TRIAXES® LEGEND™

LENTICULAR IMAGE GENERATOR FOR PRINTING DIRECTLY ONTO A LENS

USER GUIDE

1. Preface

1.1 **Triaxes Legend** Mission

Triaxes Legend encodes stereo images to be viewed by a number of various viewing methods. The encoding means "cutting" frames into thin stripes and mixing them in such a way that a pair of stripes is located under each lens: one from the first image and the other from the second one.

Triaxes Legend generates images for direct printing onto a lenticular lens. 3D images produced with this method can be viewed without special glasses or any additional devices.

The program allows you to produce lenticular images with various dynamic effects: flip, motion, morphing, zoom.

Besides, you can use the program to create a sequence of frames out of a single source image and a multilayer template.

The general procedure of creating stereo images of any type includes several steps:

● opening the sequence of frames

● adjusting their relative positions and cropping

● specifying parameters and generating a stereo image

● printing an image.

The program also allows you to apply various additional design elements (logos, frames, labels, etc) onto final encoded images.

1.2 **Triaxes Legend** Editions

Editions	Print 45	Print 90	Print 180	Pro
Number of frames	256	256	256	256
LPI	10-150	10-150	10-150	10-150
Max length of the biggest side, cm	45	90	180	3600
Resolution of generated images (PPI)	7200	7200	7200	7200
Image partitioning and encoding part by part				
Transparency support				
Mirroring				
Positioning frame				
Hardware key for software protection				

The information about new versions is published on the www.triaxes.com and sent to Triaxes news subscribers.

Effects	Frames series creation
Layered 3D	
Layered 3D with depth map for each layer	**Any graphical editor**
Flip	
Multiview 3D	**Multiview shooting and 3D modeling software** **Stereo pair-to-2D+Z or 2D+Z-to-N-view is performed by [Triaxes StereoTracer](#)**
Animation	**Cutting frames from video or graphic editors**
Fade	**Frames series are created by morphing software**
Morphing	
Additional info	
Tech support	**Free technical support by phone, email or skype**
Updates	**Free updates during a year after purchasing**

1.3   System requirements

IBM – compatible PC.

Operating system: Windows XP/Vista/7/8 (Windows 7/8 is recommended)

RAM: 1 Gb (preferably 2 Gb and more).

Free disk space: 150 Mb for software installation. When working with the large images (large data volume), additional space will be required for allocating service files and images created during work with the software.

1.4   32 or 64-bit?

We have 32-bit and 64-bit **Triaxes Legend software** versions. The main advantage of the 64-bit version is an opportunity to use more than 3 Gb of RAM compared to a 32-bit system, which assigns only 2 of 3 Gb for applications work. There can be not enough RAM to process up all frames.

1.5 **Triaxes Legend** demo version

Demo version of **Triaxes Legend** has the following limitations:

- Generated images have a semi-transparent watermark: "**Triaxes Legend** DEMO www.triaxes.com".

- It is prohibited to sell **Triaxes Legend** demo-version to distribute it as a part of any other software product without written consent of copyright holders.

> **Note**: In accordance with the **Triaxes Legend** license agreement, demo version may be used without time limitations.

1.6 **Triaxes Legend** activation

It is necessary to activate **Triaxes Legend** program in order to use it in a full functional mode. It allows you to get technical support and information about updates. One should get a Dongle (USB key) after the software purchase to activate the software. Until activated, the program will run in a demo mode.

To perform activation, do the following steps:

1. Plug a (hardware protection key in a USB port.

2. Run the software.

3. Run the command **Help >> Activation**.

4. In the Activation dialog click **Open key…** and select txt activation file received from the software vendor after purchasing.
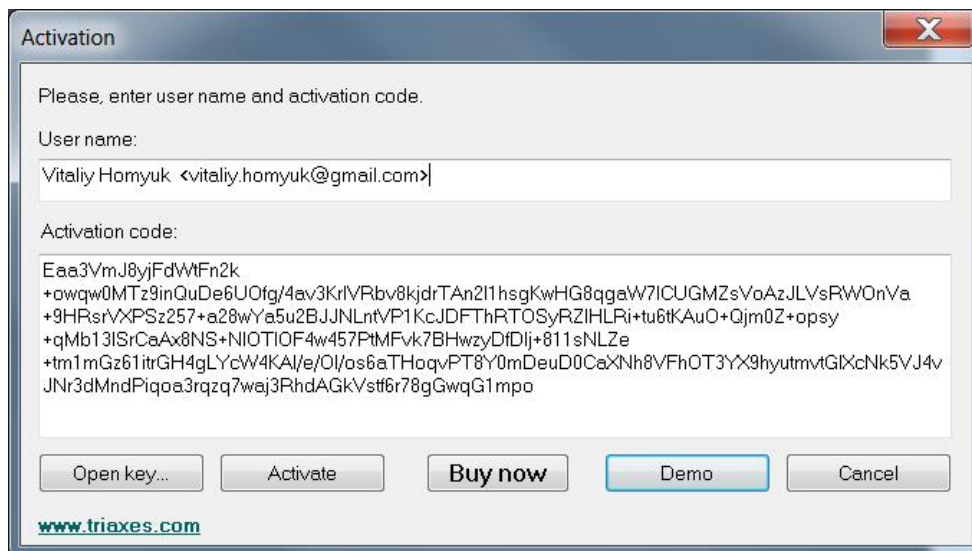
5. Press **Activate** to complete the process.

Fig.1.1. **Activation** dialog

After activation is completed the **About Legend** dialog (**Help >> About**) will display the user information.
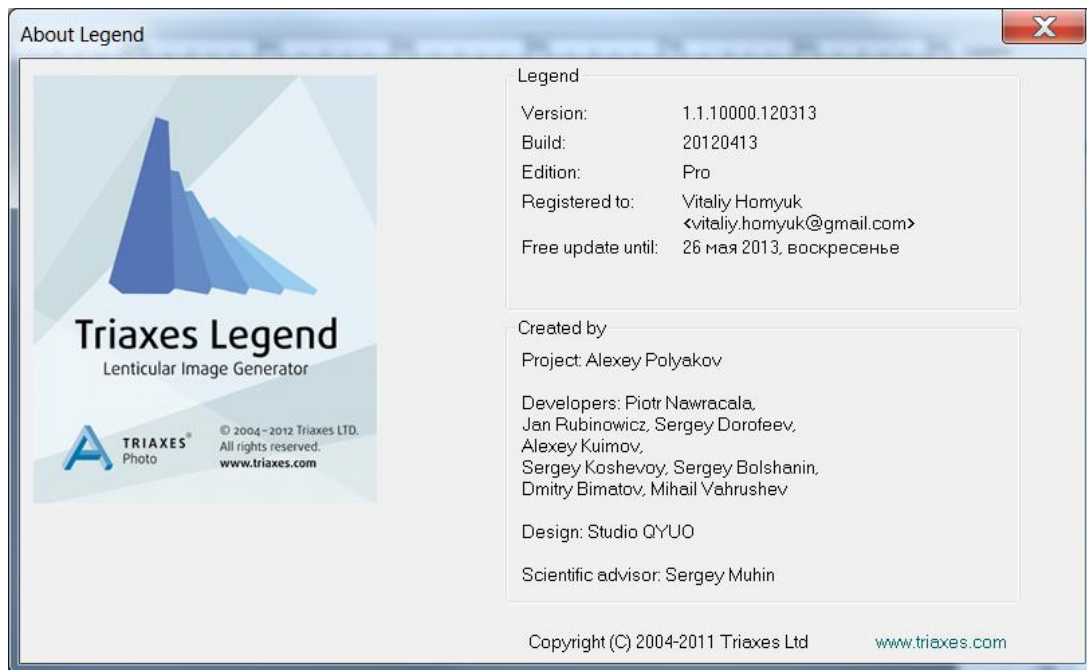
Fig.1.2. **About Legend** dialog

1.7 **Triaxes Legend** program update & upgrade policy

Free updates of all **Triaxes Legend** editions are available during the year from the purchase date. The update subscription is just the 10% of price. To upgrade to higher edition just cover the current price difference. Contact sales@triaxes.com for further information.

1.8 Technical support

Please contact your supplier for technical support questions. Besides, there is an opportunity to get help by contacting support@triaxes.com. When addressing your technical request, please specify your activation user name, hardware key serial number, and program edition or just attach your txt activation file.

The web-site http://triaxes.com contains news on the **Triaxes Legend** software and updates to download. It also provides useful articles on the theory of stereo-lenticular technology and **Triaxes Legend** operation, distributors and lenticular materials suppliers contact info, as well as answers to frequently asked questions (FAQ).

Contacts:

E-mail: mailto:info@triaxes.com

Skype: triaxes

Address: 634055, 3 Razvitiya Ave., Tomsk, Russia

Tel: +7 (3822) 701429

When submitting your request, please indicate the following:

1) Your name

2) Your e-mail

3) Your phone number

4) The distributor you purchased **Triaxes Legend** software from

5) The purchase date of **Triaxes Legend** software

2. Triaxes Legend Use
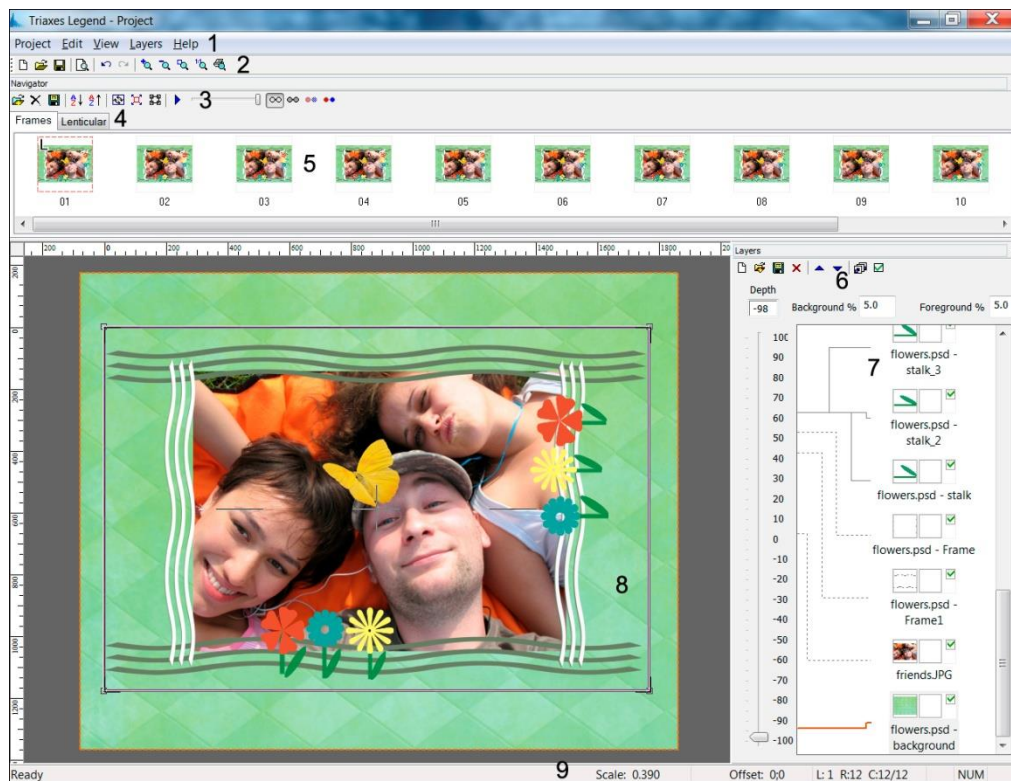
2.1 Triaxes Legend Main Window

Fig.2.1. General view of the program

1 – Menu line

2 – Main toolbar

3 – Toolbar

4 – Tabs of the Navigator window

5 – Sequence of frames

6 – Layers window

7 – Layers list

8 – Image display area (working area)

9 – Status bar

Detailed description of elements is provided below.

2.2 Navigator window

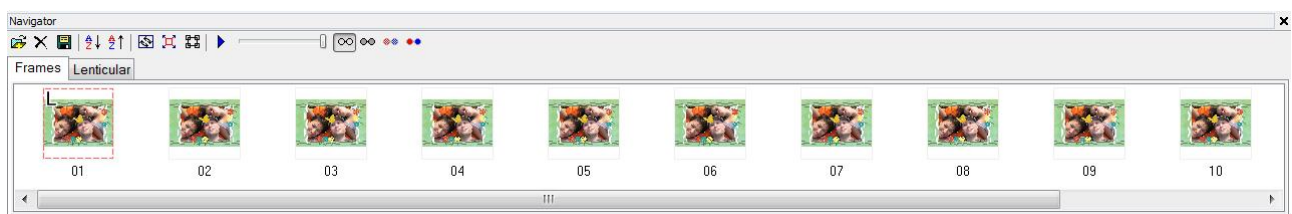The **Navigator** window is to control projects and create images of various types.

Fig.2.2. **Navigator** window

Navigator window is located at the upper part of the **Triaxes Legend** window and contains the following tabs:

● **Frames** tab is used to manage source images

Image miniatures are displayed as the list here when downloading sequence of frames into a project or generating series of frames out of a layers set.

● **Lenticular** tab is used to manage parameters of lenticular encoding

In the upper part of the **Navigator** window there is an additional toolbar to manage viewing modes and source frames sorting.

You can either show or hide the **Navigator** window using the **View >> Navigator window** in the menu or with the hotkeys **Ctrl+G.**.

Note: working with lists in Triaxes Legend program is similar to working with Windows lists – for mouse group selection use Shift key, for mouse direct selection use Ctrl key.

Useful tip: to "play" frames in turn in order to define perspective of a scene or flip effect, do the following:

1. Set the far right image as *Right frame*. Click the right mouse button on them and choose **Set right**.

2. Move slider to the right to make visible only the image marked as *Right frame*.

3. Press **Ctrl + left/right** arrow buttons to toggle current image in the frames list.

As a result the frames will be displayed in turn in the main program window. That tool is very useful to manage the movement speed and direction manually.

You can also play the sequence of source frames using the **Animation** button.

Fig.2.3. **Animation** button in the toolbar

2.3   **Layers** window

The **Layers** window is used to produce multilayer stereo images as well as to put generated images (logos, frames, labels, etc.) on layers.
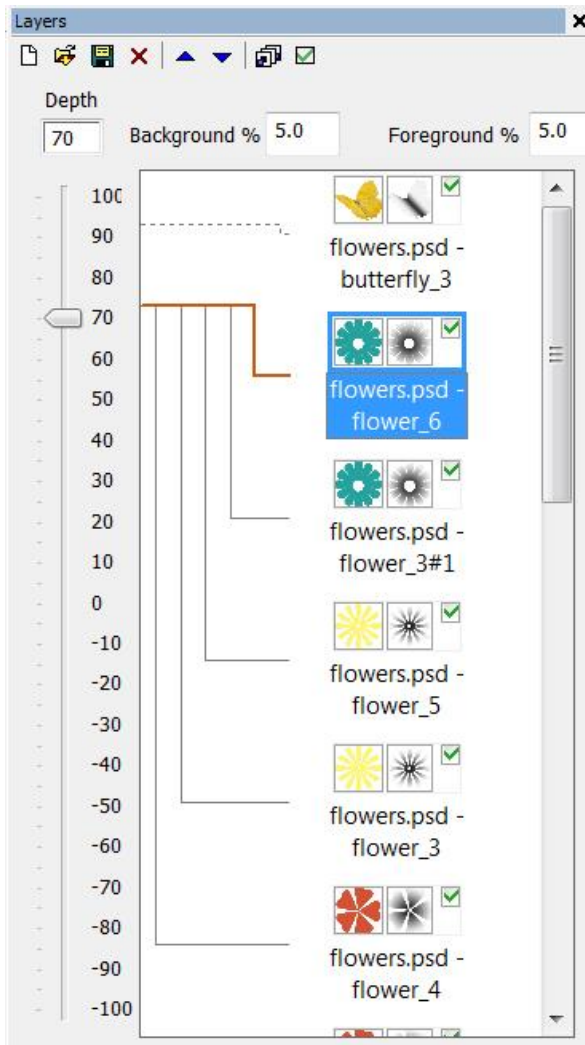

Fig.2.4. **Layers** window

Toolbar buttons:

□ - Clear layers list

Menu command: **Layers >> Clear**

🗁 - Add a layer (or several layers)

Menu command: **Layers >> Add**

💾 - Save all layers in a .psd file

Menu command: **Layers >> Save**

✕ - Delete the current (selected) layer

Menu command: **Layers >> Delete**

▲ - Move the current (selected) layer up

Menu command: **Layers >> Up**

▼ - Move the current (selected) layer down

Menu command: **Layers >> Down**

🗗 - Generate a multilayer stereo image

Menu command: **Layers >> Generate multilayer stereo (Alt+G)**

☑ - Hide or show all visible layers

Menu command: **Layers >> Set Visible/Invisible**

A tick mark ☑ on the right side of the layer image means the image of that layer will be put on the encoded image.

A tick mark ☑ in the tool bar of the **Layers** window is to hide or show all layers at once.

Background and foreground parallax

Relative depth scale of a layer

Layer depth map

2.4   Lenticular images generation

Triaxes Legend software allows to generate images for printing directly on the lens.

To create such kind of images follow the steps:

1. Create a new project or open an existing one.

2. Add a multi-view sequence of frames into the project. Locate the frames in the list in a shooting order from left to right.
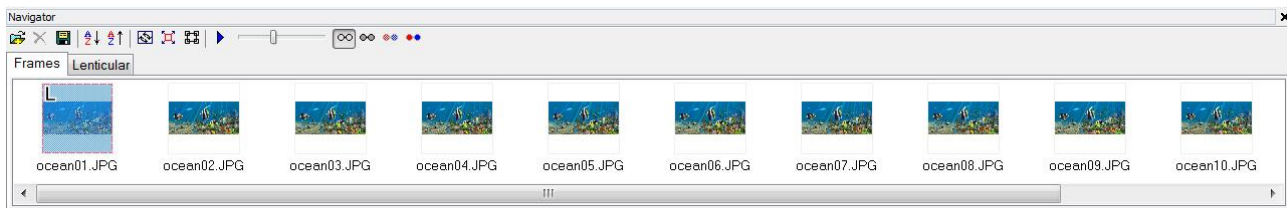

Fig.2.5. Navigator window: the sequence of frames

3. Using the right mouse button click, set the most left frame as the *Left frame* and the most right as the *Right frame*. Match the *Left frame* with the *Right frame* by the object, which will be located in zero parallax plane. Then run **Edit >> Automove** menu command. As the result, all the in-between frames will be aligned. As an option please select all the rest frames (make them *Active*) to make the final vertical and horizontal adjustment as well as zero parallax point adjustment, if it is necessary.

4. In case it is necessary to use not all images of the uploaded series, for example in order to decrease parallax of a scene, you can select the necessary sequence of frames by setting the extreme frames of the sequence as *Left* and *Right* ones.

5. Crop images the way you like using **Crop rect**.

6. Switch to the **Lenticular** tab on the **Navigator** window. Set the parameters of the lenticular material and print size then click **Generate**.

7. Generated (interlaced) image can be either printed or saved to a file.

> **Useful tip:** The program has a feature of saving to a file simultaneously with generating. It is convenient when creating lenticular images of large sizes. **To file** option allows you to significantly speed up the generating process. In case there is not enough RAM to display the lenticular image on the screen, you can still create it saving to file. The image is generated either to a .psd file (with the support of CMYK color model) or to Windows bitmap .bmp format.

