoTracer.

You can choose necessary software for editing by means of **Project | Settings** menu command.

**Attention!** Depth map and source images edition is available only before frames generation.

#### 4.16 Context menu of the **Images** window

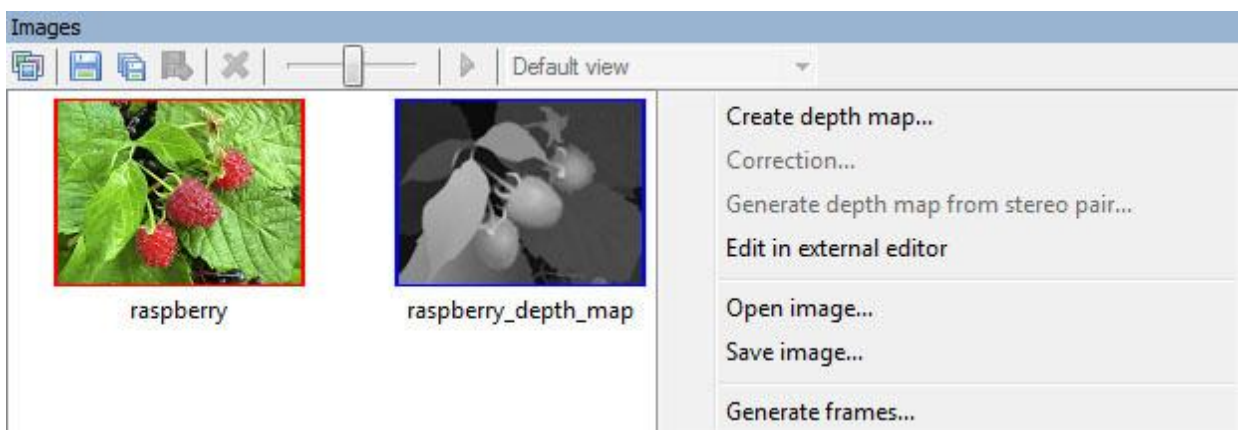


Figure 4.11 Context menu of the **Images** window

The Context menu opens by pressing the right mouse button on a depth map or the original image on the **Images** window. This menu is simplifying access to main operations with source images. The menu is active only in case the frames are not generated yet, i.e. there is only the

original image and the depth map on the **Images** window.

Menu commands:

- **Create depth map...** – a new depth map is created (just a grayscale variant of the original image) and opened for edition in the **Histogram** dialog. For the detailed description of the depth map creation process see section 4.14.
- **Correction...** – **Histogram** dialog opens for the current depth map edition. For the detailed description of the edition process see point 4.14.
- **Generate depth map from stereo pair** – the wizard for the second depth map creation from a stereo pair opens. For the detailed description of the depth map creation from a stereo pair see section 5.1
- **Edit in external editor** – a chosen image is uploaded into an external bitmap graphic editor, chosen in the menu item **Project | Settings**.
- **Open image...** – allows a new image to be opened in a project instead of the depth map or the original image. This menu command is convenient to use in case it is necessary to open the edited depth map from a file on disc.
- **Save image...** – the selected image (the source image or a depth map) is saved in a file on disc. This menu item is convenient to use in case it is necessary to edit the created depth map in an external graphic editor.
- **Generate frames...** – multiview rendering from the original image and the depth map. For the detailed description of the frames generation process see sections 4.4, 4.5.



## 5. StereoTracer Using

There are particular methods of StereoTracer usage described in this section. The software allows you to operate with a depth map, created in an external graphic editor or create a depth map in StereoTracer based on a stereo pair (see section 4.15).

### 5.1 3D sequence of frames generation from a 2D image and a depth map

To create a depth map from one source image any external graphic editor can be used. Some of the depth map creation methods are described in section 6. For the 3D sequence of frames generation from a 2D image and a depth map do the following:

- 1) Execute **Project | New (Ctrl+N)** command and select the first project type in the appeared dialog. Press **Next >>**.

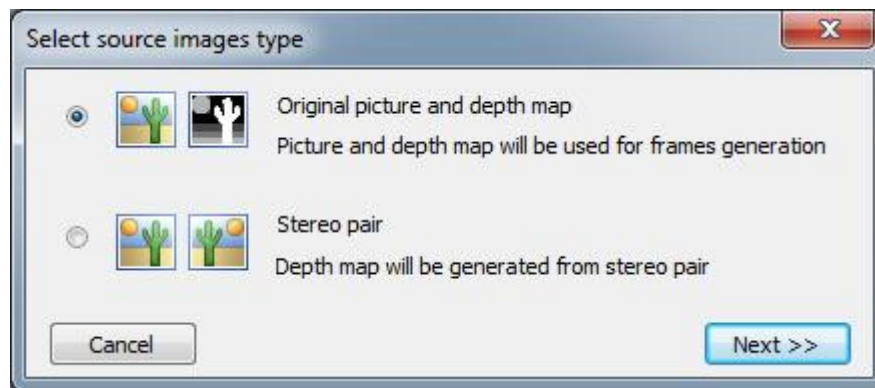


Figure 5.1 **Select source images type** dialog

- 2) It is necessary to specify file names in the **Open source images** dialog. First, an ordinary picture (2D) is selected. For example, C:\Program Files\Triaxes\StereoTracer-x.x\samples\Raspberry\raspberry.jpg (see Fig. 5.2).

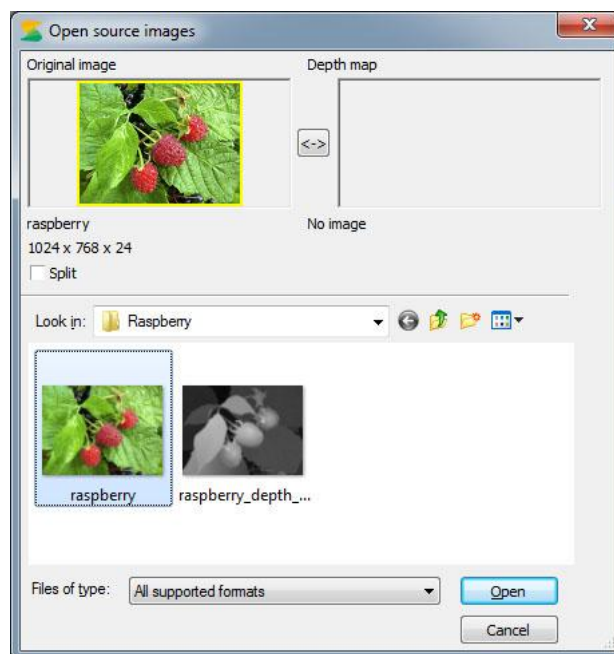


Figure 5.2. **Open source images** dialog

Preview of the chosen image will be shown in the left window of the dialog under the sign “**Original image**”.

Then, press the left mouse button on the right dialog's window under the sign “**Depth map**” and press the mouse button on the depth map's file name. For example, Files\Triaxes\StereoTracer-x.x\samples\Raspberry\raspberry\_depth\_map.jpg (Fig. 5.3).

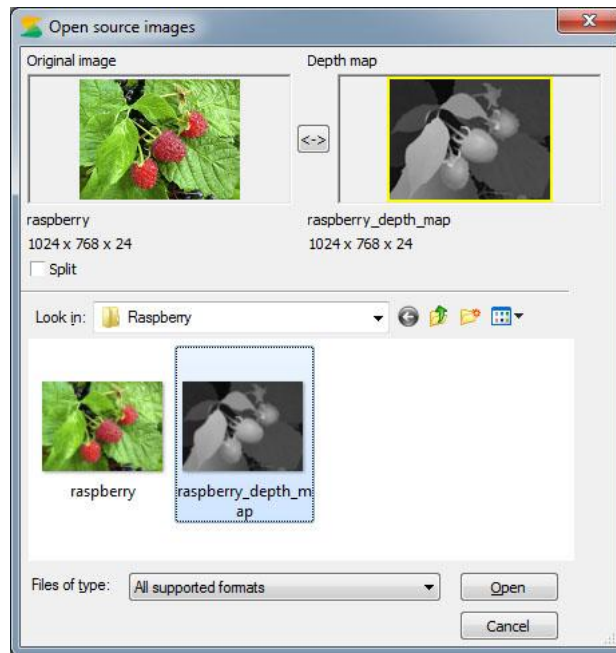


Figure 5.3 **Open source images** dialog

- 3) Press «**Open**». After that the chosen images will be opened in the main program window.
- 4) Select the menu command **Image | Generate frames (Alt+G)**. The **Frames generation options** dialog will be shown (Fig. 5.4). Select the method and press **Start** button (see also section 4.5). As a result a 3D sequence of frames will be generated.