The project can be saved as an .mtp file. All changed settings will be saved in the project.
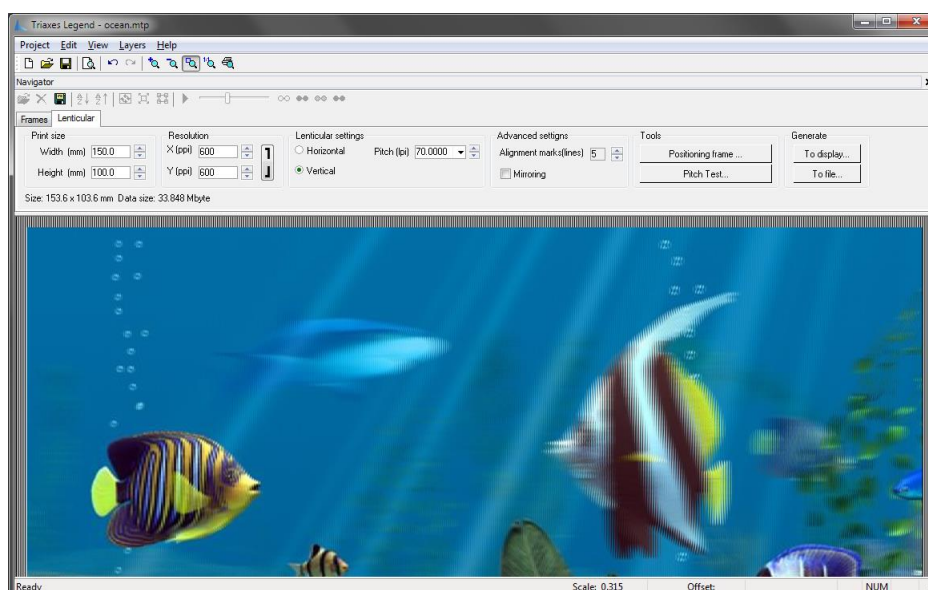
Encode parameters

The **Width** and **Height** parameters specify the output print size (in mm). When you change the size, the image proportions are retained. You can change proportions by cropping the image using **Crop rect** (**Frames** tab).

The **Resolution** parameter defines the resolution of the encoded image in **ppi** (pixels per inch). In most cases it is recommended to set the resolution equal to the resolution of the printer in ppi.

> **Note:** printing resolutions are indicated in dpi (dots per inch). Values, which are specified by printer manufacturers, can be up to 5440 dpi and more. However, it is necessary to distinguish dpi resolution from ppi resolution.

When processing in the program, digital image resolution is measured in ppi. When an image is printed, every pixel is represented by several color dots. That's why the printing resolution in dpi is higher than digital image resolution in ppi. At the same time, the printer driver processes images with the resolution defined in ppi. For Epson printers this resolution usually constitutes 720 ppi, for Canon printer - 600 ppi. Use Preview mode to find out printing resolution in ppi.

Before printing an image, the program by the request of the printer driver sets the image to the resolution (in ppi) which the driver is capable to process. So if you create an image for printing, you are advised to use the printer resolution in ppi. It would save both the generation time and the required memory size.

> **Note:** The **Resolution** parameter has a direct influence on information transmission from the initial frame sequence to the encoded image.

You should take into account that the higher the value of this parameter is the larger the encoded image will be (in bytes) and the longer it will take to encode it. On the other hand, small values set for this parameter will cause a quality loss of the output image.

The minimal number of source frames can be calculated in the following way:

N = Resolution / Pitch

Where **N** is the number of frames and **Pitch** is the pitch measured in lenses per inch (lpi). For example, if Resolution equals 720 ppi and the pitch is 60 lpi (Pitch=60), then N is 12. So it is better to use at least 12 source images to create 3D with this material.

The **Alignment marks** parameter adds a special border to the encoded image. This border will help you to align the lenses and the encoded stripes on the image when performing attachment. Adding the marks increases the size of the image.

Fig.2.7. **Alignment marks** for the encoded image

Image encoding can be performed for a lenticular screen with either horizontal or vertical lenses orientation. The orientation of lenses is set in the **Horizontal/Vertical** option. You should set vertical lens orientation for stereo images (in respect to the horizon line). Dynamic images (flip, morph, etc.) can have any lens direction; however, most typically horizontal lens orientation is used. The **Pitch** parameter defines the width of the lens base. This value is specified in lpi (lenses per inch). You can select the value from the drop-down list or type it using the keyboard.

> **Useful tip:** Sometimes when lenticular screen is imposed on the printed image the color *moire effect* occurs (periodical stripes running over the image). This effect appears due to the interference of the lenticular lens with the color dots of the image. The effect occurs when using printers with regular method of color dot formation. To reduce the *moire effect*, sometimes it is useful to rotate the image before printing. Rotation angle is defined in the following way: you must apply a lenticular screen onto the printed image and rotate it until the *moire* disappears. This angle can be measured with protractor or using mathematical formulas (arcsin, arctg etc.). The rotation of the image to the appropriate angle during printing should prevent color *moire effect.*

Rotate with the Rotate dialog.

Menu command: Edit >> Transform >> Rotate Precise

Hot keys: Ctrl+Alt+R

Toolbar button:

Attention: To get a high quality lenticular image you have to perform a pitch test prior to encoding in order to correct the encoding pitch.

Pitch test

The pitch of the lenticular screen has to precisely match the width of encoded stripes in the image.

The pitch test is conducted once for every type of printer, for every type of paper, for every type of printer settings and for every type of lens.
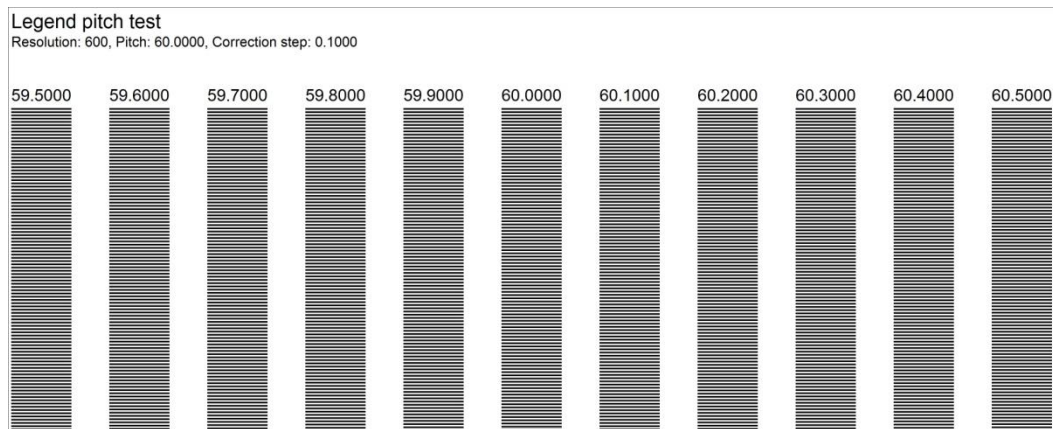

Fig.2.8. **Lenticular pitch-test**

To generate a pitch test switch to **Lenticular** tab of **Navigator** window and press **Pitch test…** button - **Pitch test** dialog appears as shown below. Specify the necessary parameters and press **Generate** (to display) or **To file**.

Fig.2.9. **Pitch test** generation dialog

The value of the tested pitch is set in the Pitch field and is specified in lenses per inch (lpi).

The distance between lines in each stripe can be specified in the **Test Step** field. The step value of 0.1 is tested firstly. The test stripe (vertical column), which more precisely and sharply switches between colors of the background and code stripes (short horizontal stripes forming the test stripe) shows proper lpi value. After that a qualifying pitch test is performed with the step of 0.01 lpi.

Use the **Resolution** field to specify the printer resolution (in ppi). It is recommended to enter the resolution which will be used to encode the lenticular image.

Besides, you can set the length and width of the stripe, the quantity of stripes and the distance between them, orientation (horizontal or vertical), printer resolution as well as the background color and lines constituting the stripes.

Frame checkbox allows the lenticular screen to be applied correctly to the printed pitch test. A pixel-wide frame is placed around the pitch test, which allows it to be aligned with the lenticular screen appropriately. To perform this, apply lens to pitch test in such a way so as to view black frame at a certain angle throughout one lens along the full length.

Click **Select printer** to choose one of the installed printers in the system. The printer name and its resolution (pixels per inch) appear above the button.

By clicking **To File** you can save the generated pitch-test into a file.

File size field will indicate the generated file size (raster data) or prompt an error message in case of an input error:
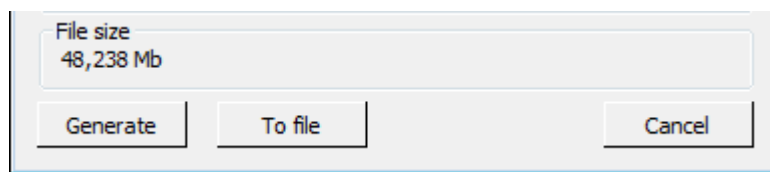

Fig.2.10. **File size** field in the **Pitch-test** generation dialog

Pitch test is generated in three modes: **Standard, Thin,** and **Custom**.

Standard mode generates two lines of 1:1 size for every lens. The color can be set by double -clicking on the line's images or on a chosen line and clicking **Change Color.**

Thin mode generates two stripes of 1:N size, where N depends on **Resolution/Pitch** ratio. The mode is very convenient to ascertain the real printer resolution. It allows you to define the visibility of every single frame.

Custom mode provides complete freedom to the **Triaxes Legend** user in terms of settings choice: one can adjust the number of lines and their color, etc.

The lines number can be typed in directly in **Lines number** field or changed with **Add** and **Remove** buttons.

To find the best pitch for lenticular encoding you have to:

1) Apply lenticular material to the test sheet (with the smooth side) so that the strokes of test stripes match the lenses

2) Look at the lenticular image so that the view direction is perpendicular to the lens orientation. The optimal distance from which the item is observed is 30-50 cm for images of 10-30 cm width and 1 m – for large width interior design items)

3) Altering the observation angle (moving forward and backward in respect to the lenticular image), identify the code stripe which changes its color simultaneously along its full length. Use the pitch period of this stripe when encoding the image (enter the pitch value into the **Pitch** field).
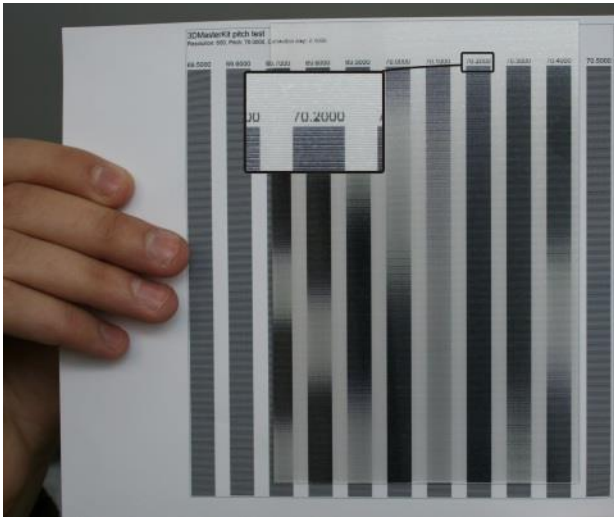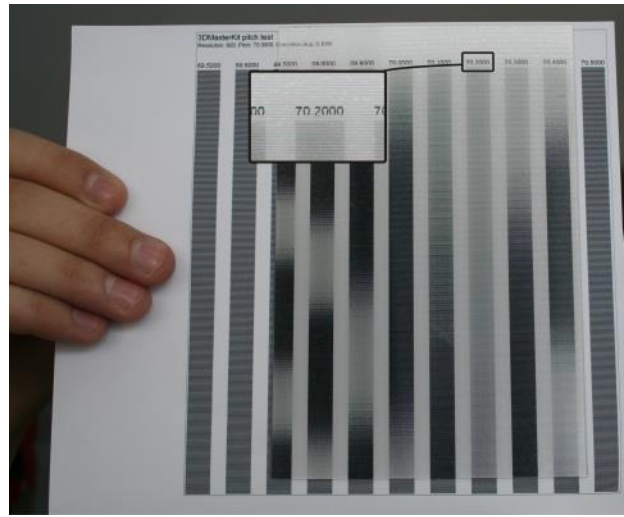
A   B

Photos A and B show the identification of the proper pitch for the 70 LPI lenticular lens. The optimal value is determined as 70.2 LPI.

Positioning frame

It's necessary to position the lenticular lens properly on the printing table before printing. To do so generate the positioning frame and print it on the printing table.
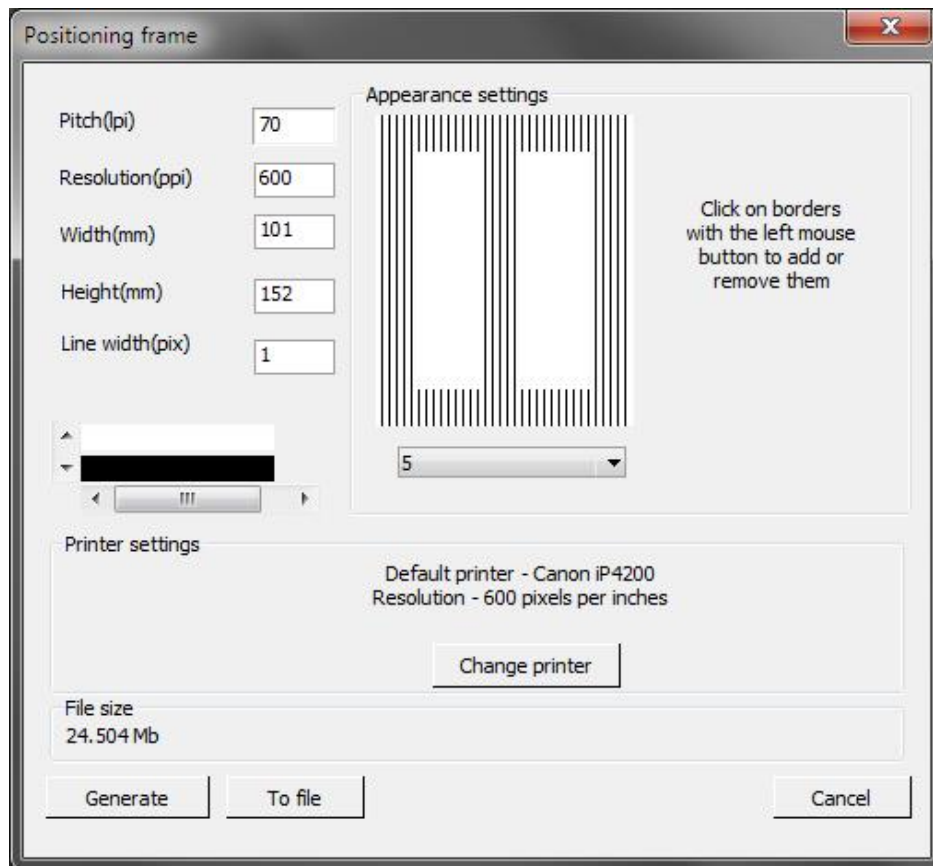

Fig.2.11a. **Positioning frame**

Here you should specify the precise lpi value of the lens you use (make a <ins>pitch test</ins> to get this value), resolution of you printer in ppi (pixels per inch), width and height of the frame (it's recommended to use the image size), width of lines (in pixels), color of the lines

(black or white for white or black printing tables correspondingly). It's also necessary to adjust the appearance of the frame by choosing the number of border lines and adding or removing the borders (up and down, on each side and on center). To add or remove the borders left-click on borders in the frame preview block.

3. Basic operations

This section describes basic operations performed in **Triaxes Legend**.

3.1 Work with a project

Triaxes Legend creates a stereo image from a set of frames for various kinds of viewing.

A combination of settings (links between the files of source images, the method of images alignment and their relative orientation, as well as encoding parameters) is called **Triaxes Legend** project.

Triaxes Legend project can be saved to a file, which can be opened later to continue working with. The extension of **Triaxes Legend** project files is .mtp.

> **Note:** only program settings and links between source images are saved in **Triaxes Legend** project. The source images themselves are neither saved nor modified in any way.

Paths to source images files are saved according to the location of the project file. That is why when you move (or copy) a project file to a new location on the disk, you should also move its source images.

It is convenient to store source images and project files together in the same directory (folder).

Create a new project

Menu command: **Project >> New Project**

Hot keys: **Ctrl+N**

Toolbar button:

Save a project

Menu command: **Project >> Save Project**

Hot keys: **Ctrl+S**

Toolbar button:

Open a project

Menu command: **Project >> Open Project**

Hot keys: **Ctrl+O**

Toolbar button:

Opens the project saved previously.

Add frames into a project

Menu command: **Project >> Add frames**

Hot keys: **Alt+Shift+O**

Toolbar button:

The **Add frames** command opens the **Open Source Images** dialog. Here you can select one or several image files to add into a project. The left part of the dialog contains the

group of elements from the standard Windows Open file dialog. The right part of the dialog contains the list of selected files. To choose a file, select its name from the left list and click the button with the arrow $\boxed{\rightarrow}$. Holding down the **Shift** (or **Ctrl**) key, you can select several files at once.
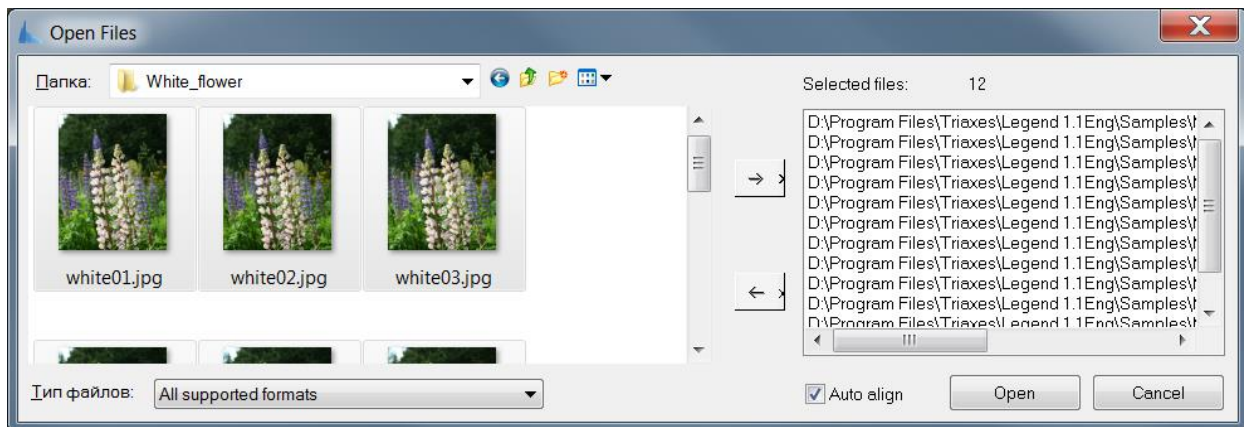

Fig.3.1**. Open source images** dialog

To delete a file or several files from the right list, select it/them with the mouse and click the arrow $\boxed{\leftarrow}$. A double click with the left mouse button also removes the files from the list.

To load selected files to the project, click the button **Open**. If The **Auto align** is marked the loaded images will be aligned relative to the first image of the frame sequence or relative to the first loaded image.

Add layers into a project

Menu command: **Layers >> Add**

Hot keys: **Ctrl+Shift+O**

Toolbar button:

The **Add** command opens the Open Layers dialog. You can find more detailed description of this dialog in the previous section.

Supported input formats are given in the previous section (Add frames into a project)

Delete the current image from a project

Menu command for frames: **Edit >> Delete**

Hot keys:**Del**

To delete an image (either a source frame or a layer) from a project, click on it and press **Delete** or run the corresponding menu command. You can also delete the current layer using a special button ✕ on the **Layers** window (see section 2.5).

Using Shift and Ctrl you can select and delete the set of images from a project.

3.2   Supported input formats:

Format	Description
bmp	A file format to store bitmap images without data compression and losses in their quality.
tiff	A file format to store bitmap images with some compression but without losses in their quality. Tiff file is in average two times smaller than bmp file.
jpg	A file format to store bitmap 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.
jps	The same as jpg. The letter s at the end means that the file contains a stereo pair of images for the cross-eyed viewing. Special software for viewing stereo pairs recognizes files of this type.
png	A spread storing format for bitmap graphic information using some compression without losses in quality.
gif	A storing file format for graphic images with indexed color palette.
psd	A storing format for bitmap graphic information using some compression without losses in quality.
3dm	A special file format which was created to store multilayer templates of the **Triaxes Legend** software.
mpo	A file format to store bitmap images used in Fuji FinePix REAL 3D W1 3D camera. It contains 2 images in jpg format with special technical information.

3.3   Export results

Save the generated image

You can save the generated image to a file on the disc.

Menu command: **Project >> Save** Generated Image

Hot keys: **Ctrl+Shift+S**

Toolbar button: 💾

Supported:

When a lenticular image is encoded **to file** saving will be executed in the psd format (supports RGB and CMYK color models), or in the .bmp (RGB only). The extension will be added to the entered file name automatically. It's recommended to use .psd format.