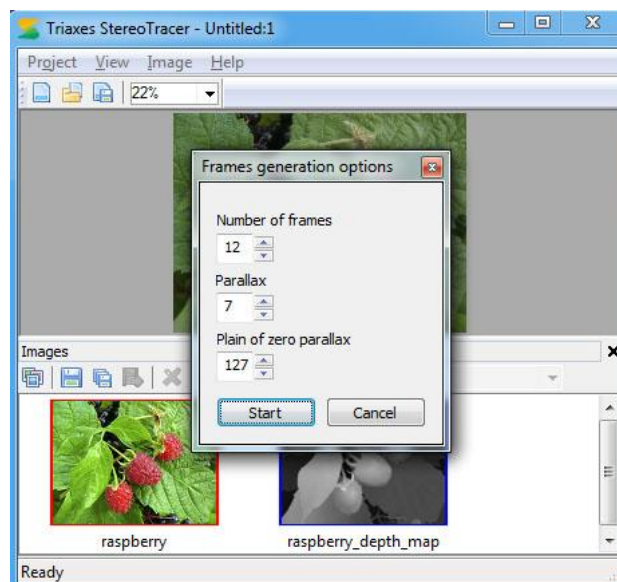


Figure 5.4 The main program window and the **Frames generation options** dialog

- 5) Gotten 3D sequence of frames can be saved on disk as separate files (Image | Save frames (Ctrl+Shift+S)) or exported to Triaxes 3DMasterKit (Image | Export to 3DMasterKit).

## 5.2 Depth map creation from a stereo pair

1. Choose «Stereo pair» in the **Select source images type** (Fig. 5.5)

Menu command: **Project | New**, hot key **Ctrl+N**

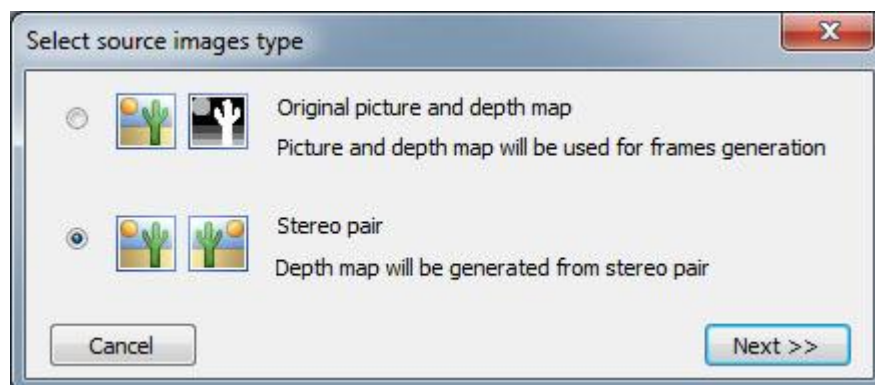


Figure 5.5 **Select source images type** dialog

Press **Next>>** - **Open source images** dialog will appear.

2. Select and open the left and the right frames of a stereo pair in the **Open source images** dialog (Fig. 5.6).

First, the left image is selected. For example, C:\Program Files\Triaxes\StereoTracer-x.x\samples\Stereo pair\white\_flower\_L.jpg. Preview of the chosen image will be shown in the left window of the dialog under the sign "**Left image**". Then, press the left mouse button on the right dialog's window under the sign "**Right image**" and select the depth map file. For example, C:\Program Files\Triaxes\StereoTracer-x.x\samples\Stereo pair\white\_flower\_R.jpg (Fig. 5.6). Press **Open**.

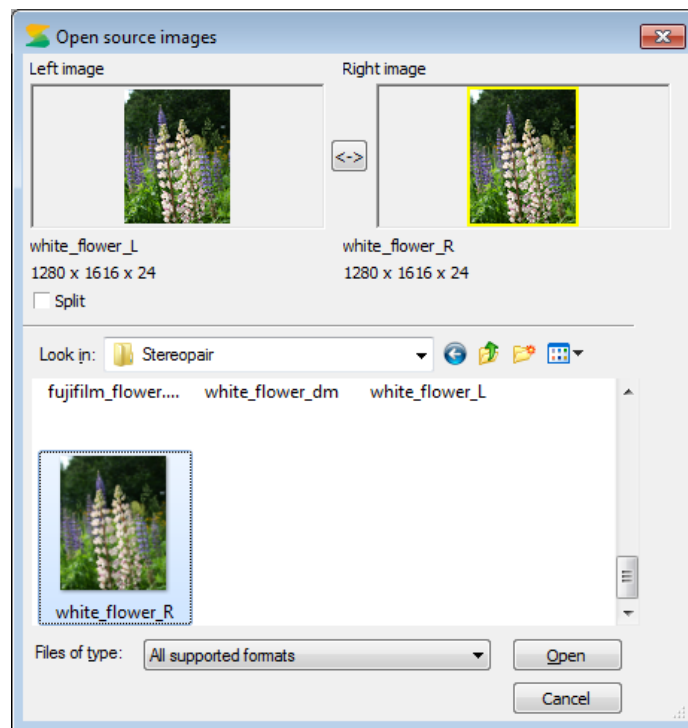


Figure 5.6 **Open source images** dialog

3. **Select outcome** dialog will appear:

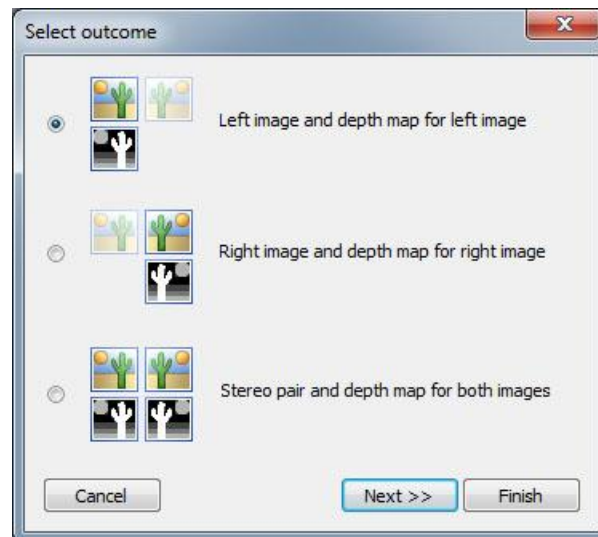


Figure 5.7 **Select outcome** dialog

It's possible to get 3 variants of the outcome, which will be used for multiview series generation:

- the left image and a depth map for the left image
- the right image and a depth map for the right image
- a stereo pair and depth maps for both images

Select the outcome type and press **Next >>**.

4. The left and the right frames of a stereo pair, overlapped upon each other are

represented in the **Matching of images** dialog (Fig. 5.7.). It's possible to carry out matching of images automatically or manually. Use **Auto parallax** button for automatic matching. To match frames manually, use the sliders. Match the left images by the most distant object and the right one by the closest object, thus, to obtain the max sharpness of the object, by which the matching is being done.

Press **Auto align** button to align the frames vertically in the automatic mode. Vertical alignment provides that one and the same object in these frames will be on the same level. This is an obligatory condition of getting better result.