Save frames

Use the menu command **Project >> Export Frames** for saving the generated series of multilayer frames, as well as aligned and cropped sequence of source frames. When exporting only the area of images within the crop the rectangle is saved.

3.4   Encode an image for viewing via lenticular lens

Two output options are possible: to encode the image to display (**To display…** button) or to encode it to file (**To file…** button). The available saving formats are psd and bmp (psd is specified by default).

Fig.3.2a. Generate buttons of the **Lenticular** tab

If the image is spitted then it's possible to encode it part by part or encode it as a whole.

To encode the image to display press **To display…** button –**Select part to encode** dialog appears.
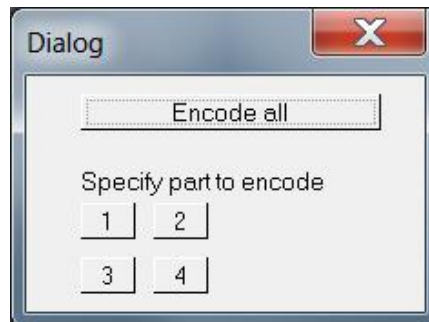
Fig.3.2 b. Select part to encode dialog (to display)

To encode the whole image press **Encode all**.

To encode a part press button with the part number.

The numbers of the encoded parts are marked with the blue color.

To encode an image to file press **To file…** button – **Select part to encode** dialog appears.
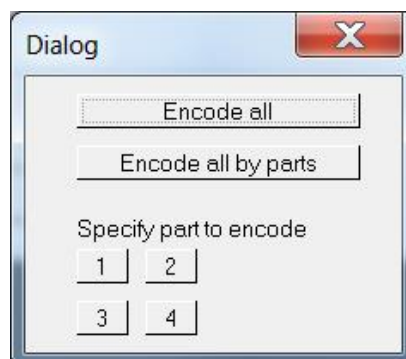

Fig.3.2c. Partitioning to file dialog

To encode the whole image to file press **Encode all**.

To encode all parts one by one to file press **Encode all by parts**.

To encode one part to file press button with the part number.

The numbers of the encoded parts are marked with the blue color.

Image export dialog is shown in Fig.3.2d. You can choose the type of the created file in the drop-down list in the bottom (bmp, jpg – to create a series of pictures; gif, avi - to create an animation file).
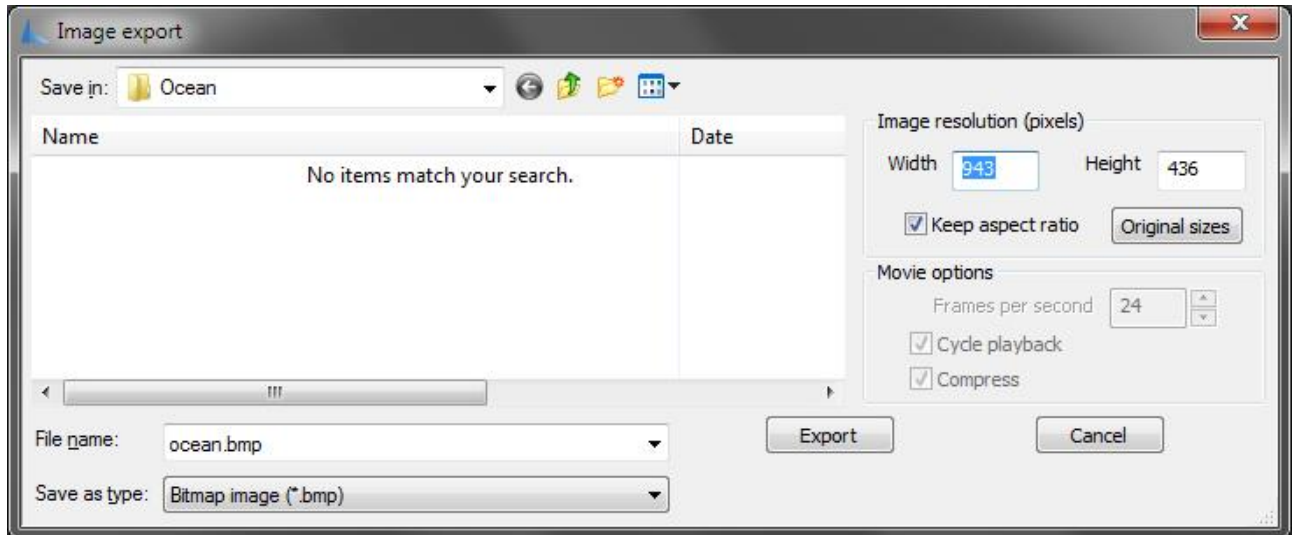

Fig.3.2d. **Image export** dialog

3.5 Supported output formats:

Format	Description
bmp	Saving images without data compression. Images are saved without losses in their quality.
tiff	Saving images with insignificant compression. Images are saved almost without quality loss.
jpg	Image data are compressed with some losses in quality. The file is in average 40 times smaller than a bmp file. The quality level approximately corresponds to 7-8 (Medium-High). It is not recommended to save lenticular encoded images in this format.
jps	The same as jpg. The letter s at the end means that the file contains a stereo pair of images for the cross-eyed viewing. Special programs for viewing stereo pairs recognize files of this type.
gif	Frames are saved into a video. The derived file is convenient to allocate on web sites.
avi	Series of frames are saved into a video. The derived file has a better quality than Animated Gif
psd	Saving images in psd format.

In the **Image resolution (pixels)** box you can change the size of an image (in pixels). When **Width** or **Height** is changed, resolution is automatically recalculated so as to save original ratios of width to height. The **Original sizes** button allowing to restore original sizes of images.

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

Cycle playback option allows you to get the video with a frame sequence from the first frame to the last one and back to the first one. That perfectly illustrates the stereo effect.

If the **Cycle playback** box is not checked – the video with frames only from the first frame to the last one is created (with smaller file size).

When the **Compress** box is checked (active only for avi format), compression by standard video-codec is taking place. Such file occupies much less disc space.

3.6 Multilayer stereo image

Taking a sequence of photos for making a lenticular stereo image requires special conditions: a still object, a tripod for the camera and the same lighting during the whole photography session. Besides, photos often need to be corrected – askew images, shifted frames (these operations can be fulfilled in **Triaxes Legend** or graphical editors). If you follow all these rules, you will get a perfect stereo photo as a result.

However, for creating collages, imposing photo objects on pictures or performing professional design work, there is a special method which allows to create stereo pieces from a set of "flat" layers – the method of multilayer stereo generation.

Multilayer stereo image (the so called pseudo-3D image) – is an encoded sequence of source frames obtained through setting non-zero parallax for one or more photo layers. By layers we mean photographs, frames imposed on them, and other photo objects).

The distance to objects (layers) of the multilayer stereo image is determined by parallax values. The object "in focus", i.e. perceived by both eyes equally, without displacement, is an object with zero parallax. Distance to all other objects in the back- or foreground will be evaluated in respect to this object.

Triaxes Legend allows to prepare a sequence of frames from a set of layers with transparency and then encode it, i.e. obtain a multilayer stereo photograph. The final image will have layers located at a different distance from each other, which would provide a stereo effect.

The sequence of steps when creating a multilayer stereo image:

1. Create a new project or open an existing one.

2. Add files with layers into the project.

3. Arrange the layers in the necessary order on the canvas.

4. Set the background and foreground parallax values

5. Arrange the layers in terms of depth using the depth scale

6. Run the menu command to generate the frame sequence: **Layers >> Generate multilayer** Alt+G), in the dialog window specify the background, foreground, and zero parallax layer (automatically) or set the parallax values for each of the layers (manually);

7. Use the **Project >> Export frames** menu command to save the generated series of frames.

8. After that you can follow the procedure described in the previous sections - to encode images of any type: lenticular, anaglyph, etc.

Please, see section 4.2 for a step-by-step guide on creating multilayer stereo images.

Generate a sequence of frames for a multilayer stereo image

Menu command: **Layers >> Generate multilayer stereo**

Hot keys: **Alt+G**

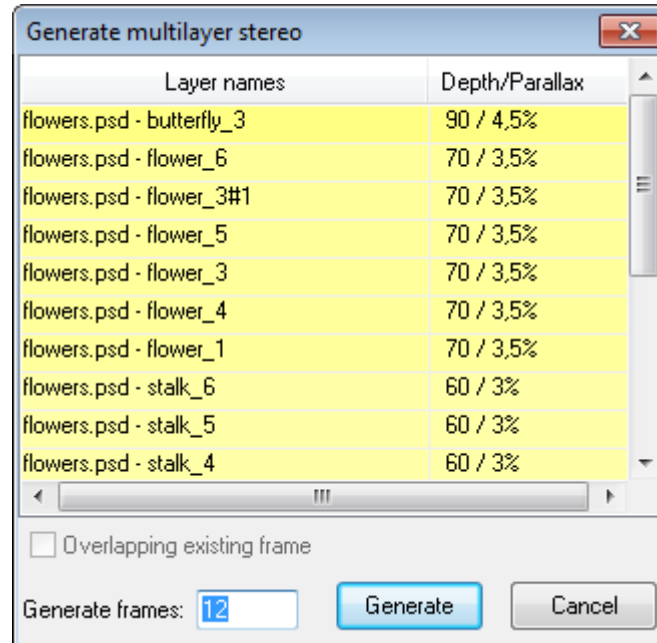You will see the following dialog after you select the command:

Fig.3.3. **Generate multilayer stereo** dialog

With the **Generate multilayer stereo** window you should specify the number of resulting frames. Depending on the specified parallax, the line in the list will be colored with blue or yellow. Yellow means, that the layer will be "elevated" from the medium plane, blue - that the layer will be depressed. The further away the layer moves from the medium plane the more saturated the color of the list line will become. Color indication of parallax allows to avoid errors associated with typing "-" sign.

After generation multilayer images are already aligned to zero parallax layer.

To save the generated frames sequence go to **Project >> Export Frames.**

3.7   View modes

Sort images

Frames are added into a project in the order in which you select their names in the **Open Source Images** dialog (see Fig.3.1). The list of images in the project is displayed in the **Frames** tab of the **Navigator** window.

The sequence of images have a great impact on the result of lenticular encoding. Images must be arranged in the initial shooting order from left to right. The **Frames** tab has two buttons: **Sort descending** and **Sort ascending**, which you can use to sort images by their file names in alphabetical (**A-Z**) or counter-alphabetical (**Z-A**) order.

Change transparency

To simplify the process of images' position correction the *Active image* (an image selected at the moment) is shown overlapping the second image (the *Left frame*). You can regulate transparency of the *Active image* towards the *Left frame* with the help of the **Transparency slider**. The leftmost position of the slider corresponds to the full

transparency of the *Active image*. Only an image, set as the *Left frame* is seen on the screen. The rightmost position of the slider corresponds to the full opacity of the *Active image*.
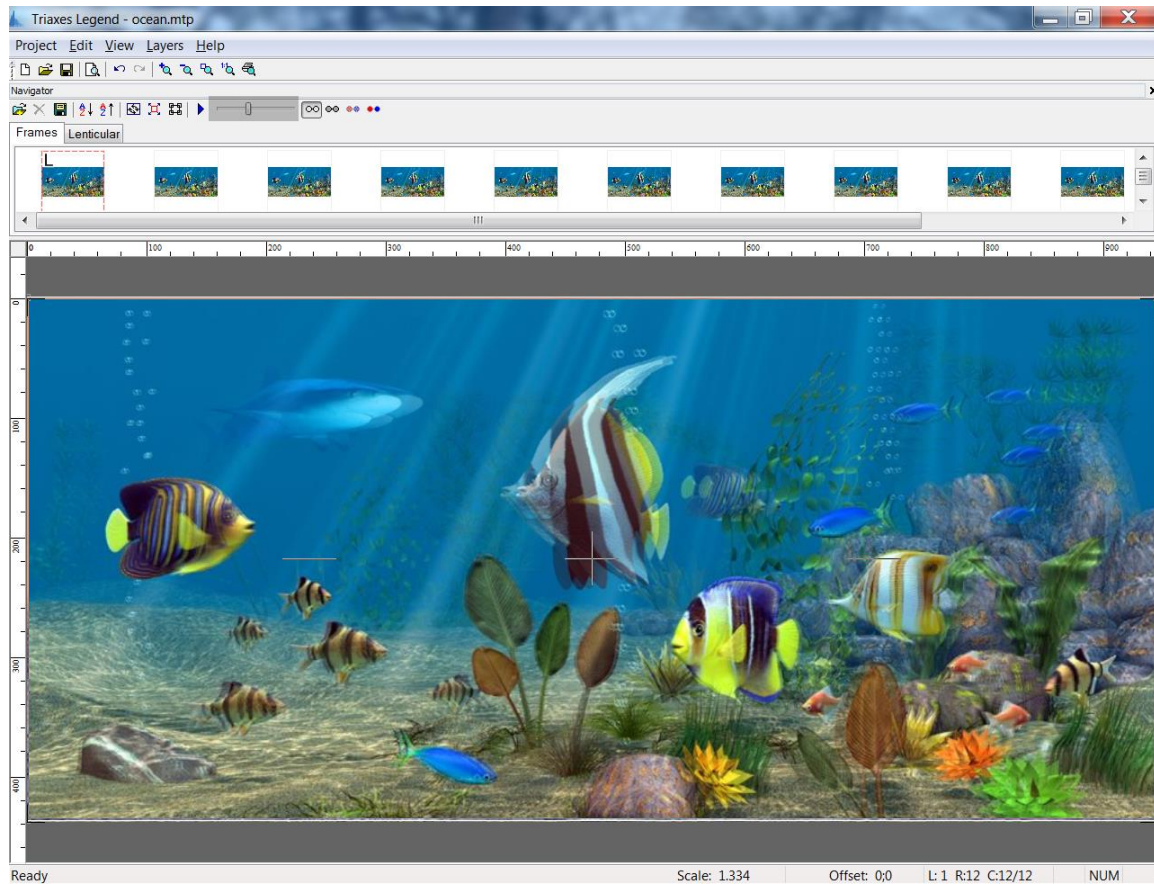

Fig.3.4. Changing the frames transparency
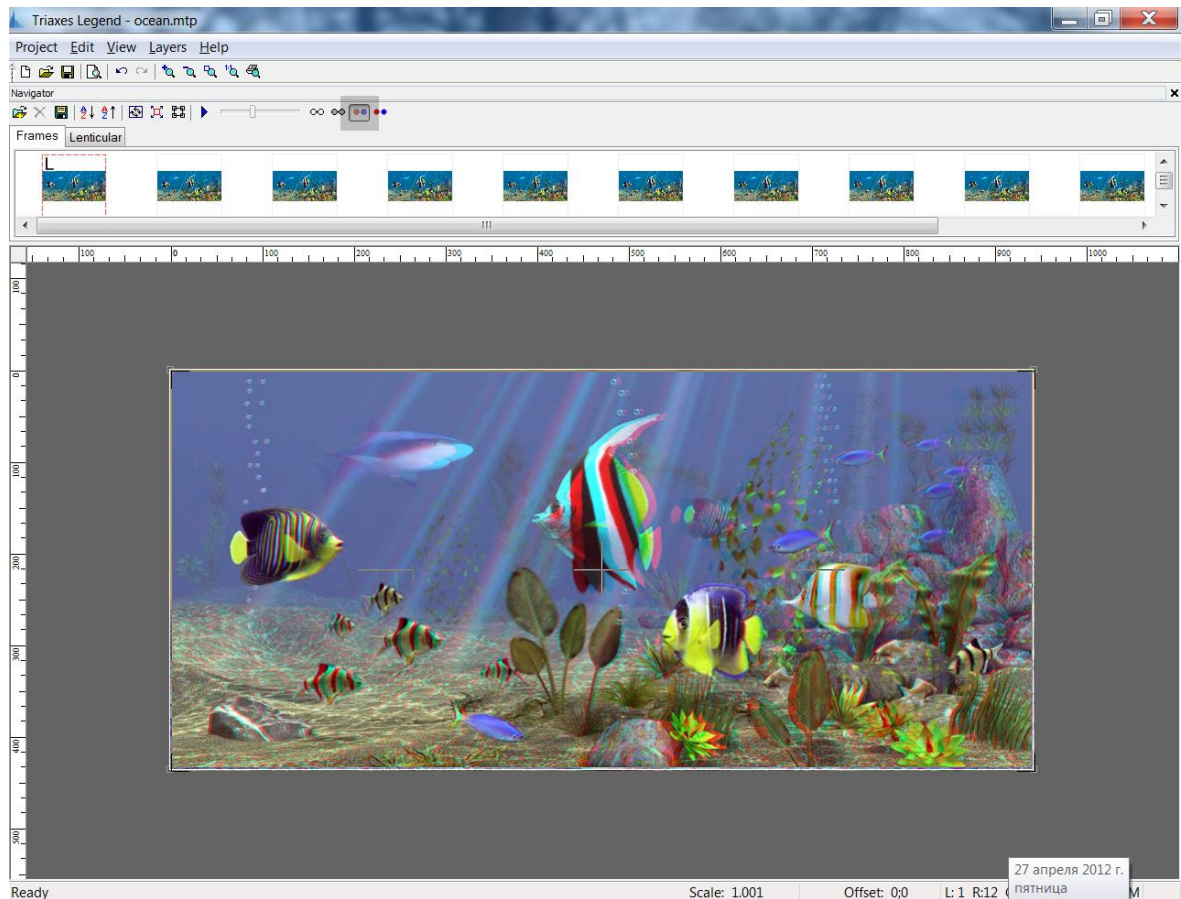
Frames view modes

Fig.3.5. **Anaglyph view** mode

To simplify the images matching, there are several view modes available in the **Frames** tab. You can select one of them from a drop-down list (normal and anaglyph of three types: monochrome, quasi-colored, and colored). The anaglyph mode might be quite helpful to view a stereo effect at a stage when you match images.

You can experience stereo effect when viewing such image through anaglyph (red and cyan) glasses.

Zoom images in and out

Zoom in:

Menu command: **View >> Zoom In**

Hot keys: **+**

Toolbar button:

Zoom out:

Menu command: **View >> Zoom Out**

Hot keys: - (minus on the keypad)

Toolbar button:

Fit to the screen:

Menu command: **View >> Fit on Screen**

Hot keys: **Ctrl+0**

Toolbar button: 🔍

This command zooms images so that they completely fit to the program window.

Actual size (in pixels):

Menu command: **View >> Actual size**

Hot keys: **Ctrl+Alt+0**

Toolbar button: 🔍

This command zooms the image as 1:1, i.e. one pixel of the image corresponds to one pixel of the display.

Print size:

Menu command: **View >> Print Size**

Hot keys: **Ctrl+Alt+P**

This command zooms the image so that its size on the screen is the same as when it is printed.

Zoom in and out with the mouse:

You can also zoom images in and out by mouse scrolling.

Animation view

The sequence of frames can be "played" using **Animation** button on the toolbar, or go to **View >> Animation**.
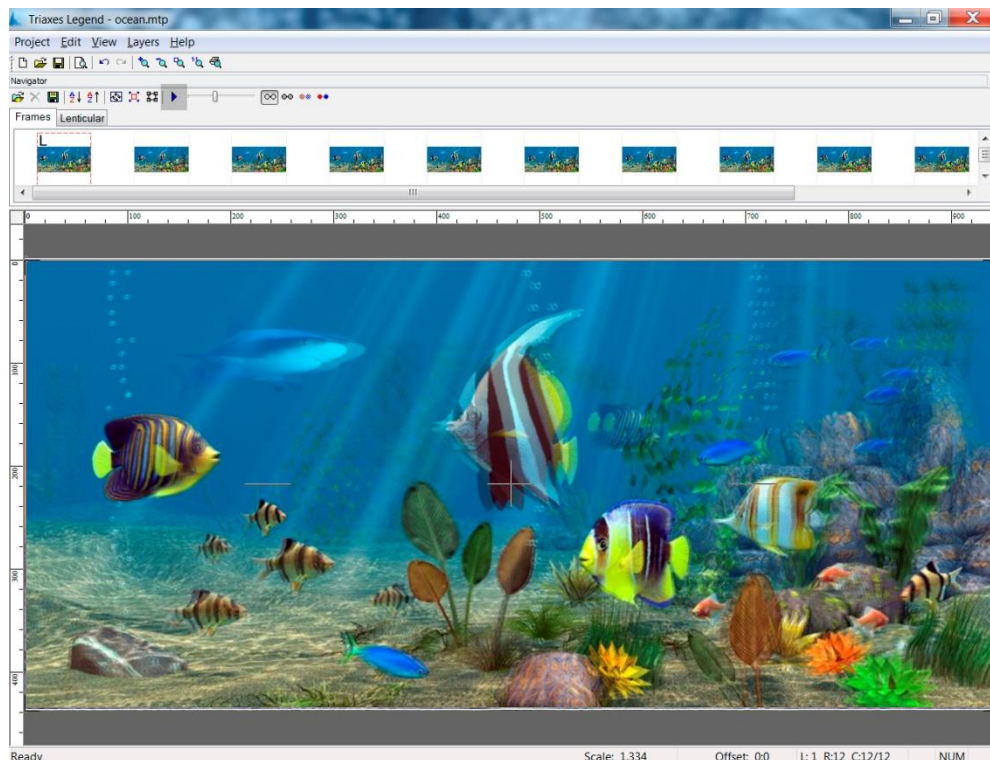
Fig.3.6 **Animation view**

The playing speed is changed in **Settings** dialog (go to **Project >> Settings)**.
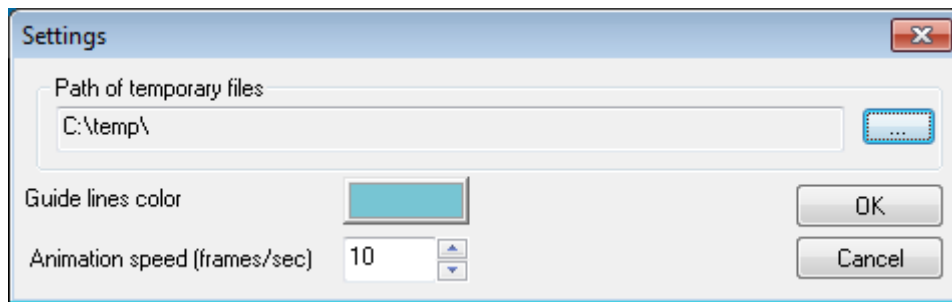
Fig.3.7. **Settings** dialog

3.8   Mark and correct images

Mark images

The marking lies in setting two images from a series as the *Left* and the *Right frames*. The *Left* and the *Right frames* set the boarders of the frames sequence, which participates in stereo image generation. In order to set an image as the *Left frame*, it is necessary to click the right mouse button on a necessary image and then select **Set left** in the list of the appeared context menu. The same with setting a frame as the *Right* one.

When you create anaglyph stereo images, cards for the stereoscope, cards for parallel or cross-eyed viewing methods, only two frames, set as the *Left* and the *Right* ones, will participate in generation .

When you create lenticular images, all frames between the *Left* and the *Right* one will participate in generation. All the images beyond this sequence of frames will be marked by the black-white color and won't participate in generation.

The *Active image* in **Triaxes Legend** is an image selected at the moment. It is indicated with blue frame in the **Frames** tab. In order to select an image, i.e. make it *Active*, just click the left mouse button on its thumbnail.

Active image is shown over the *Left frame* with transparency. *Active* image transparency could be controlled by slider ▶ [━━━━━━] in the **Frames** tab.

That is necessary for vertical and horizontal alignment of a frames series and also for zero parallax plane setting.

Image motion

The right image of a stereo pair is always displayed above the left one. To specify the zero parallax object you should correct the position of the right image relative to the left one.

Any image can be moved relative to the canvas. The image motion operation is applied to the *Active image*, towards the current (selected) object. To mark an image you should click on it in the list of thumbnail images.

To move an image you should direct the mouse pointer at the object you are matching to. Then click the left or right mouse button, which will correspond to one of two moving modes (see the description below). Then hold down the mouse key and move the mouse pointer to the desired position.

The process of moving the image will be finished at the point where the mouse button will be released.

The modes of moving differ in the following way: if you hold down the right mouse button, a line is drawn from the initial point to the current position of the pointer, but if you hold down the left mouse button, the image moves together with the pointer.
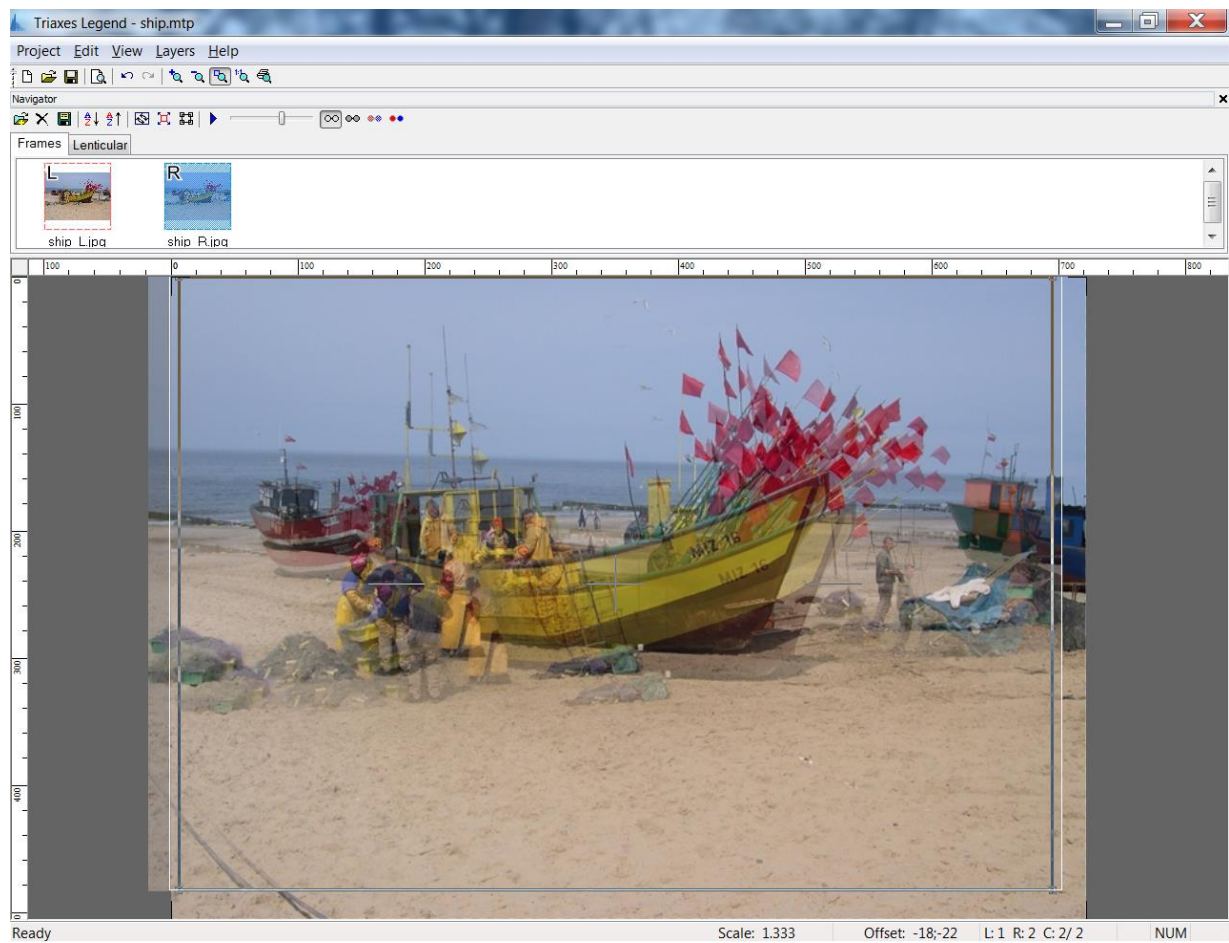
Fig.3.8. Image motion

> **Useful tip:** If during the operation with one of the mouse buttons being held down, you click the second mouse button, the operation will be canceled. This rule also applies to other operations: scaling and rotating.

If you create a lenticular stereo image out of a sequence of frames taken with the parallel method, the setting of zero parallax object must be done <u>for all images in the sequence.</u>

It is very convenient to align images using keyboard buttons without a mouse – switching between frames with **Ctrl + left/right arrow** buttons.

Automove

Menu command: **Edit >> Automove**

The automove operation is used to prepare a stereo sequence for lenticular encoding.

In order to use the **Automove** command, it is necessary to set the leftmost image as the *Left frame* and the rightmost – as the *Right frame*. Then perform vertical alignment and combine them by the zero parallax object. To finish the operation go to **Edit >> Automove**.

As the result, all the inbetween frames will be automatically combined by the principle of proportionality. Select in turn all the rest frames (make them *Active*) and perform the final zero parallax point correction.

Rotate images

It's hard to keep the cameras parallel to the horizon during the manual stereo shooting process. This defect also depreciates stereo effect. You can compensate it by rotating images.

Menu command: **Edit >> Transform >> Rotate**

Hot keys: **Alt+R**

Toolbar button:

The rotation operation is applied to the *Active image*. To set an image as the *Active*, click the left mouse button on it.

The mouse pointer has additional arrows indicating rotation.

To rotate an image, press the left mouse button, move the mouse pointer to the new position and release the button. The image will be rotated and the initial point will be moved to the final rotation point.

The image is rotated around the center of the crop frame. The initial and final rotation points are joined by arc. The rotation angle is displayed next to the rotation center as two numbers: the angle before the operation + the current rotation angle.

Fig.3.9. Initial image rotation

In the rotation mode you can change the size and the position of the crop frame and thus set the rotation center to the position you need.

If you click the right mouse button during rotation (when the left mouse button is pressed), the current operation will be canceled.

To exit the rotation mode, just click the right mouse button or press **Esc**.
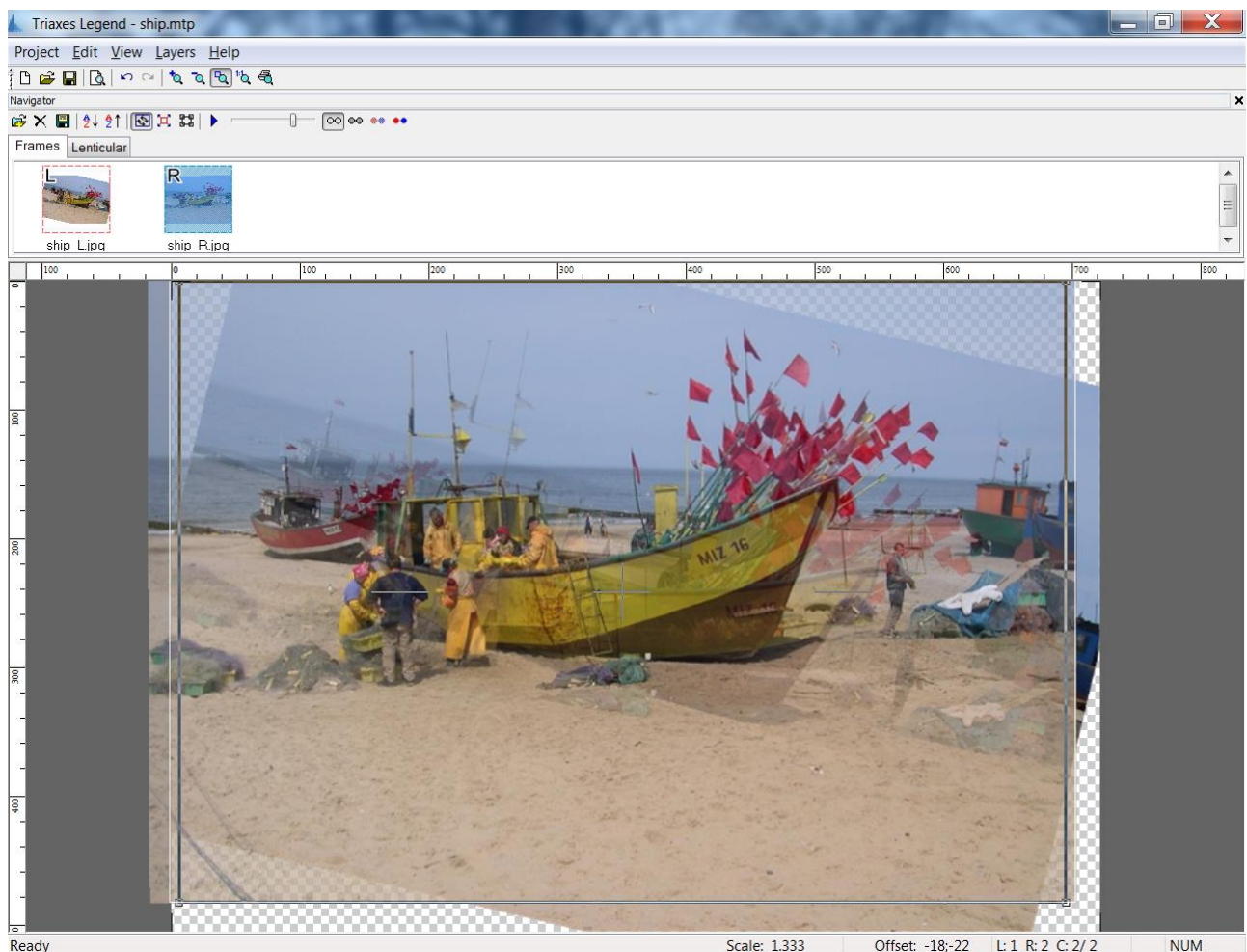

Fig.3.10. Rotation result

Here is a practical example of correcting an image. Fig. 3.10 illustrates a slight defect when the stereo pair was taken: horizon lines are not parallel.

Fig.3.11. The example of the image correction (initial state)

Correct the right frame first. Set the **Opacity** slider to the rightmost position. Change the size of the crop frame so that the crosshair is on the horizon line of the image. Enable the rotation mode for the right frame. Point the mouse to the horizon line and move it until it matches the horizontal line of the crosshair.
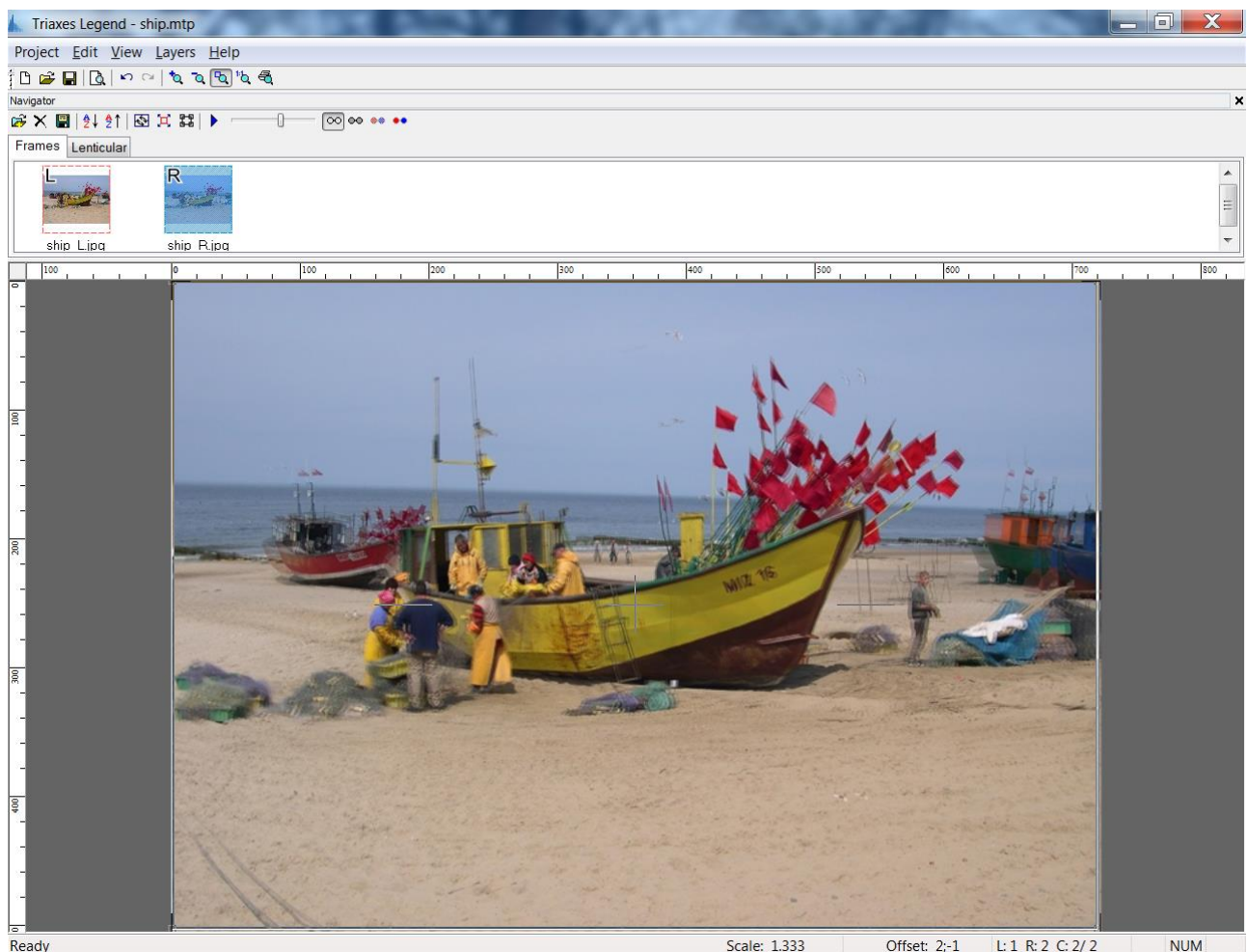
Fig.3.12. Adjusting the horizon line

Repeat it with the left frame. Then you should only specify the zero parallax object and crop the image.

Rotate dialog

The **Edit >> Transform >> Rotate** menu command is used for the exact angle rotation of an image.

Hot keys: **Ctrl+Alt+R**

The command opens a dialog allowing you to specify the exact rotation angle.
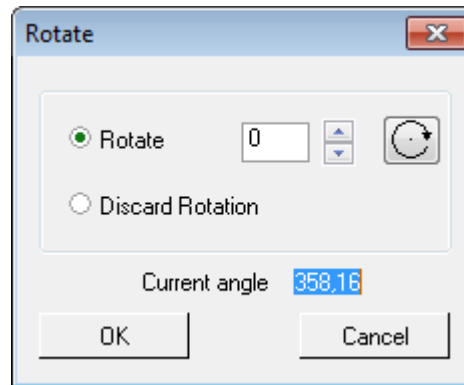
Fig.3.13. **Rotate** dialog

You should specify the rotation angle in the **Rotate** field. You can specify the angle either manually or using the "scrolling" buttons with arrows. You can specify the direction of rotation using the button located near the field. The button click changes the direction of rotation to the opposite one.

You can undo all previous rotations with the **Discard Rotation** option. Click **OK** to apply rotation or **Cancel** to close the dialog without applying the changes.

Scaling images

Menu command: **Edit >> Transform >> Scale**

Hot keys: **Alt+S**

Toolbar button:

The scaling operation allows you to correct inaccuracies in the scale of source frames caused by automatic focus in cameras. If the scale of objects represented on a series of frames differs, you can take the scale of the left frame as a basis to adjust the sizes of objects on all frames by it.

> **Useful tip:** Scaling can also be used to create a lenticular image with the zoom effect. To do it, add a sequence consisting of copies of the same image to the list of frames, set gradually increasing scale for this sequence and align frames by the selected object.

In the scaling mode, the mouse pointer changes its form: squares of different sizes that appear next to the arrow, and running frame (marching ants) that appear around the currently selected image. To scale the image, press the left mouse button on the screen, move the mouse pointer to the new position and release the button. Scaling is always done relative to the initial size of the image. The scaling percentage is shown near the center of the window.

Scale dialog

The **Edit >> Transform >> Scale** command in the menu is used to scale images precisely.
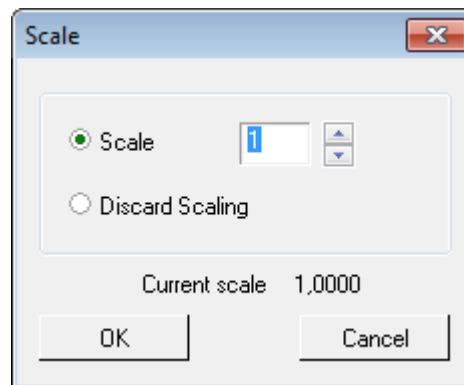
Hot keys: **Ctrl+Alt+S**

Fig.3.14. **Scale** dialog

The scale value is entered in the **Scale** field.