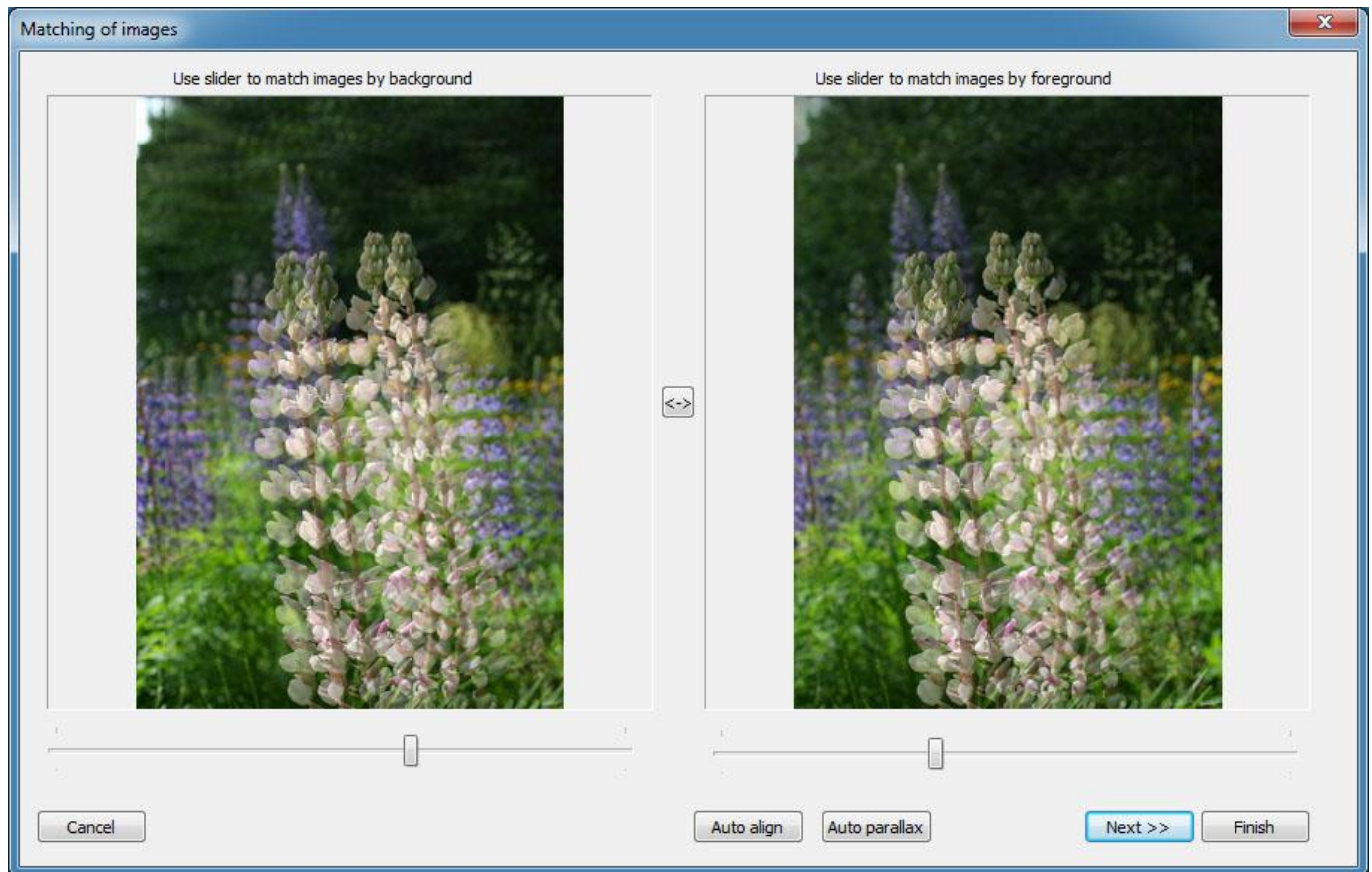


Figure 5.8 **Matching of images** dialog

5. There are 9 different variants of the depth map In the **Select depth map** dialog (Fig. 5.9), from which it is necessary to select the best one (usually it's the central variant). Note, that it's just a preview mode. The quality of depth maps in the preview mode is lower than it will be after the selection.



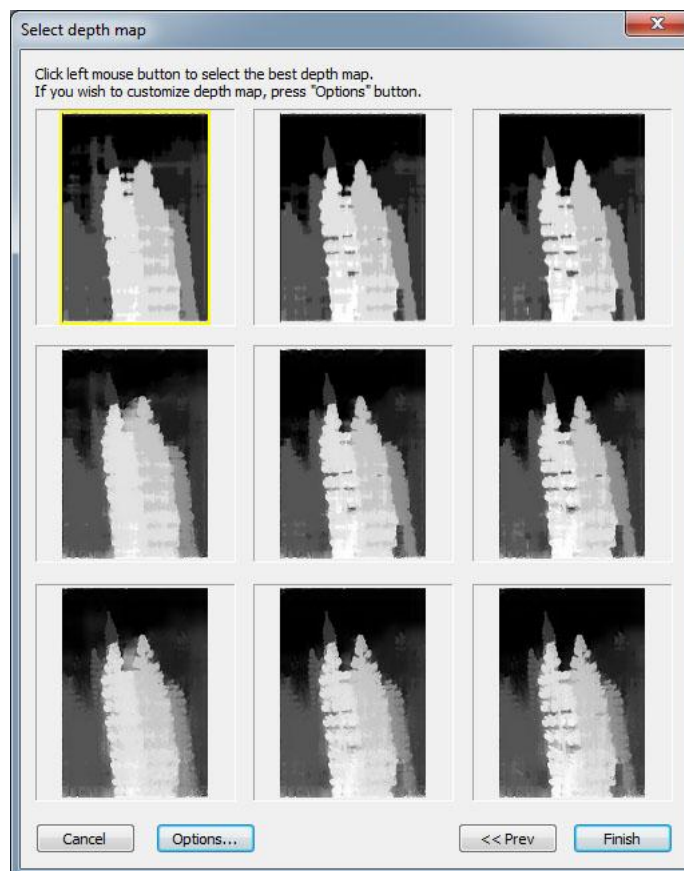


Figure 5.9 **Select depth map** dialog.

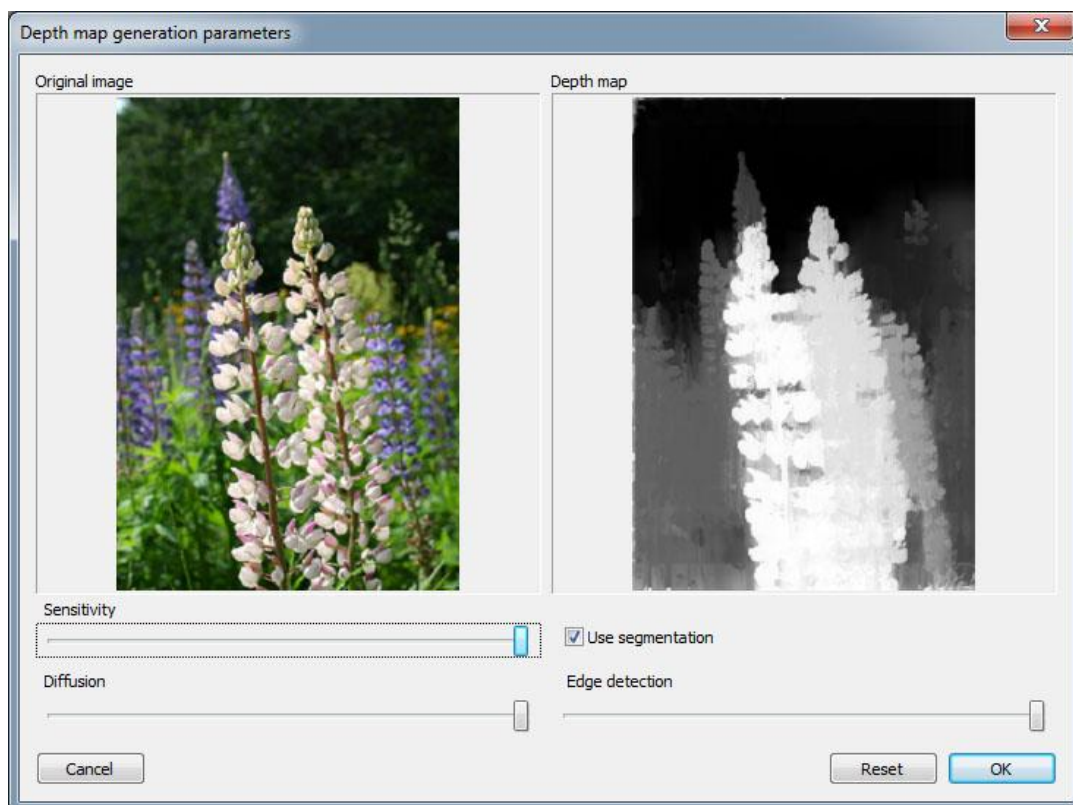


Figure.5.10 **Depth map generation parameters** dialog



It's possible to change depth map generation parameters in **Depth map generation parameters** dialog (Fig 5.10), which opens by pressing the **Options...** button in the **Select depth map** dialog (Fig. 5.9).

6. Press **Next>>** after the variant of a depth map is selected – the process of a depth map generation will start. (Fig. 5.10.).