You can undo all scale changes by marking the **Discard Scaling** option.

Click **OK** to apply the new scale to the current image or **Cancel** to close the dialog without applying the changes.

Correct the Histogram

Menu command: **Edit >> Transform >> Histogram**

Hot keys: **Ctrl+Alt+H**
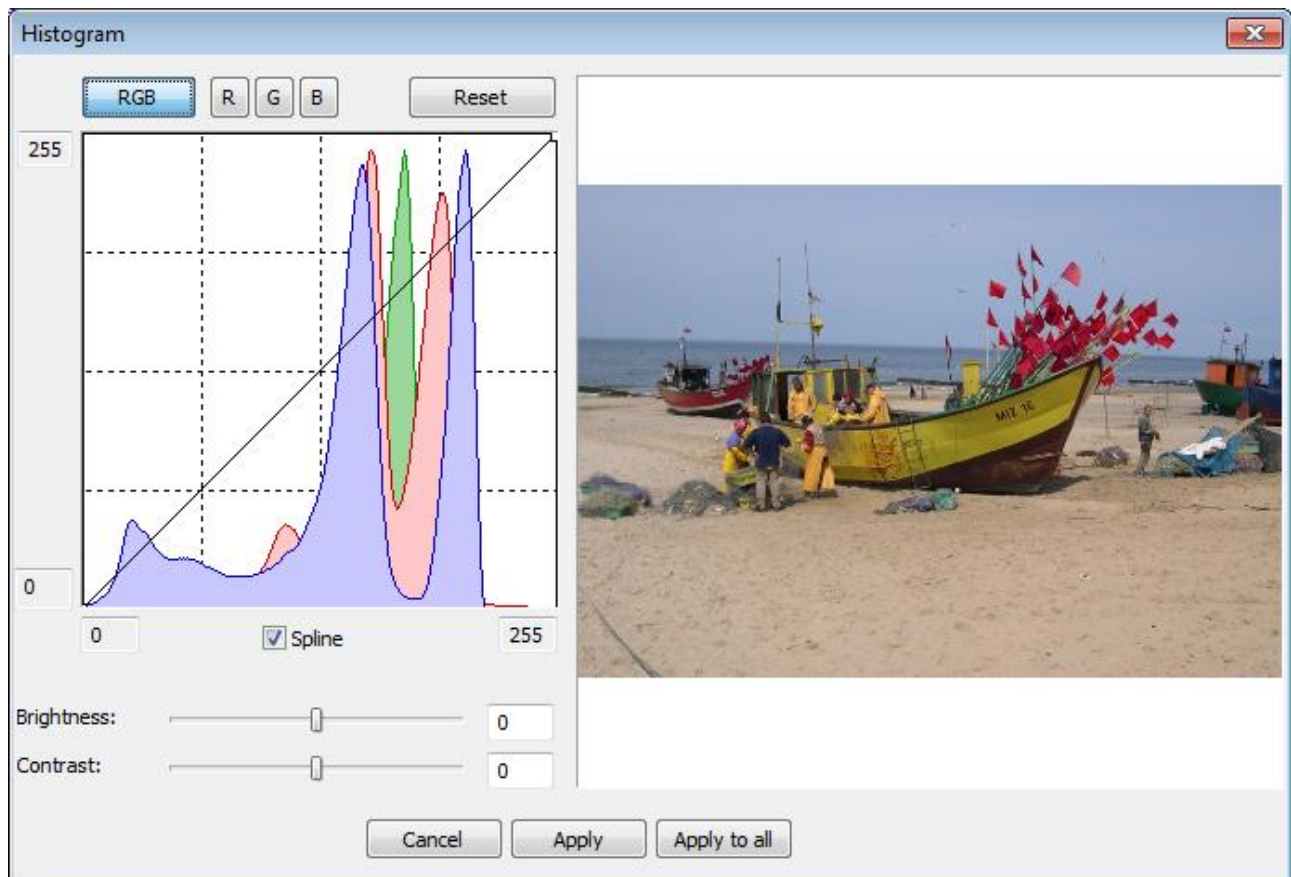
Fig.3.15. Histogram correction dialog

Histogram (in 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 histogram you can find out the main idea of exposition correctness, image contrast and color depth, and also 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 you can go back to the source histogram.

Set the control point by a left mouse button clicking. Remove the control point by a right-mouse button clicking. 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 spline mode. Fields by the x and the y axes allow to correct the brightness of borders manually. Besides, they can be moved by left mouse button clicking on the required border.

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

With the help of the histogram one can noticeably increase the image quality. For example, the histogram below does not have optimal distribution. For optimal correction move the right border nearer to the histogram:
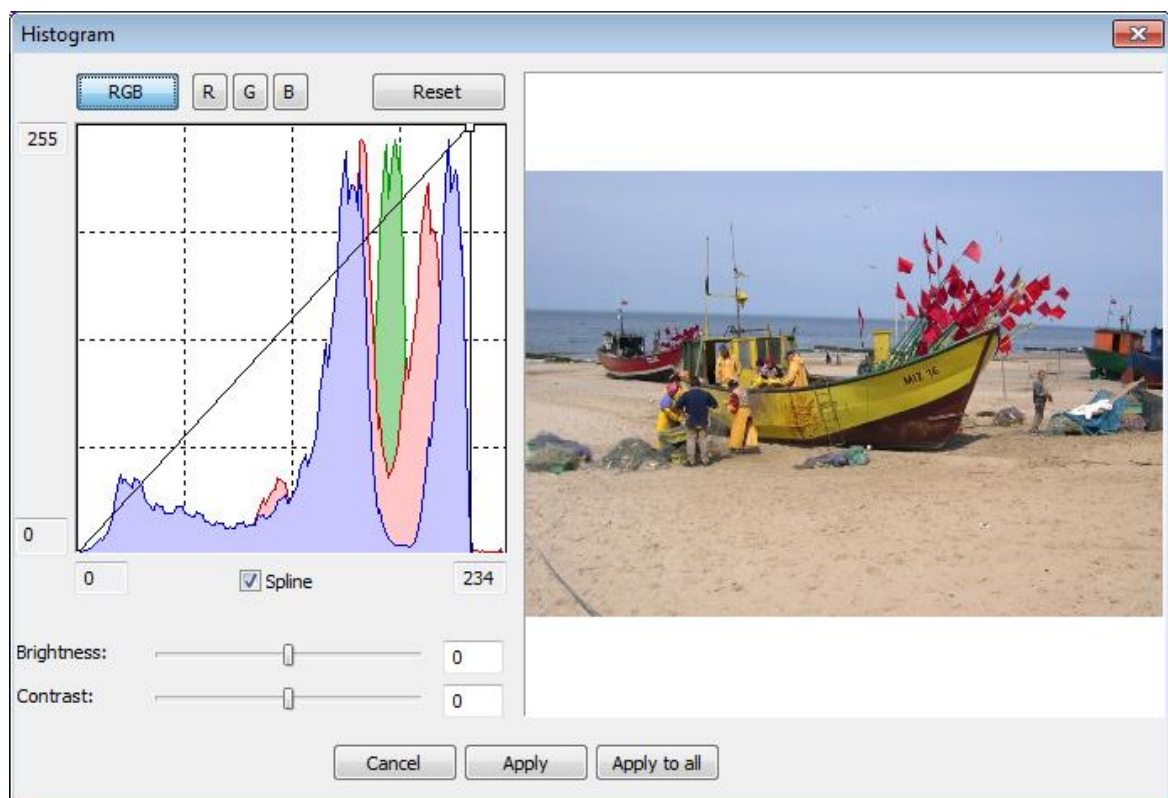

Fig.3.16. **Histogram** correction dialog (continuation)

The above image contains too much of red color. It is easy to correct it. Toggle into the red channel (**R**), put a point on the histogram and move it a little.
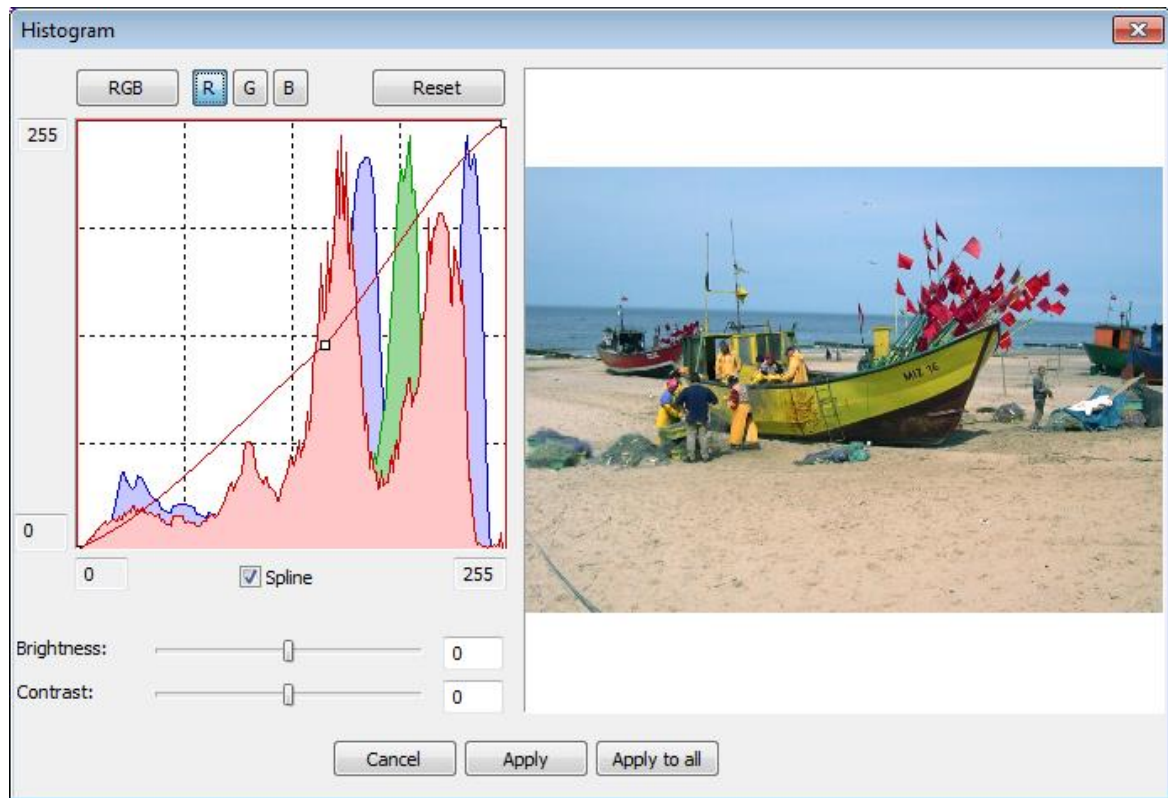
Fig.3.17. Histogram correction dialog (completion)

By clicking **Apply to all** button the histogram correction is applied to all frames.

3.9   Canvas and images cropping

Canvas

The canvas limits the work area of the crop frame.

The canvas size is in pixels and is automatically set when you open the first image (either with layers or an initial one). When you open a .psd file , the canvas size in **Triaxes Legend** is set as equal to the canvas size saved in this file.

If necessary, you can change the canvas size in the **Canvas settings** dialog.
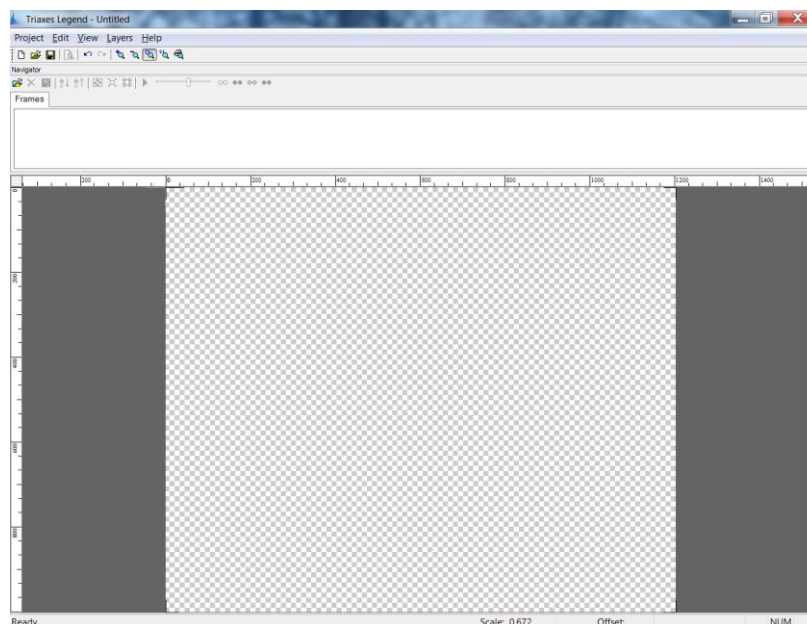
Fig.3.18. The Canvas

Canvas settings dialog

The dialog of the crop rectangle parameters settings, **Canvas settings** dialog, is used to change the canvas size.

The canvas size is set in pixels.

Menu command: **Edit >> Canvas settings**
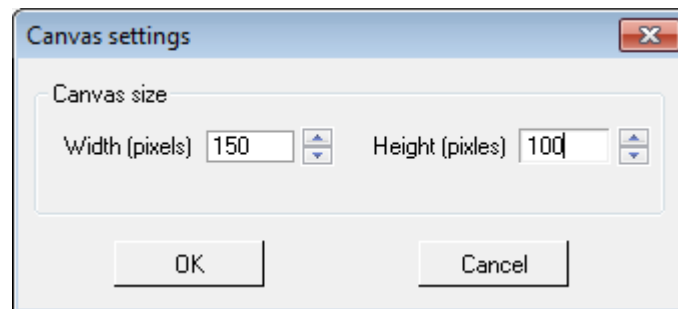
Hot keys: **Ctrl+Q**

Fig.3.19. **Canvas settings** dialog

Crop Rect settings dialog

The Crop Rect settings dialog is used to control the properties of the crop rectangle.

Menu command: **Edit >> Crop Rect settings**

Hot keys: **Ctrl+F**

Toolbar button:

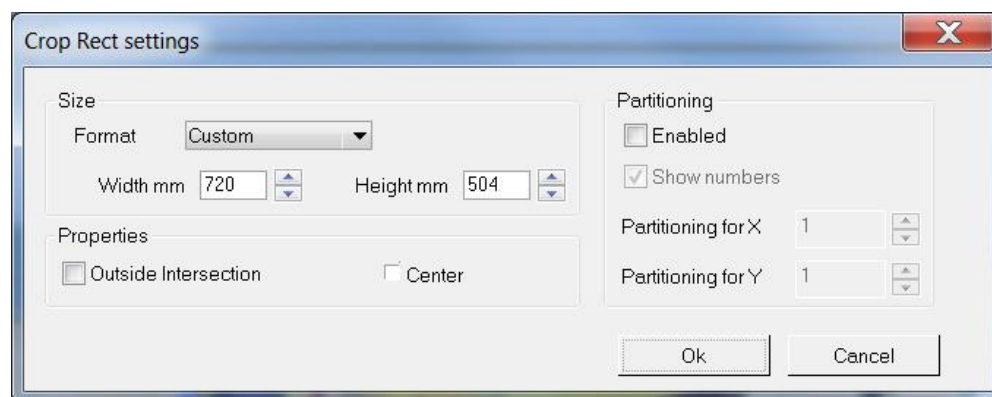You can open this dialog by clicking the right mouse button at any side of the crop rectangle.

Fig.3.21. **Crop Rect settings** dialog

It is often necessary to specify the aspect ratio of the crop rectangle corresponding to the planned size of the stereo image. For example, it can be the size of the lenticular screen equal to 100x150 mm. To make the encoded image corresponding to this size, specify the necessary aspect Ratio for the crop rectangle. Use the **Width mm** and **Height mm** fields to specify the aspect ratio.

The **Center** parameter enables the automatic selection of the size and position of the crop rectangle. The size of the crop rectangle is set to the maximum possible value taking into account the specified aspect ratio. When you change the relative position of frames, the area of their overlapping may get smaller. The crop rectangle automatically monitors all changes and corrects its position.

When you change the size or position of the crop rectangle manually, the **Center** mode is disabled.

There are some cases when the full image could not be printed due to its large size, material and printer limitations, etc. **Partitioning** could help here to divide the image into parts with a crop rectangle and to print them one after another. When activating this mode you need to specify the number of parts by x and y axes. **Show numbers** option activates the numbering of the generated parts.

3.10   Print images

Triaxes Legend allows to print directly from itself, however, plotters for direct printing are supplied with special software for printing process control. In such case it's necessary to encode an image **To file** and open it in the plotter software.

Print Setup

Menu command: **Project >> Print Setup**

The command opens the standard Windows **Print Setup** dialog where you can select the printer, the size and the orientation of paper.

Print Preview

Menu command: **Project>>Print Preview**

Toolbar button:

The **Print Preview** command switches the program to the print preview mode. You can see the position of an image on the printed page in this mode. The **Print** button sends an image to the printer. The **Close** button exits the preview mode. The **Print Setup** button opens standard **Print Setup** dialog.

In the **Print Preview** mode, you can:

● Use the mouse or the keyboard to set the position of the image on the printed page (the coordinates of the upper-left corner in mm: x, y);

● Rotate the image 90° – select the **Horz/Vert** checkbox;

● Fill the page with image copies (the **Fill** checkbox) and specify the interval between copies (the **Interval** field);

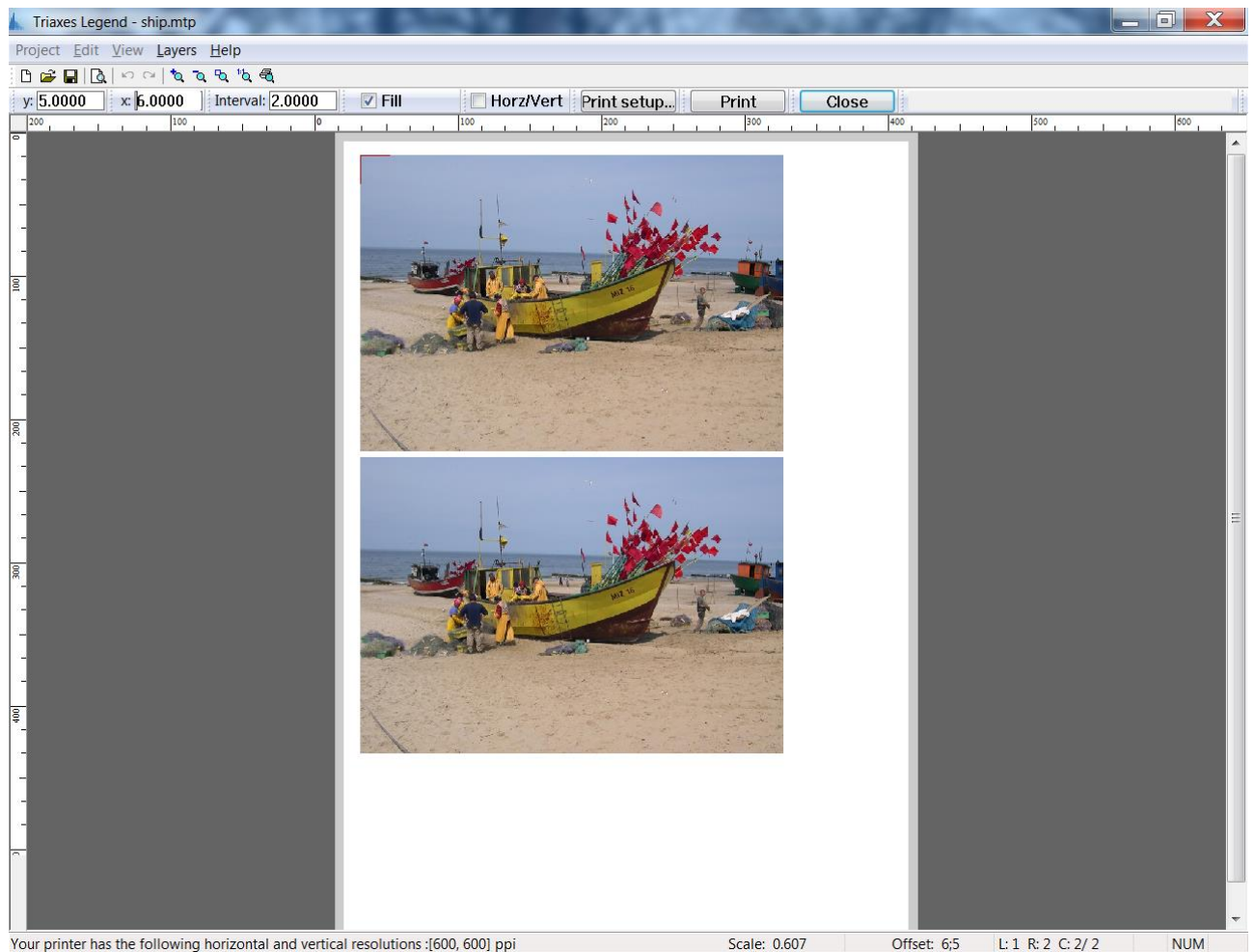● Use mouse scrolling to zoom the image in and out.

Fig.3.22. **Print preview**

Status line shows the current printer resolution in dpi (ppi) received directly from the printer driver.

4. Use cases

4.1 Make a lenticular flip image

Lenticular flip is an image which changes depending on the viewing angle. Lenticular flip images consist of two or more frames. Two different frames are used in common (Fig. 4.2).

The flip effect is achieved due to changes in the viewing angle (Fig.4.1).

Fig.4.1. Flip image principle (the first frame is red, the second one is blue)

Fig.4.2. Source frames

To add the text or logo we cut it from another photo using a graphical editor and save it with a transparent background into the separate file.

Fig.4.3. The text for the card

Launch **Triaxes Legend** and load frames by selecting the **Project >> Add frames** (hot keys: **Ctrl+Shift+O**)**.**

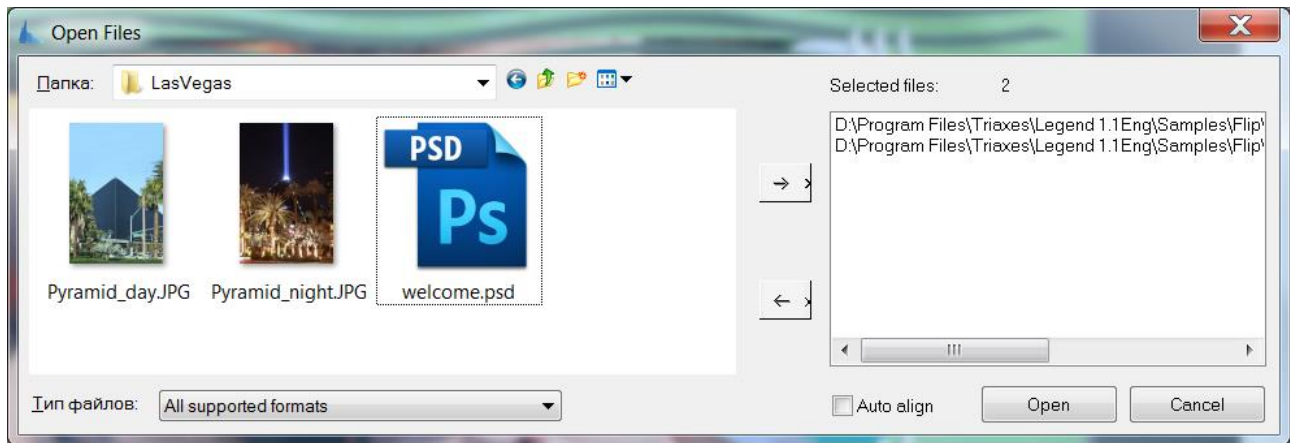Select photos and move them to the right list in the **Open Files** dialog.

Fig.4.4. **Open Files** dialog

After you click **Open**, the photos will be displayed in the list of frames at the upper part of the **Frames** tab in the **Navigator** window (Fig.4.5).
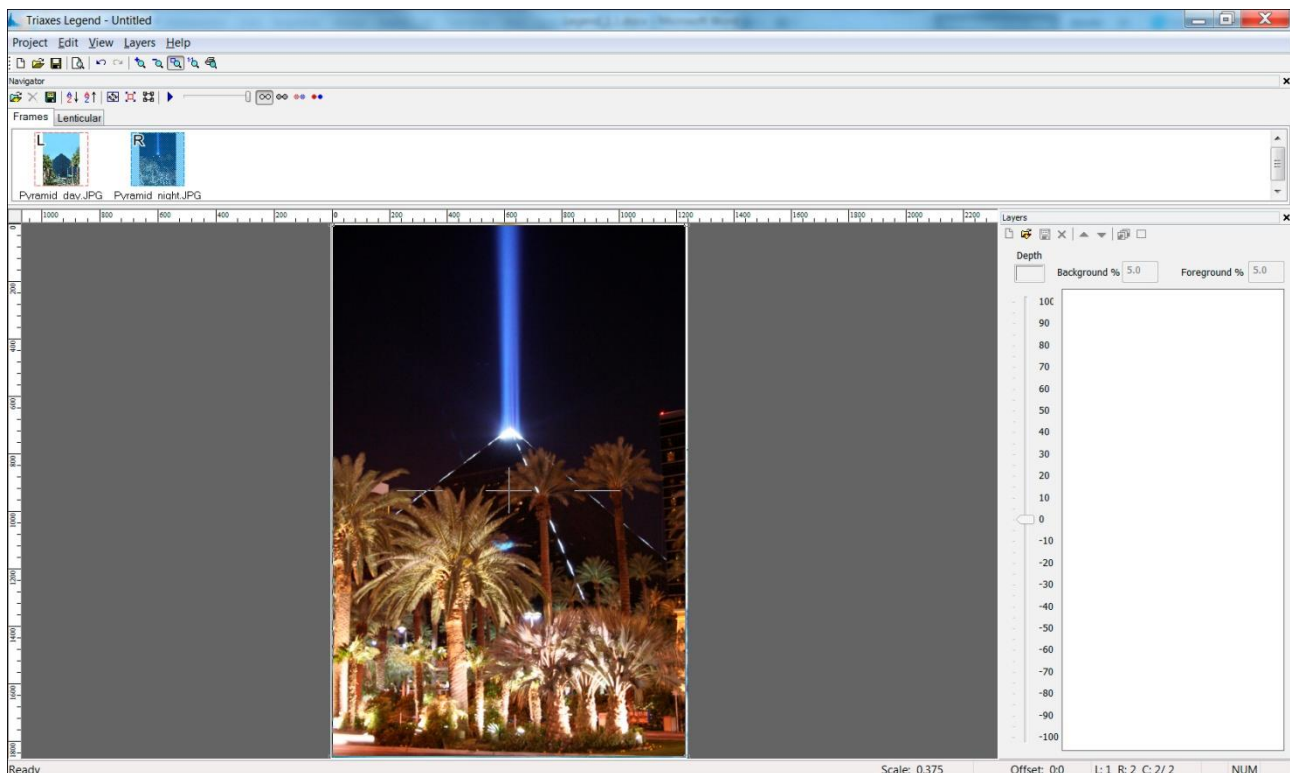

Fig.4.5. **Navigator** window

The frames will be automatically set as the *Left* and the *Right* and marked with the red and the blue dashed rectangles correspondingly. Both frames will be shown in the main window of the program. The *Right frame* will be automatically made *Active* and superimposed over the *Left frame* with transparency.

Add text / logo

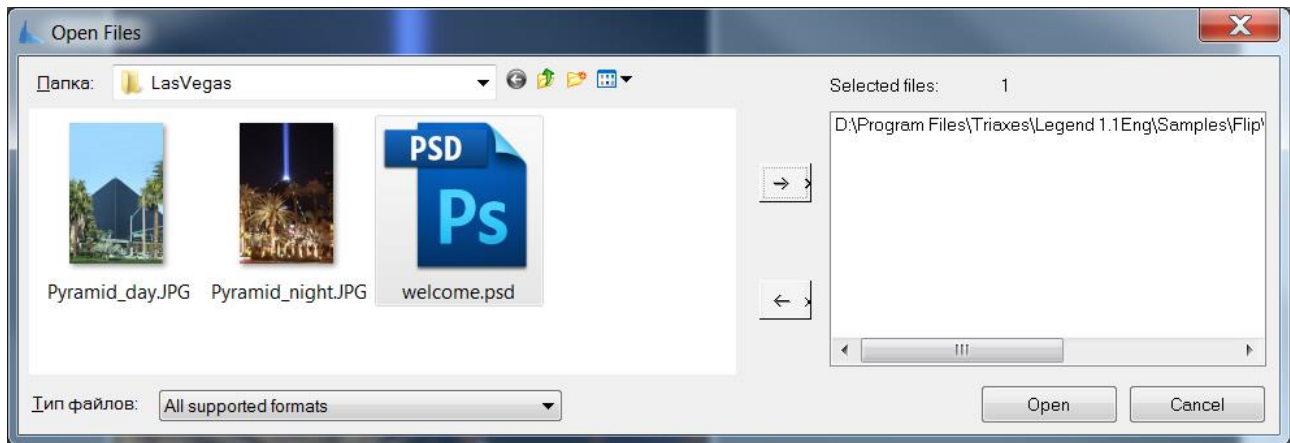The next step is to add text to an image by using **Layers >> Add** (**Alt+Shift+O**).

Fig.4.6 Add layer with text

Output image size and positioning

After adding the text layer set its size and position.

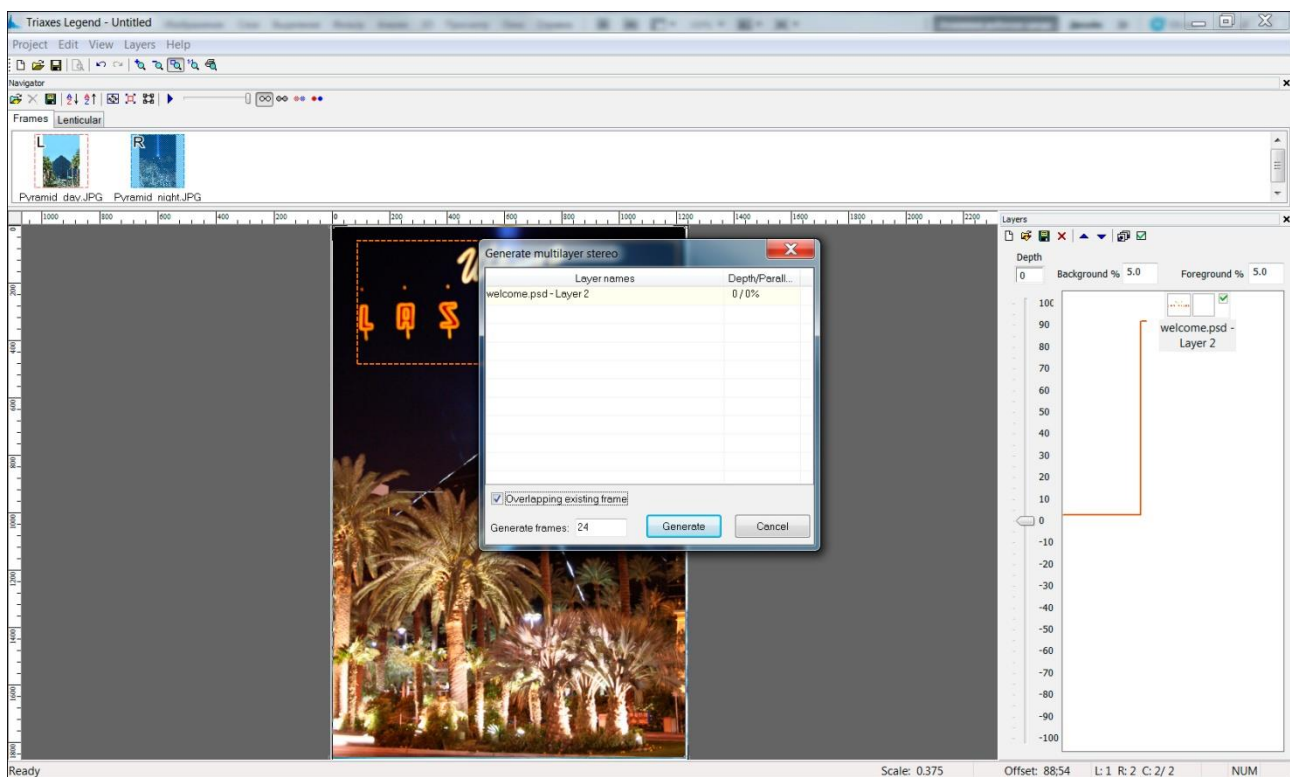The next step is to put text on frames by **Overlapping existing frames** option.

Fig.4.7 The image with overlapped text

The working area of **Triaxes Legend** always contains the **Crop Rectangle** control element (it looks like a rectangle with active areas in its corners). It automatically detects the area of image overlapping to show how the final image will look like. The frame can automatically keep the aspect ratio you need. E.g. to prepare a photo with the size of 10x15 cm open the **Crop Rect Settings** dialog (**Edit >> Crop Rect Settings**), specify the image proportion you need and also select the **Lock Aspect Ratio** checkbox (Fig.4.8).
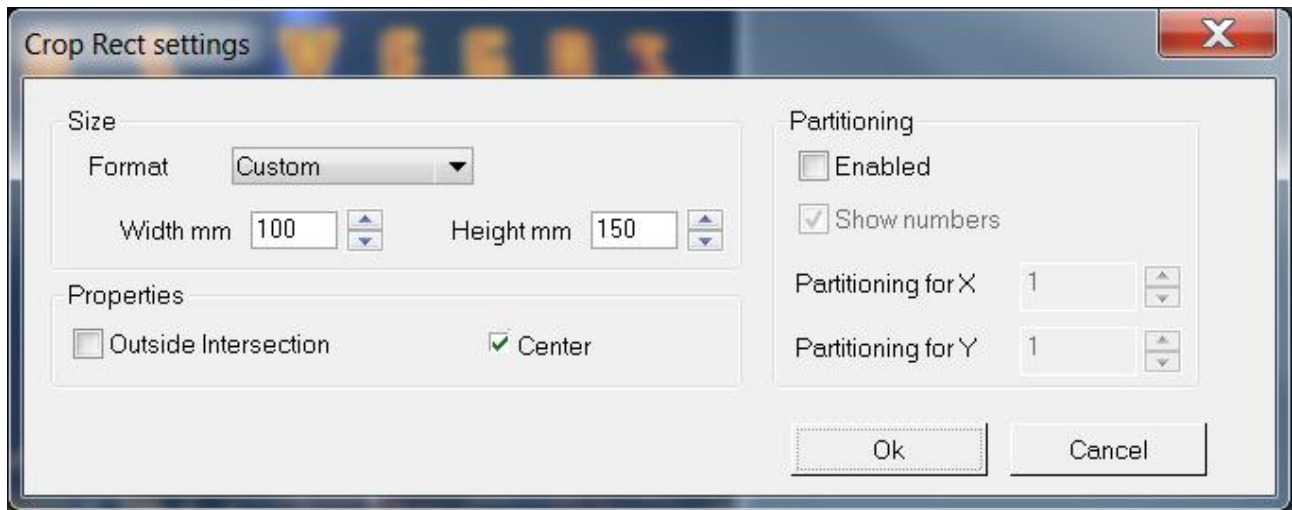
Fig.4.8. **Crop Rect settings**

The active areas on the sides of the rectangle allow you to change its size keeping the aspect ratio. Use this tool to crop the image in order to remove the unneeded background.

Encode the images

Switch to **Lenticular** tab of **Navigator** window. This tab shows control items specifying the size and resolution of the encoded image, lens orientation (horizontally or vertically), lens (encoding) pitch (make a pitch test to get precise lens pitch). To create a flip image, select the horizontal lens orientation (Fig.4.9).

Fig.4.9. Settings of the lenticular lens encoding

Note that printing on the lenticular lens is performed on the back of the lens, therefore it's necessary to mirror the encoded image. Most plotters for direct printing have special printing software for printing process control. **Triaxes Legend** is intended to generate the encoded image for viewing via lenticular lens. If you're not going to mirror the image with special printing software, don't forget to mark it with a tick **Mirroring** before encoding.

The next step is encoding. There are two options: **Generate To display** and encode **To file**. Most plotters are supplied with special printing software, therefore it's recommended to encode an image to file. It's possible to save the encoded image as .psd or .bmp file, .psd is set by default (recommended).

To encode an image to file press **To file…** button, select the directory for saving and press **Save As**.
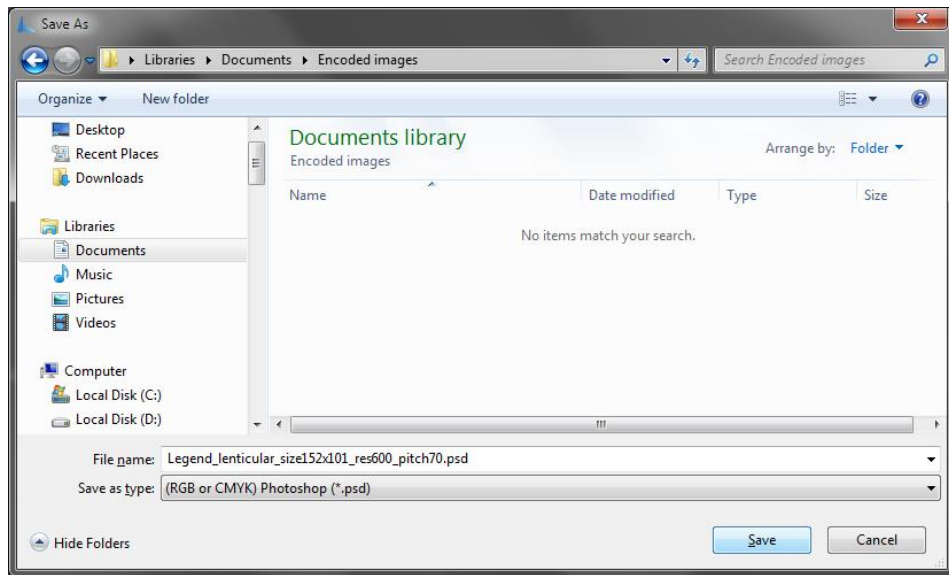
Fig.4.10. **Save As** dialog

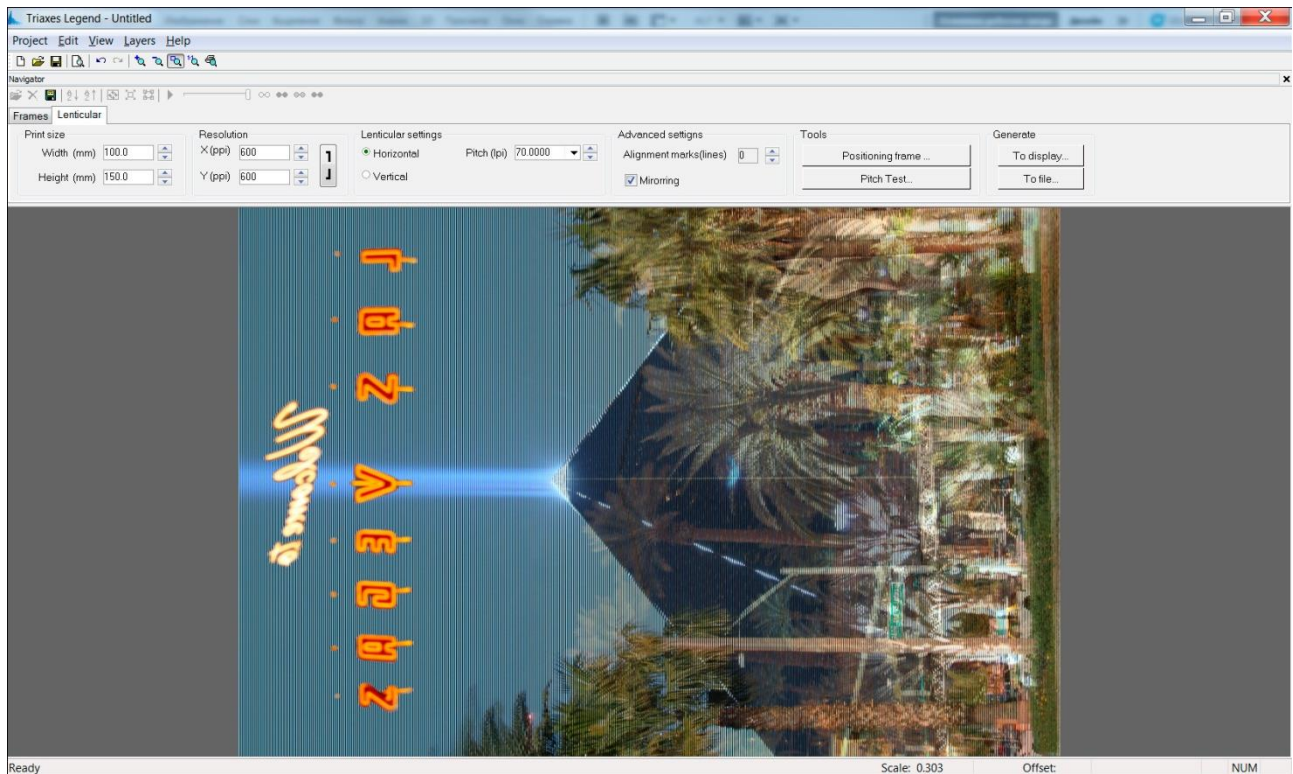You can encode an image **To display** to have a look at the encoded structure (fig.4.11).