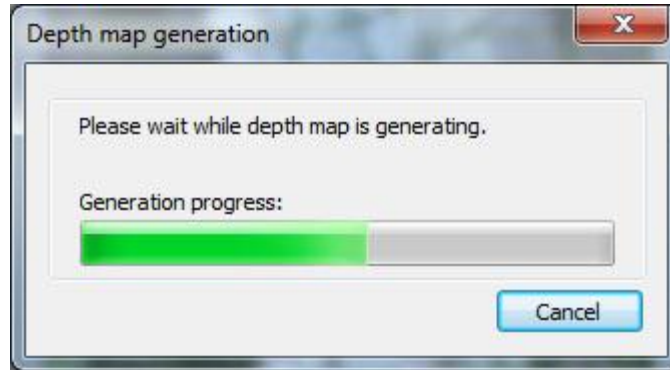


Figure 5.11 Depth map generation progress bar

7. The result, which will be shown in the main window, depends on the outcome variant you've selected in **Select outcome** dialog (Fig. 5.7). In case you select "*left image and depth map for left image*" or "*right image and depth map for right image*" you will see an image (left or right) with the corresponding depth map (Fig. 5.12)

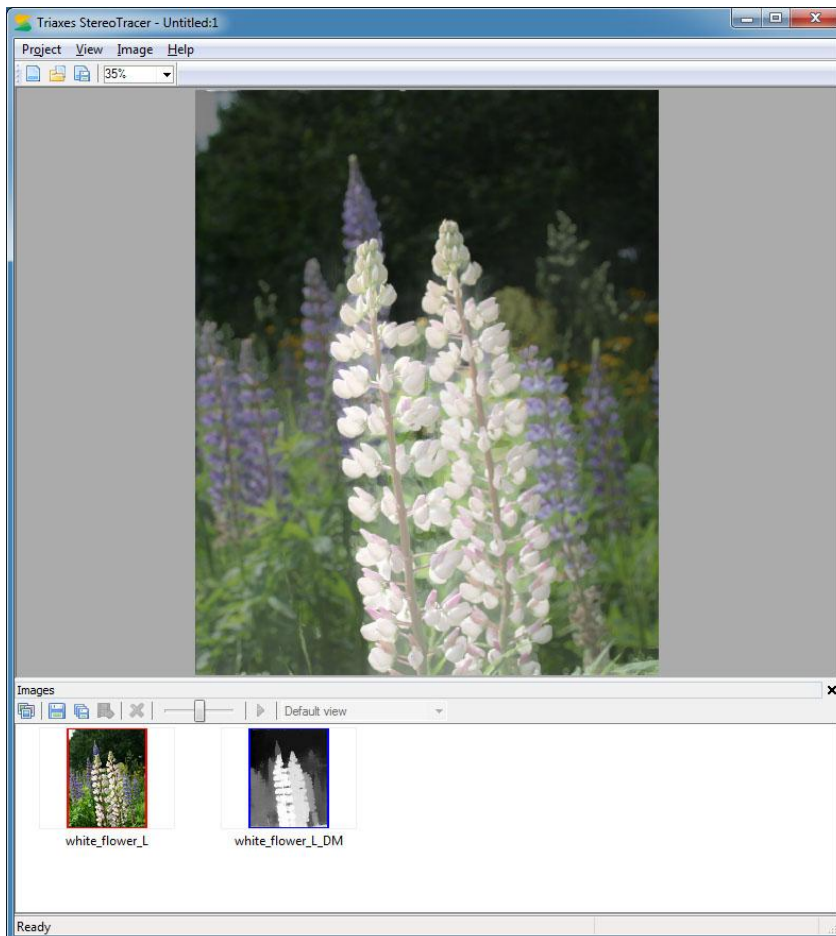


Figure 5.12 Main window

In case you select “*stereo pair and depth maps for both images*” you will see the left image with the left depth map and the right image with the right depth map (Fig. 5.13).

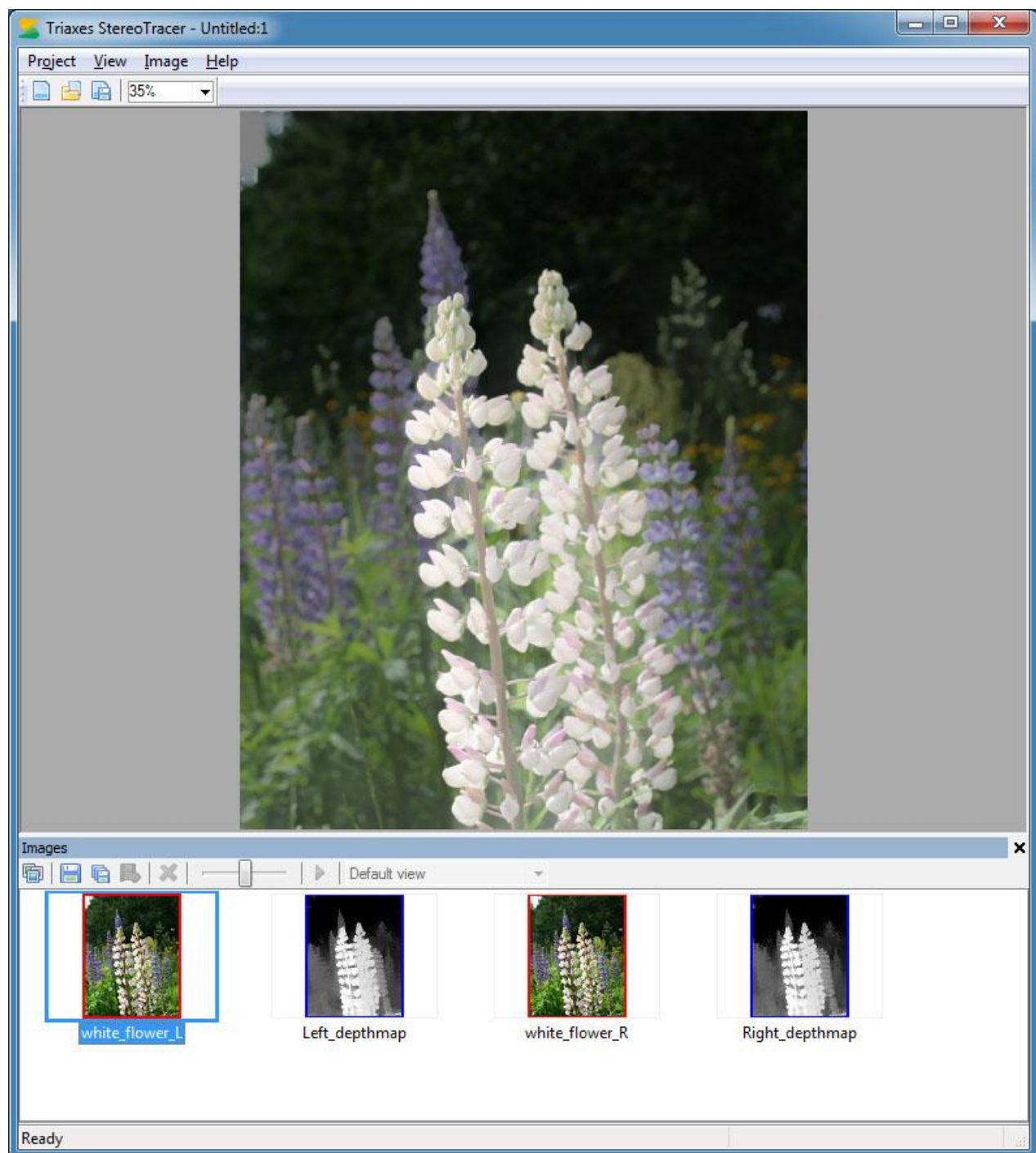


Fig. 5.13 Main window

The left image with the left depth map and the right image with the right depth map are represented sequentially in the **Images** window. Left image and left depth map (or right image and right depth map), overlapped upon each other, are represented in the main window. Use the slider of the **Images** window to compare an image and its depth map.

Now, you can generate a 3D sequence of frames as it was described in section 5.1, steps 4 and 5.

There is the only difference in generation process namely **Frames generation options** dialog. In case you select “*stereo pair and depth maps for both images*” you’ll get:

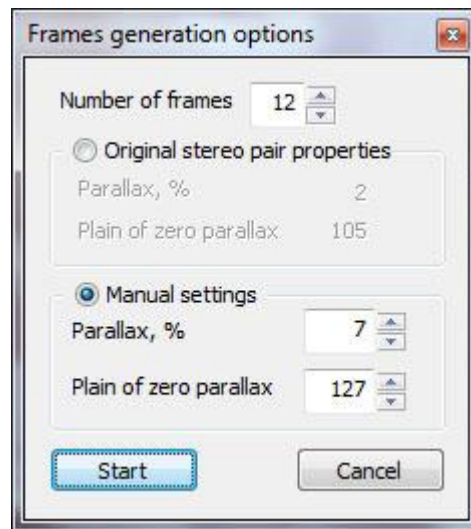


Fig. 5.14 **Frames generation options** dialog in case you select “*stereo pair and depth maps for both images*”

It is possible to set the following parameters of generation:

- 1) **Number of frames** is the number of frames which will be generated.
- 2) Select the set of parameters you will use for generation:
  - **Original stereo pair properties** are parallax and plane of zero parallax values, calculated automatically from the original stereo pair.
  - **Manual settings** are parallax and plane of zero parallax values, you can set manually.

*Parallax* is the value, which characterizes the distance of the object's projections on the plane for the left and right eyes (disparity). It's specified in percentage from canvas width.