Fig.4.11. Encoded flip image

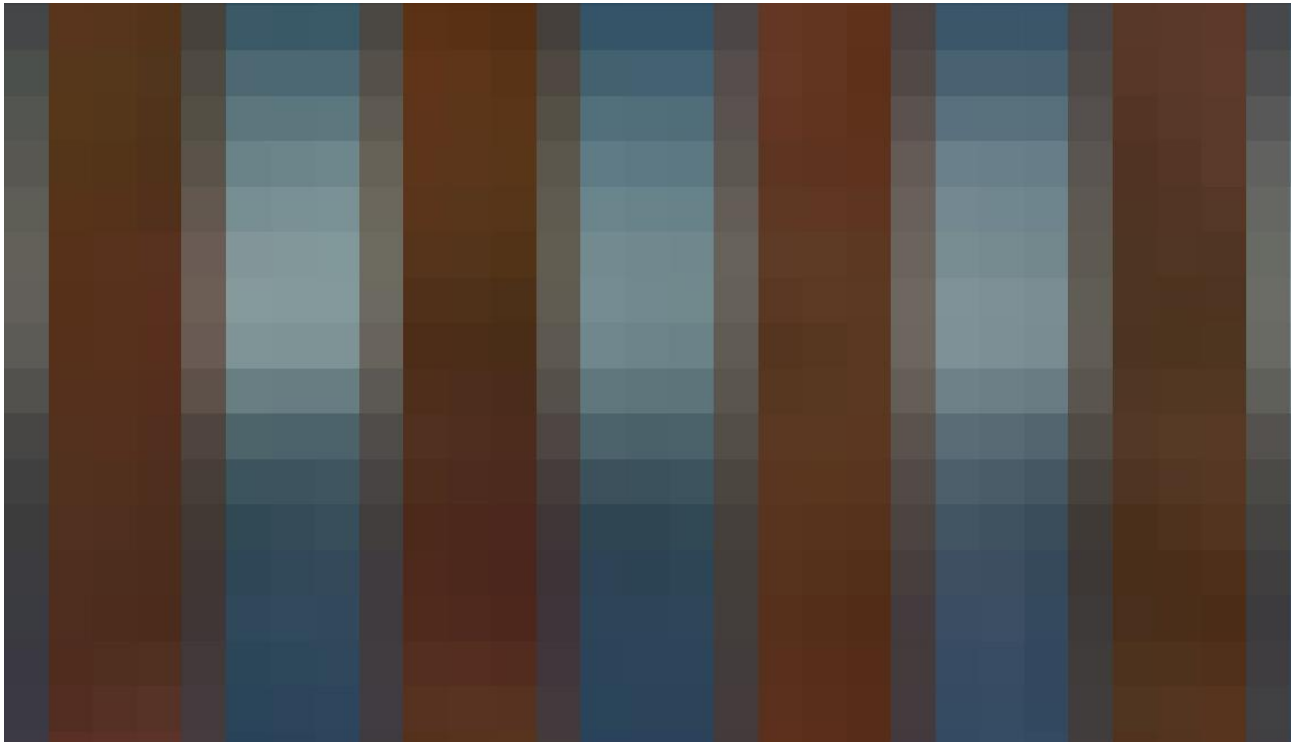You can zoom and examine it (fig.4.12)

Fig.4.12. Piece of encoded image zoomed in 40 times

The next step is to print the image, see section 4.3 for more information.

Fig.4.13. Flip image

4.2 Make a multilayer photo

To create a stereo-image from some ordinary picture (see also section 2.7) you can use some predesigned templates.

Start by launching **Triaxes Legend** and loading frames as layers by selecting the **Layers >> Add menu** (hot keys: **Alt+Shift+O**).

In the **Open Files** dialog select files containing your photo and a template, and then move them to the right list by clicking the right arrow button (Fig.4.14).
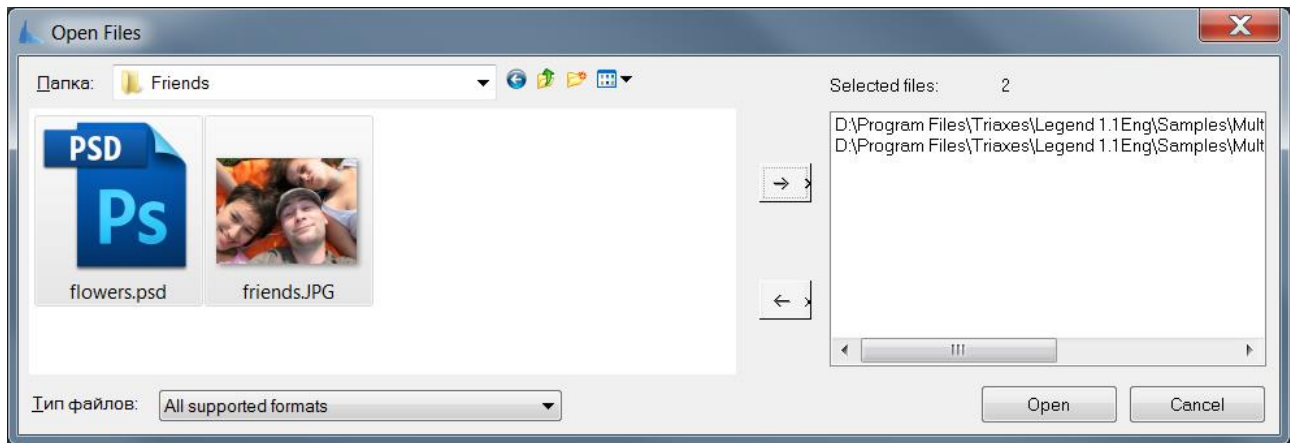
Fig.4.14. **Open files** dialog

After the **Open** button is clicked, a photo and template layers will be displayed in the layers list, on the right side of the screen (Fig 4.15).
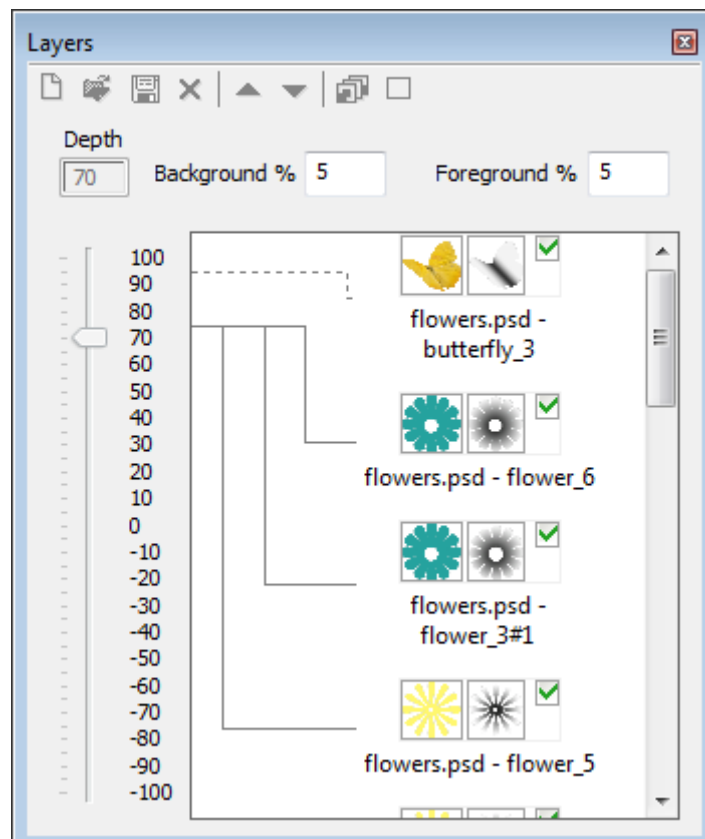

Fig.4.15. **Layers** list

Displayed layers are overlapped in the main window of the program. The green check mark on the right side of the tool bar shows the layers visible in the work area.. Those frames participates in the multilayer image generation.

Arrange layers

To set one of the layers as a background while all the rest are on top of it, we need to move the background image to the bottom of the list. Click the left mouse button on the layer thumbnail image in the list or click on the image itself directly holding **Ctrl** key to activate it (it will be highlighted with red). Then press the «down» button on the toolbar of the **Layers** window to move the layer to a background. Buttons for moving up and deleting a layer are located nearby. After moving the photo down you'll get the necessary arrangement of the layers.
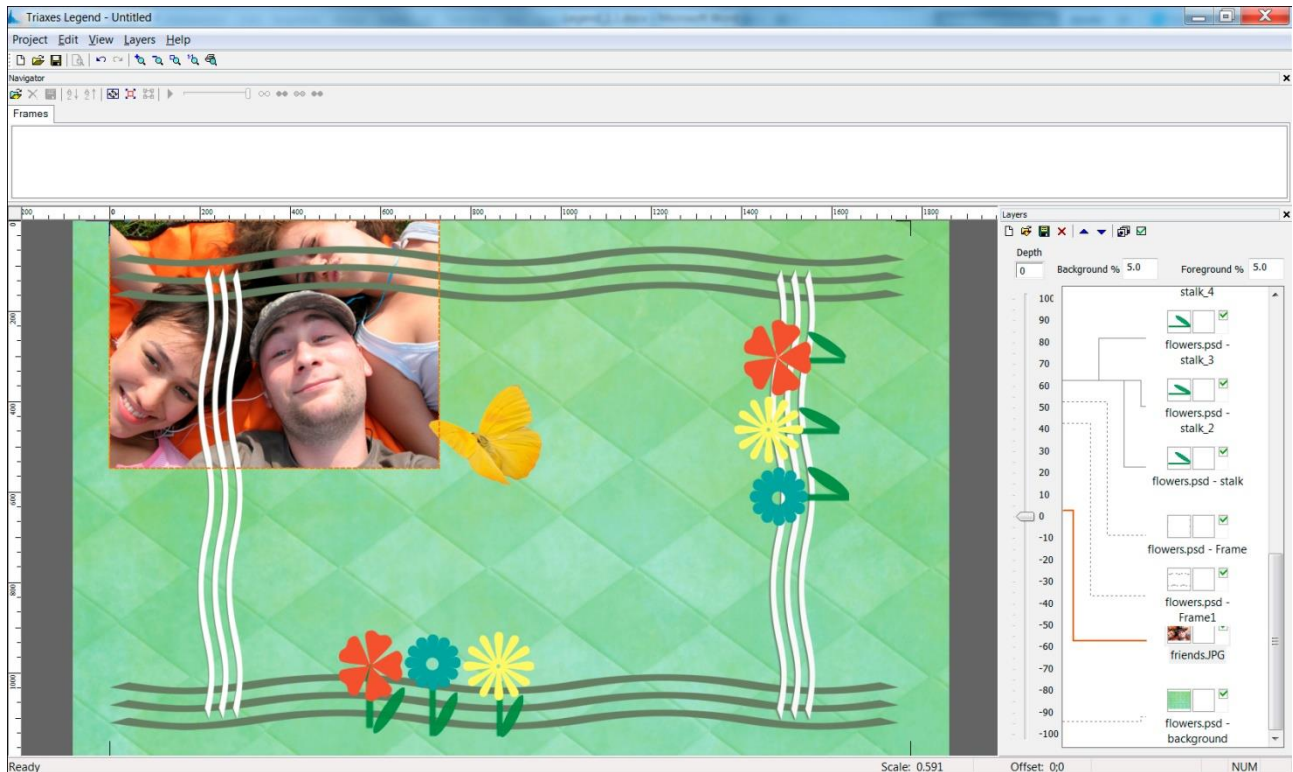
Fig.4.16. Photo is smaller than a template

Adjust image size and position

If a photo is a little bit smaller or bigger than a template, it is necessary to adjust its size to fit the template. Select **Edit >> Transform >> Scale** (hot keys **Alt+S**). The running frame (marching ants) will appear around the selected image.. Press the left mouse button and holding it, adjust new proportions of the image being scaled. Release the left mouse button only when it fits the template. Scaling is done in relation to the center of an image. You can repeat it till get the perfect result.

You can move the layer with the photo closer to the center of the template. Switch to the movement mode by clicking the right mouse button at any place on the screen. Click the photo with the left mouse button and drag it to the desired place, release the button when done. You can change the location of any layer in the same way. Just select it in the list and move to a desired position.

Working with lists in **Triaxes Legend** is similar to working with Windows lists: you can select a group of objects holding **Shift** key, or separate objects by pressing **Ctrl**. To make all layers invisible it is necessary to select an extreme layer Press **Shift** and click the check mark to the right of the layer located on the other side of the list.

Edit >> Transform >> Rotate (hot keys **Alt+R**) allows rotation at user-specified angle.

Repetitive use of scale and rotation operations in **Triaxes Legend** does not cause the loss of image quality. At any stage of editing it is possible to undo or redo the recent actions.

To save the result go to **Project >> Save** project from a menu or press Ctrl+S.

To exit the scaling and rotation mode press **Esc** key or click the right mouse button.

Adjust 3D (stereo) effect

To maintain an amazing 3D depth effect set parallaxes values for foreground and background in the respective fields – **Foreground parallax** and **Background parallax**. Then allocate layers in depth in relation to each other. To do so select a layer from the list and move up or down the depth scale slider.

When we have correctly allocated layers on the canvas and set a relative depth, it is possible to add the depth map for each layer. Right click on the thumbnail image of the layer and select **Load depth map**.
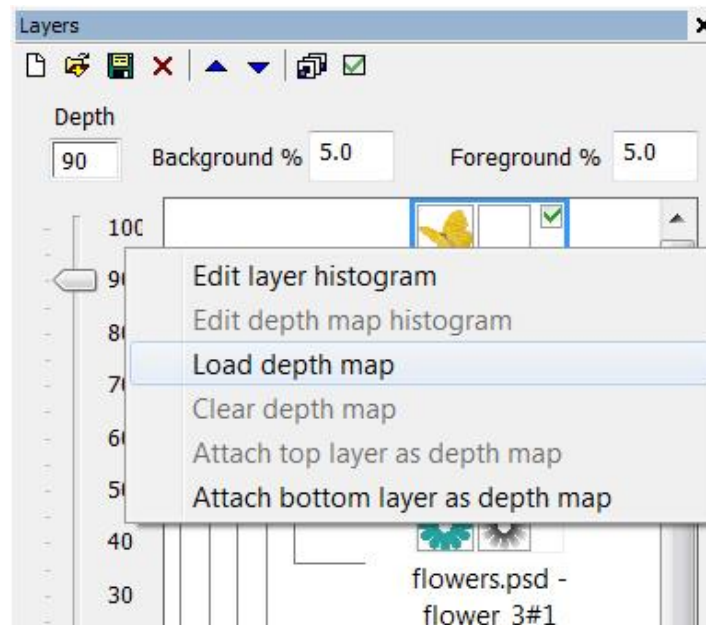

Fig.4.17 **Load depth map**

A depth map can also be added when preparing a template in graphical editors. In this case a depth map will be stored as a separate layer directly in a template. When you open the depth map in **Triaxes Legend** it is necessary to specify the layer it corresponds to. To do so locate the depth map layer below the image layer in the list. Then right click on the original layer thumbnail image and select **Attach bottom layer as depth map**.

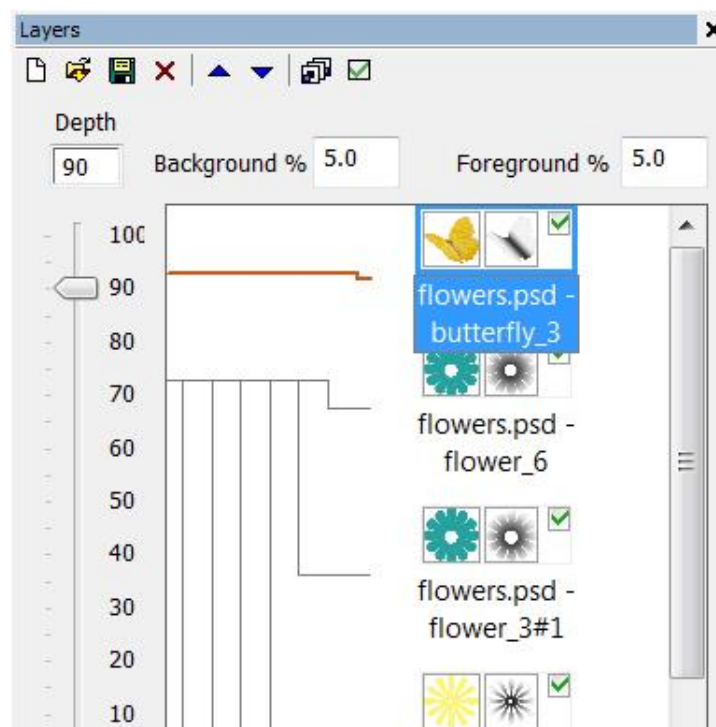As a result, a depth map a thumbnail has to appear to the right of an image icon.

Fig.4.18.List of layers with depth maps

Generate multilayer 3D (stereo) image

The preparation stage is completed. Now it's time to turn to the frame sequence generation process. Select **Layers >> Generate multilayer stereo** (hot keys: **Alt+G**). The **Generate multilayer stereo** dialog appears (Fig.4.19).

Generate multilayer stereo	
Layer names	Depth/Parallax
flowers.psd - flower_6	70 / 3,5%
flowers.psd - flower_3#1	70 / 3,5%
flowers.psd - flower_5	70 / 3,5%
flowers.psd - flower_3	70 / 3,5%
flowers.psd - flower_4	70 / 3,5%
flowers.psd - flower_1	70 / 3,5%
flowers.psd - stalk_6	60 / 3%
flowers.psd - stalk_5	60 / 3%
flowers.psd - stalk_4	60 / 3%
flowers.psd - stalk_3	60 / 3%

☐ Overlapping existing frame
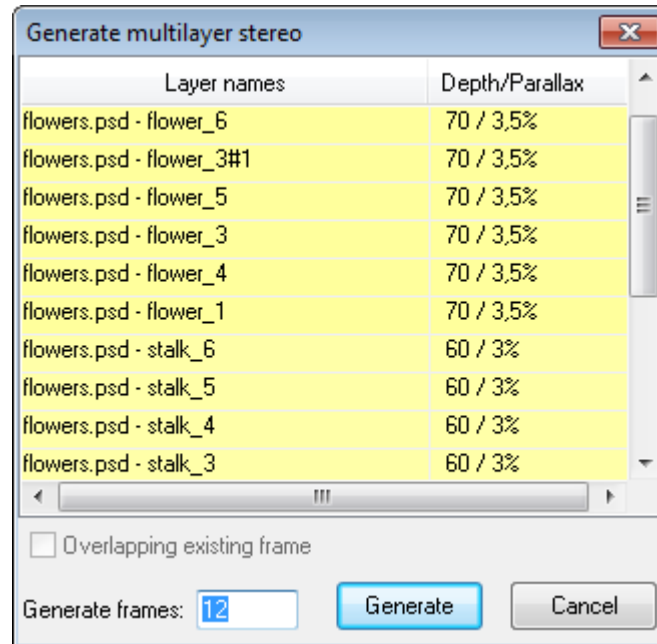
Generate frames: 12   [Generate]   [Cancel]

Fig.4.19. **Generate multilayer stereo** dialog

Depending on the specified parallax, the line in the list will be colored with blue or yellow. Yellow means, that the layer will be "elevated" from the medium plane, blue - that the layer will be depressed. The further away the layer moves from the medium plane the more saturated the color of the list line will become.

In **Generate multilayer stereo** dialog we set the number of frames to be generated and press **Generate**.

If for whatever reason you are not satisfied with the generated frames series (e.g. there was a mistake in parameters), it is possible to undo generation by pressing **Ctrl+Z**, choosing **Edit >> Undo** menu command, or selecting the respective frames and pressing **Delete** key.
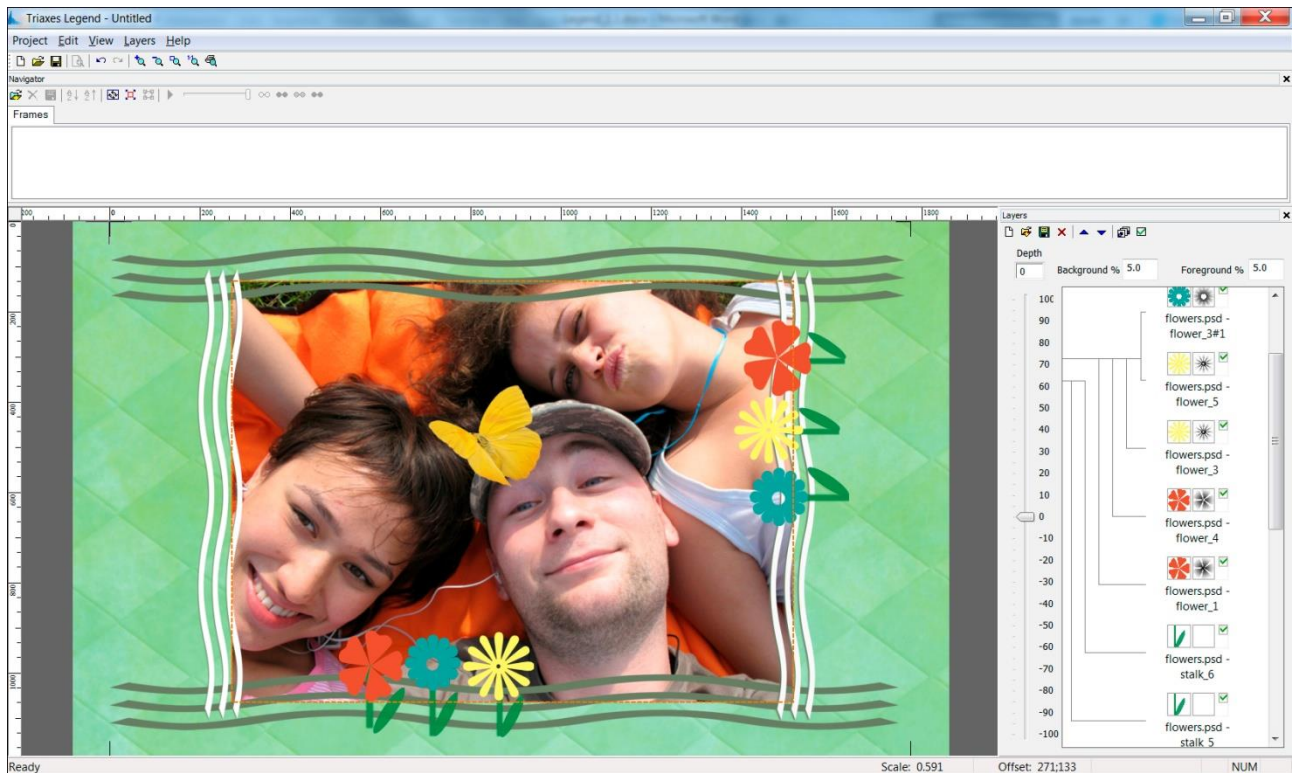
Fig.4.20. Generated frames sequence

Multilayer 3D (stereo) image preview and export

To evaluate the stereo effect quickly you may switch to anaglyph mode and use colored glasses (Fig.4.21).
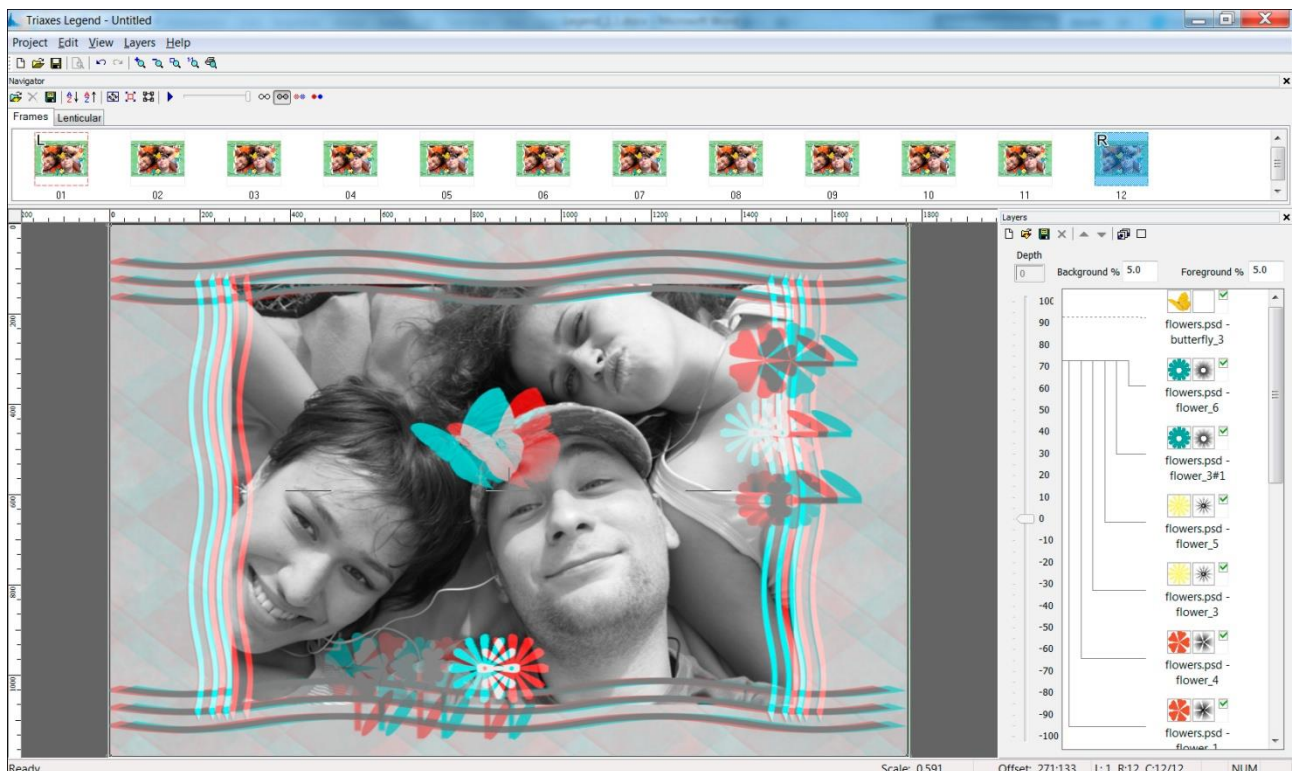

Fig.4.21. Anaglyph view mode for frame series

You can save the generated sequence of frames on disc, with the **Project >> Export frames** menu command.

Generated frames are modeling a multiview stereo photography. The frames are already aligned to each other, so you can switch directly to Frames tab, encode the image and start printing (see section 4.3 for more information).

4.3   Principles of direct printing on the lens

Most plotters for direct printing have special printing software for printing process control. **Triaxes Legend** is intended to generate the encoded image for viewing via lenticular lens. If you're not going to mirror the image with special printing software, don't forget to mark it with a tick **Mirroring** before encoding. To create a file with the encoded image use encoding **To file**.

Fig.4.22. Encoding to file option

Before printing it's necessary to position the lens properly on the printing table in order to match the lens and the encoded bands.

To do so generate the positioning frame and print it on the printing table (fig. 4.23).
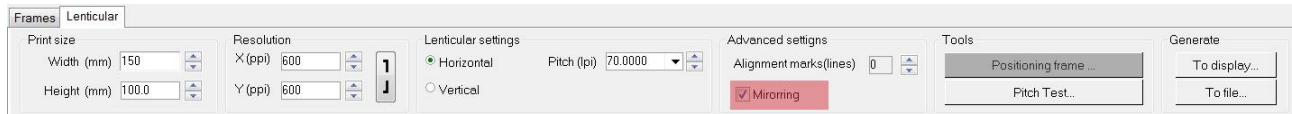

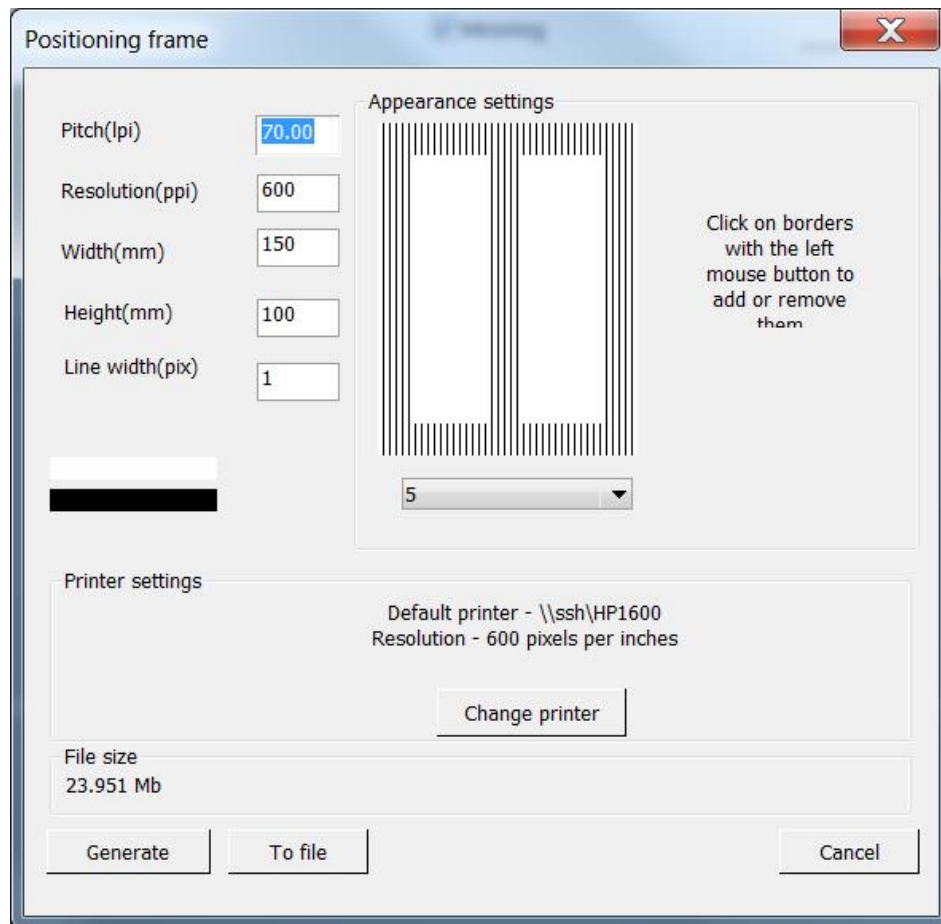Fig.4.23. Calling of Positioning frame dialog

Fig.4.24. **Positioning frame** dialog

Adjust the appearance of the frame in **Appearance settings** block. It's possible to add/remove the borders (up and down, on each side and on center). Use left mouse button.

It's necessary to specify the precise lens pitch, therefore make a pitch test before.

Select the color of frame borders (black or white) for printing on white and black printing tables correspondingly.

The resolution parameter must be equal to the resolution of printing device.

It's possible to **Generate** the frame to display and **To file**. Generate it to file if your plotter has special printing software.

It's important to match the frame and the encoded image origin of coordinates.

Figure 4.25 shows the example of positioning frame printing using Mimaki A3.
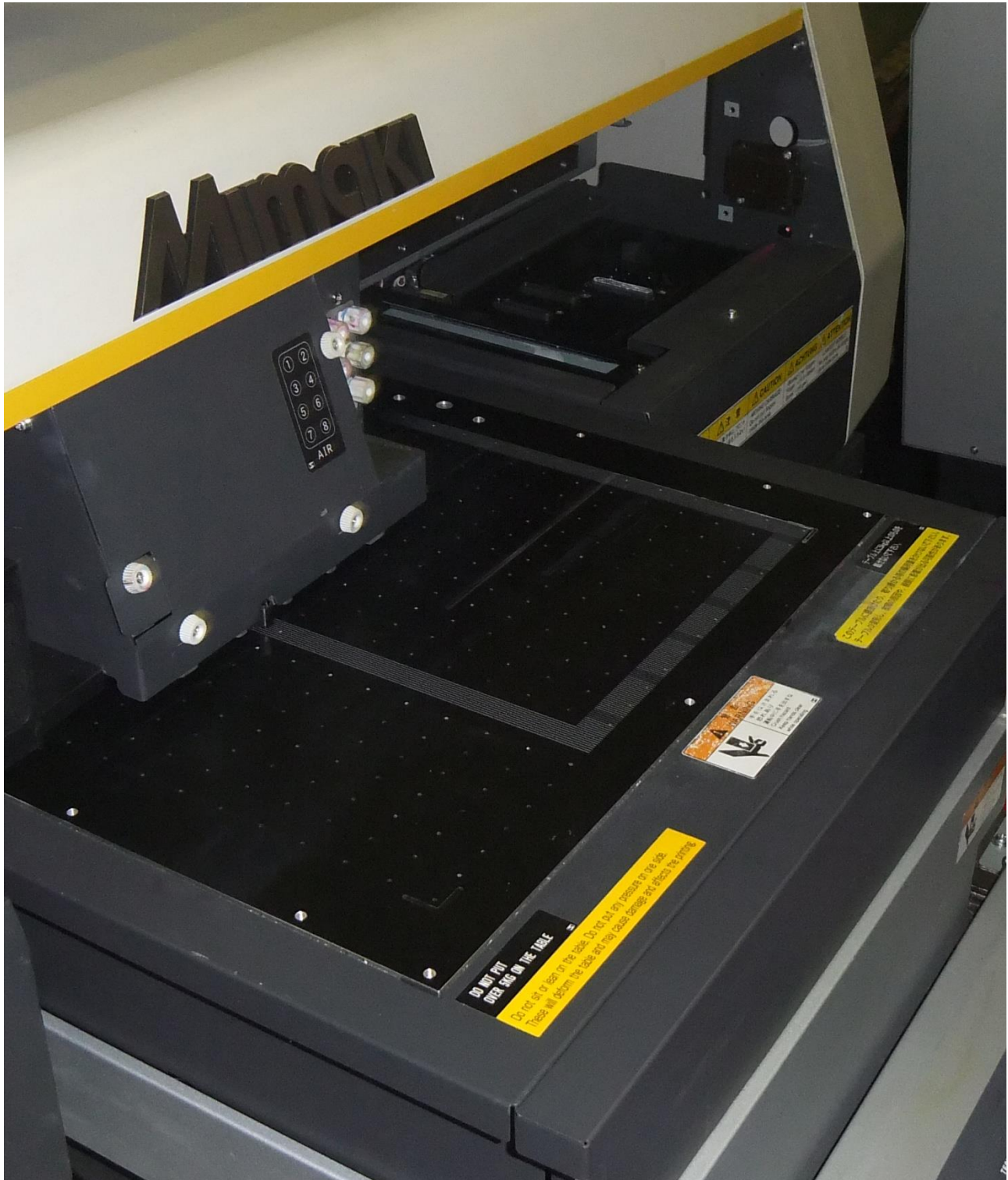

Fig.4.25. Positioning frame printing on Mimaki A3 printing table

Then it's necessary to position the lenticular lens in such a manner as to be able to see all lines without zigzags. To see the lines more clearly you can use additional devices such as lantern or magnifier (fig.4.36).
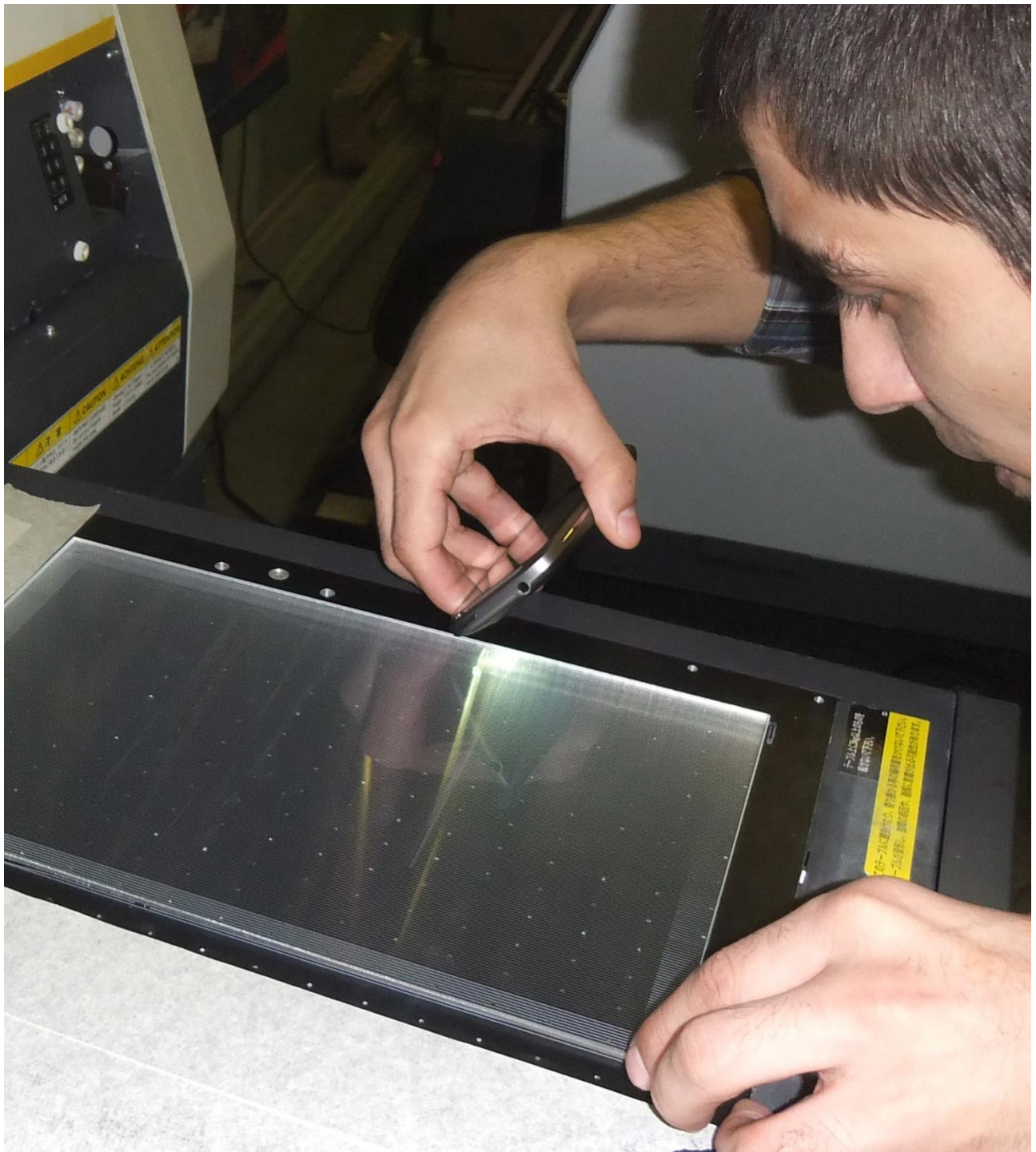
Fig.4.26. Positioning of lenticular lens on a plotter printing table

After positioning it's necessary to switch on a vacuum pump to fix the lens and start printing.