Available range: from the *original parallax value* to 25.

Default value: 7.

The bigger value corresponds to the bigger 3D effect, but it should be taken into account that the value bigger than 10 often causes artifacts on the generated images. So, we recommend to use values from 5 to 10.

*Plane of zero parallax* characterizes the placement of the zero parallax plane.

Available range: from 0 to 255.

Default value: 127.

For 255 value the plane of zero parallax (disparity) is situated at the foreground (at the depth map the foreground is colored in white), while the whole image is situated in the depth. For 0 value the plane of zero parallax is situated at the background (colored in black), and all of the image's objects seem to be flying above the paper or screen. Usually the best results can be achieved with the values in the 100-160 range.

### 5.3 Stereo pairs batch processing mode

Batch processing allows to generate GIF or images+depth maps (2D+Z) animation from the several stereo pairs. To launch batch processing go to **Project >> Batch processing** (Fig. 5.15).

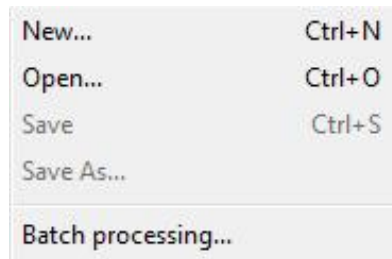


Fig.5.15. Menu – Project – Batch processing

And **Select conversion type** (Fig. 5.16).

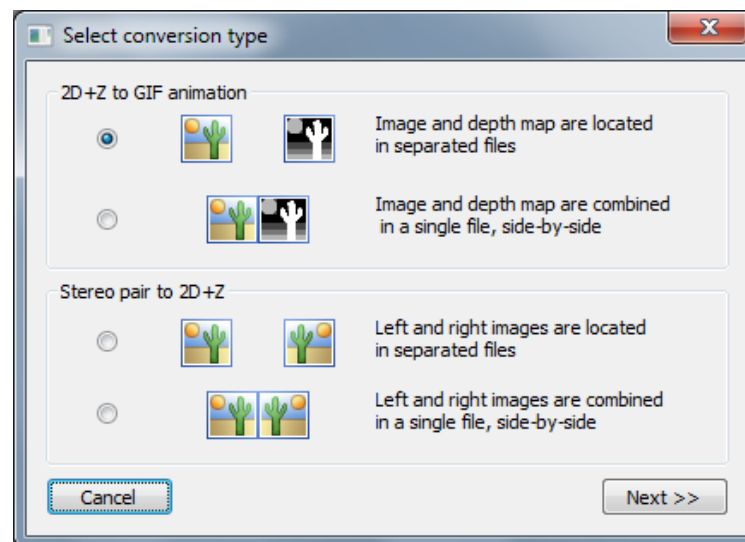


Fig.5.16. **Select conversion type** dialog

Source images for GIF animation could be:

- The original image and the depth map are stored in separate files
- The original image and the depth map stored in one file (side-by-side)

When you select the first option and press **Next** the **Select images** dialog appears (Fig. 5.17).

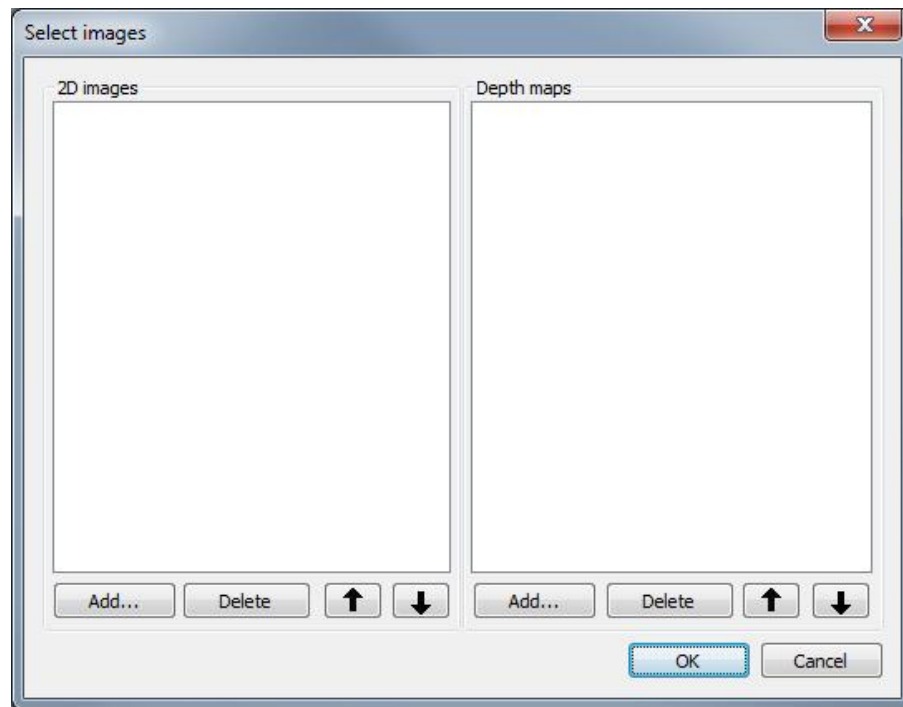


Fig.5.17. Dialog **Select images** for batch processing

Select source images and depth maps by pressing **Add...** (Fig. 5.18).

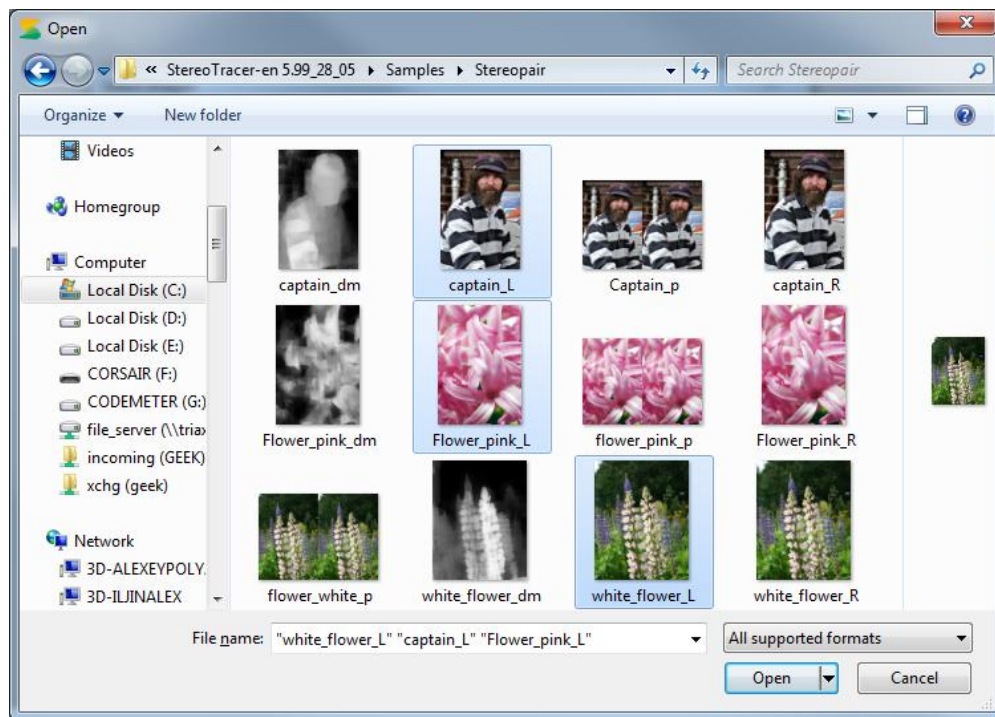


Fig.5.18. **Open** dialog

Selected images are numbered automatically (Fig. 5.19). This order will be used to couple the source image and its depth map (e.g. the first image is used in combination with the first depth map). Check the order and update with “up” and “down” arrows in case it’s wrong. You can delete files that were added occasionally.



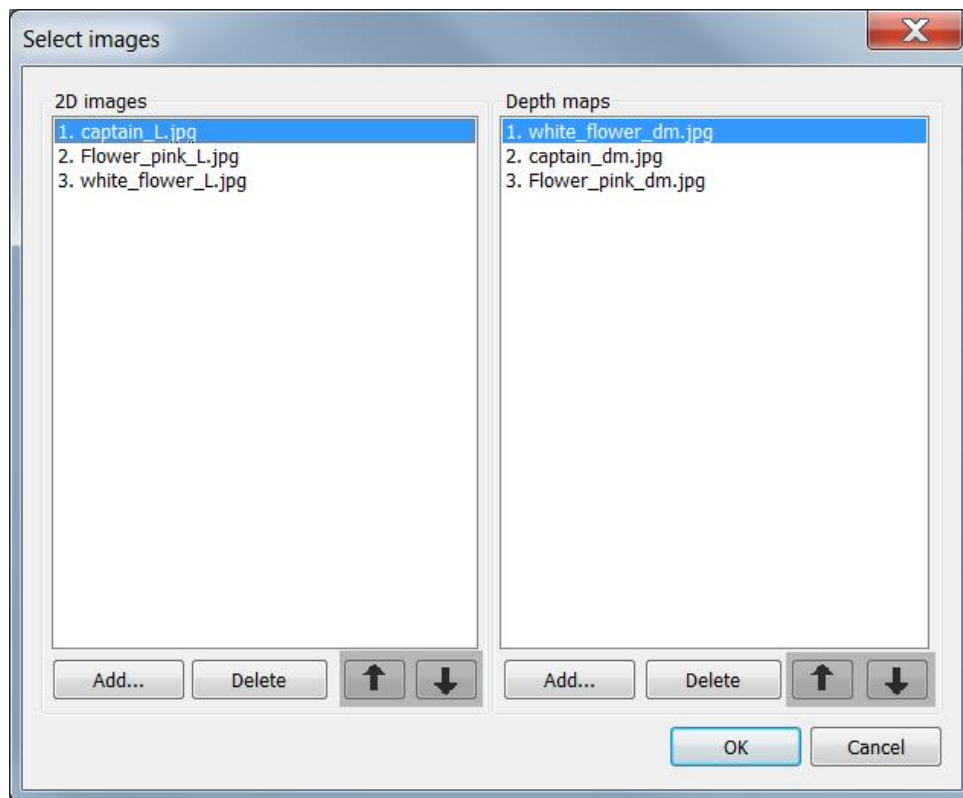


Fig.5.19. Sorting images and depth

Press OK when finished, **Batch animation properties** dialog appears (Fig. 5.20).

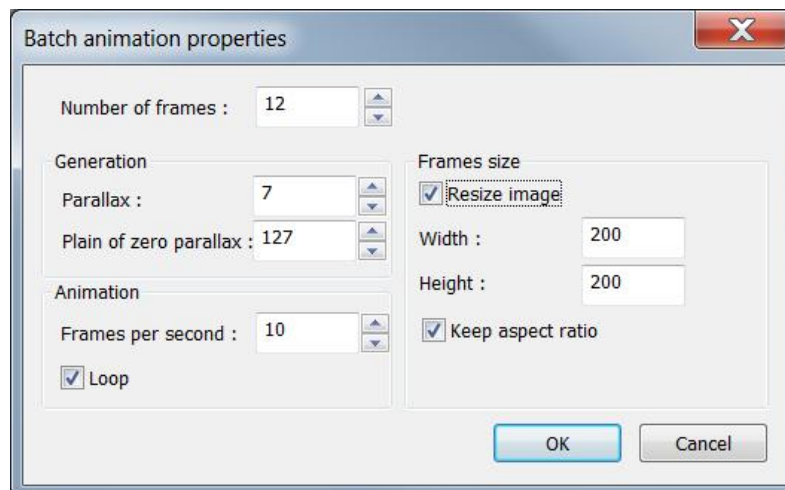


Fig.5.20. **Batch animation properties** dialog

Here you can control the following settings:

- **Number of frames** animation consists of.
- **Parallax** - the first and the last frames difference (shift between them).
- **Plain of zero parallax** - the object with zero parallax is an object “in focus”, i.e. perceived by both eyes equally, without displacement (have no parallax).
- **Frames per second** – animation speed.



- **Loop** –GIF-animation repeat mode.
- **Resize image** – change the source image size (pixels).
- **Keep aspect ratio** - to keep the source image proportions when edit **Width** or **Height** parameter.

Press **OK** to continue. **Browse for folder** dialog appears (Fig. 5.21). Select the path to save your GIF-animation result..

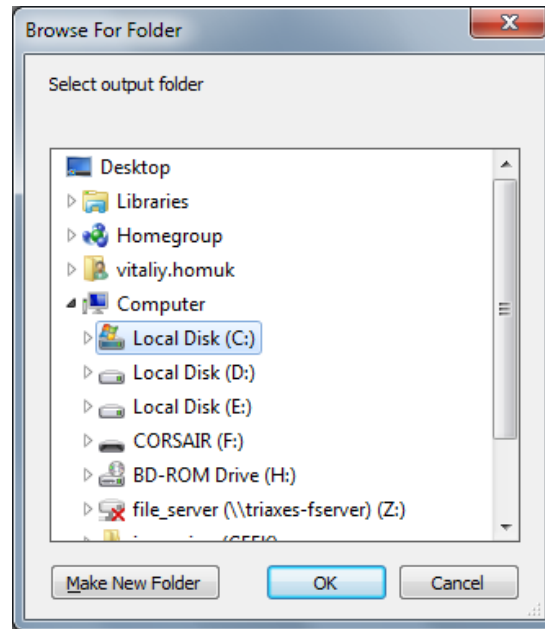


Fig.5.21. **Browse For Folder** dialog

Press **OK** to launch the generation process.

In case you select side-by-side source image for GIF animation (Fig. 5.22), select 2d plus depth side-by-side dialog appears (Fig. 5.23).

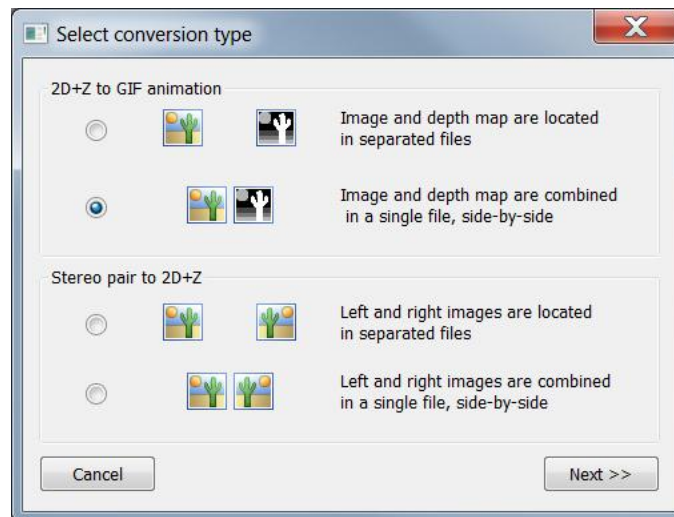


Fig.5.22. Select conversion type dialog

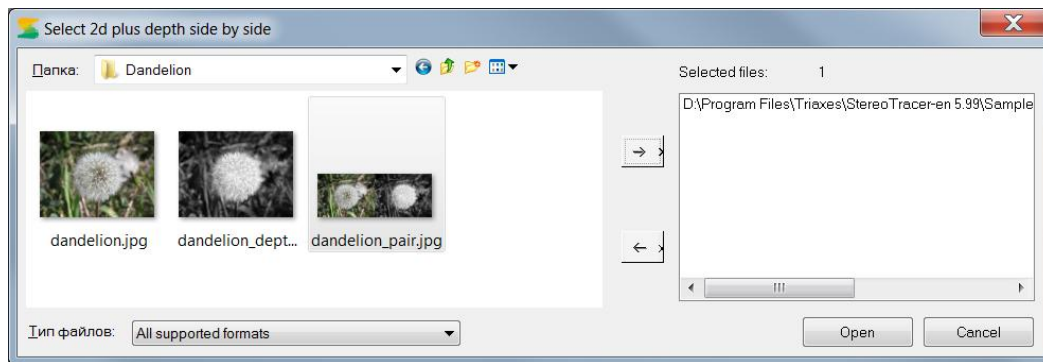


Fig.5.23. **Select 2d plus depth side-by-side** dialog

Then you can adjust **Batch animation properties** and save the result.

When you select stereo pair to 2D+Z conversion type (Fig. 5.24) you follow the same steps as when processing GIF-animation except **Batch animation properties** step (Fig. 5.20). The left image serves as a source image, the right image is used instead of the depth map.

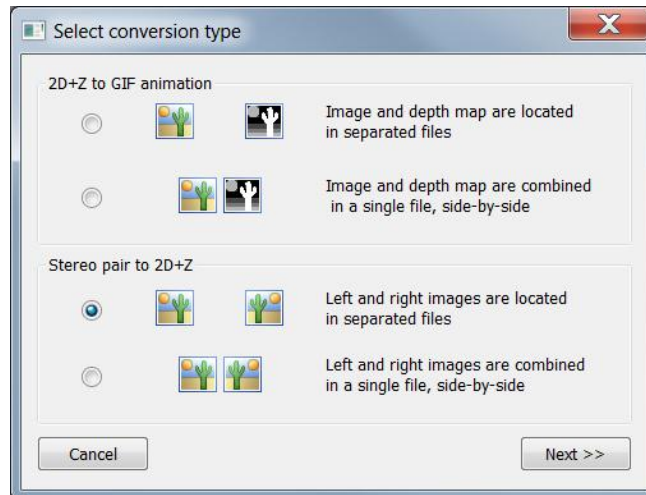


Fig.5.24. **Select conversion type** dialog

In case you select 2D+Z animation out of a stereo pair side-by-side (Fig. 5.25) specify the source stereo pair (Fig. 5.26) and press.

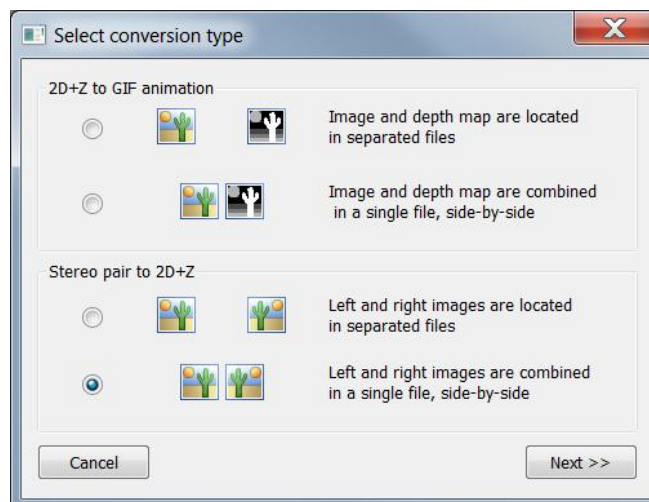


Fig.5.25. **Select conversion type** dialog

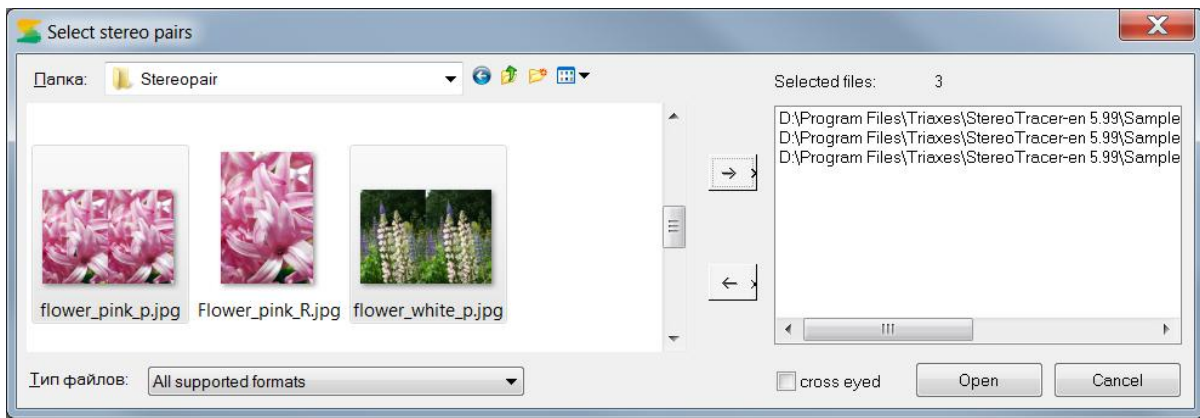


Fig.5.26. **Select stereo pairs** dialog for batch processing

Note! A stereo pair should be in side-by-side format (left and right frames aligned). In case the source stereo pair has the backwards order, mark cross eyed check box.

Side-by-side source image sample is shown on the image below (Fig. 5.27).



Fig.5.27. Side-by-side source stereopair

Press **Open** to continue. **Browse for folder** dialog appears (Fig. 5.28). Specify the path to save your result. The output depthmaps will have the same format as the source images.

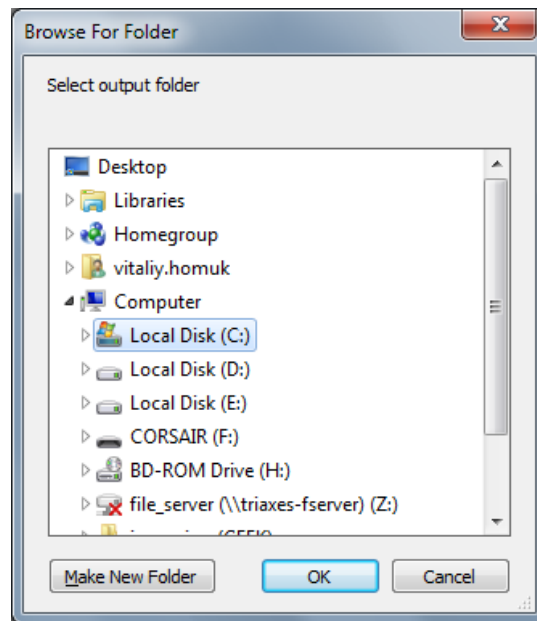


Fig.5.28. **Browse For Folder** dialog

Press **OK** to launch the generation process.

#### 5.4 3D view

**StereoTracer** allows to preview the output with a autostereoscopic display **Dimenco** (Dimenco ASD). To launch it go to **View >> 3D view** (Fig. 5.29).

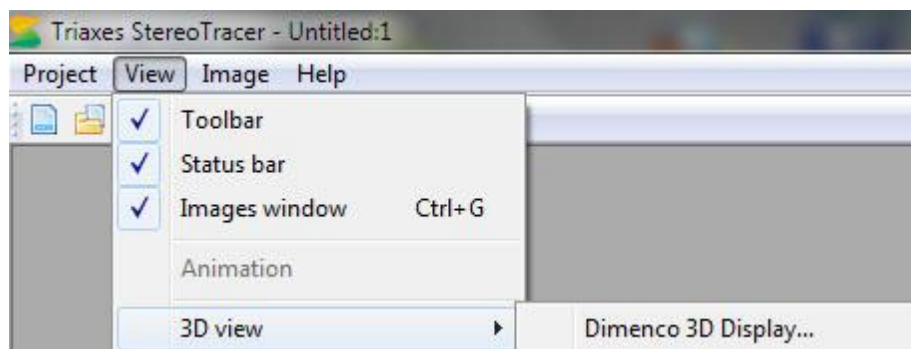


Fig.5.29. Menu >> View >> 3D view

Select **3D view >> Dimenco 3D Display** to launch **Dimenco 3D Display Preview** window (Fig. 5.30). To watch it on your Dimenco ASD drop **Dimenco 3D Display Preview** window to Dimenco display and press **Full screen**.

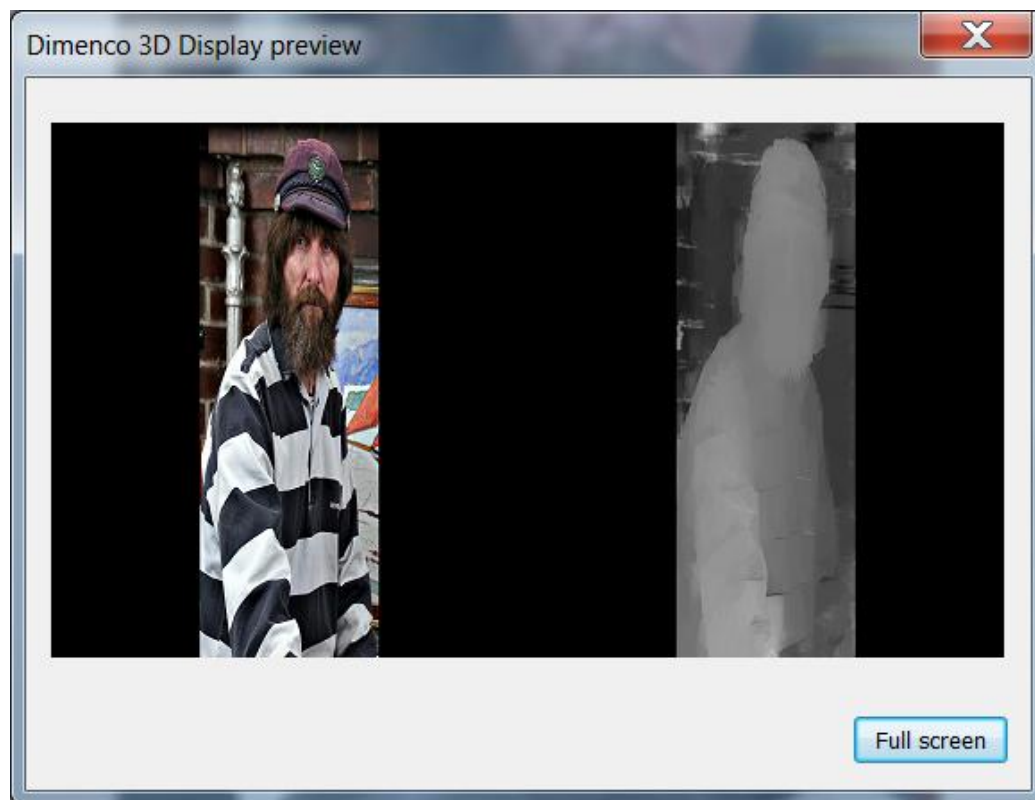


Fig.5.30. **Dimenco 3D Display** preview dialog

## 6. Methods of manual depth map creation

### 6.1 Creating a depth map using conversion to grayscale and blur filter

You can create depth maps by using external graphic editors like Adobe Photoshop or GIMP.

Here is an example of using grayscale and blur filter.

(The files are located here: C:\Program Files\Triaxes\StereoTracer-x.x\samples\Fire)

Convert the original image (Fig. 6.1) from color to grayscale mode and smooth the contours of the objects using graphic editor's tools. A depth map is gotten as a result (Fig. 6.2). Such simple expedients are enough in this case to obtain depth. A depth map is coming out concerning the location of the objects in space, because brighter forks of flame stand out against the dark background.



Figure 6.1 Original image



Figure 6.2 Depth map

A depth map should agree in size with the original image and have the same color model. *For example, if an original image is in RGB, a gray scale image should be converted in RGB before saving.*

There is an anaglyph image, gotten from a pair of generated frames in figure 6.3. In order to see the 3D effect, use anaglyph glasses .



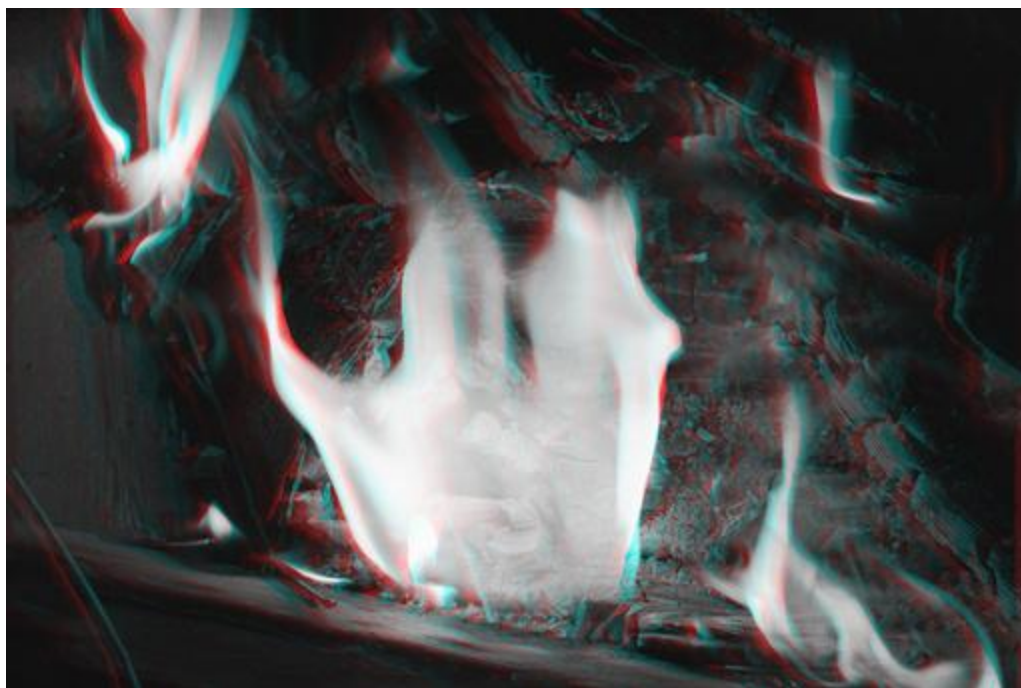


Figure 6.3 Anaglyph image

## 6.2 Creating a depth map using gradient tool and color inversion

When we have a landscape picture with wide distance range - gradient tool is efficient to create a depth map of high quality. Here is an example of making such a depth map in an external graphic editor.

(The files are located here: C:\Program Files\Triaxes\StereoTracer-4.0\samples\Field)

Take the original image.



Figure 6.4 Original image

Create a copy of the original image, select the area till the horizon line and color it using the gradient tool, as it's shown in figure 6.5.

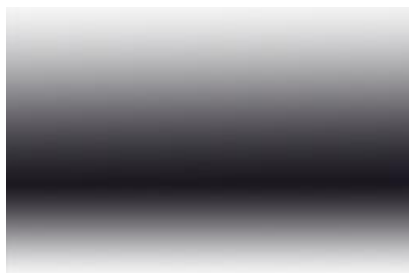


Figure 6.5 Use "Gradient" tool

Create a grayscale copy of the original image and invert the colors. (Fig. 6.6).




Рис.6.6 Use “Inversion” tool

Overlay the inverted grayscale image on the gradient image with 50% transparency (Fig. 6.7).



Figure 6.7 Depth map is gotten by means of “Gradient” and ”Inversion” effects union

The generated 3D color anaglyph image is made by using the depth map in figure 6.8. Use anaglyph glasses  to see 3D.

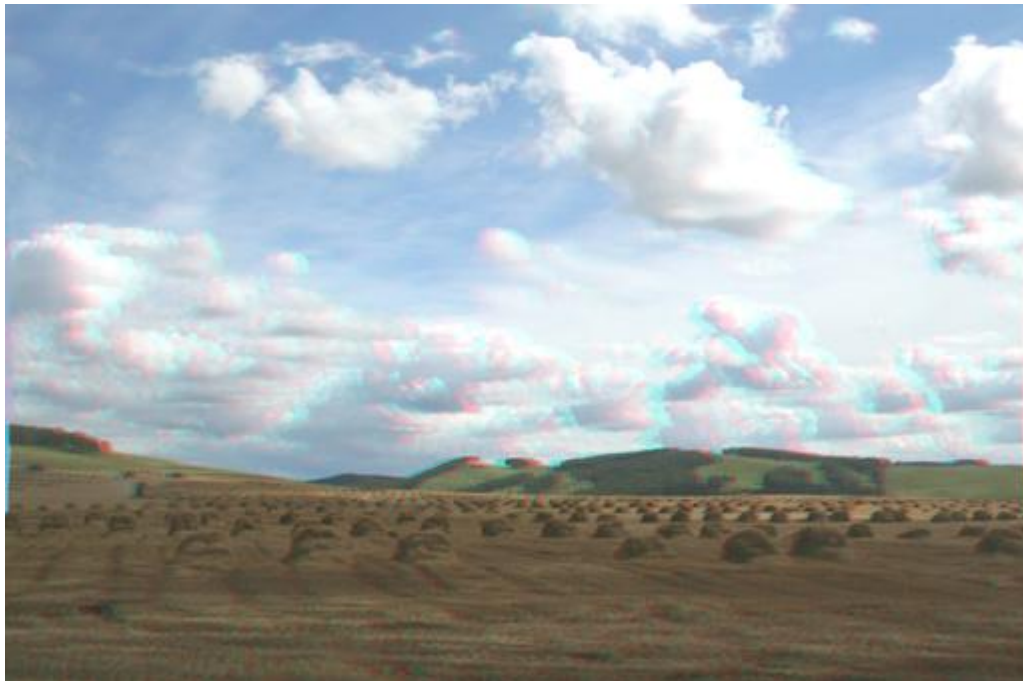


Figure 6.8 Anaglyph image gotten by means of using the depth map

### 6.3 Creating a depth map by means of image conversion into monochrome mode and contrast correction

In cases, foreground objects are brighter than background ones, the image itself may be used as a depth map.

Create a gray scale copy of the source image (Fig. 6.9), apply a **Blur** filter to it, correct brightness and contrast. A depth map is gotten as a result (Fig. 6.10)

(The files are located here: C:\Program Files\Triaxes\StereoTracer-4.0\samples\Dandelion)



Рис.6.9 Source image



Рис.6.10 Depth map

There is a colored anaglyph image, gotten from a pair of generated frames in figure 6.11. In order to see the 3D effect, use anaglyph glasses .



Figure 6.11 Anaglyph image gotten by means of using the depth map

#### 6.4 Additional examples of depth map creation

Additional articles and discussions upon methods of depth maps creation are located at the following addresses:

«**Multiview rendering out of stereo in Triaxes StereoTracer**»

<http://www.3dphoto.net/forum/index.php?topic=1628.0>

«**2D to 3D conversion**»

<http://www.3dphoto.net/forum/index.php?topic=1679.0>

You are welcome to visit the forum and get familiar with StereoTracer user's experience as well as share your own experience!