Digital Photogrammetric System

PHOTOMOD

Version 5.21

USER MANUAL

GeoMosaic

RACURS

Table of Contents

1. About

The current User Manual contains information about information of Geomosaic program functionality. This program is designed to merge the georeferenced orthorectified imagery and create the orthomosaic from them. The main part of document contains description the technology of mosaic creation.

2. About program

2.1. Purpose and main definitions

The GeoMosaic program (hereinafter is referred to as “program”) is purposed to create the orthomosaic from georeferenced orthorectified aerial and satellite imagery, splitting of created orthomosaic with the capable of saving sheets in popular raster file formats.

The orthoimage is the image, obtained after the transformation from the central projection to the orthogonal projection with automatic removal of distortions, which were caused by the imaging equipment, elevation angle and relief.

The orthomosaic is the single image, which obtained during the brightness adjustment and merging the multiple georeferenced orthorectified images.

The program uses the following conventions and terms:

- Throughout this User Manual, the source geoereferenced orthoimage is referred to as “mosaic project image” or “source image”.
- Throughout this User Manual, the orthomosaic, created from the source images, is referred to as “output mosaic” or “mosaic”.
- Throughout this User Manual, the *cutline* is *the boundaries of the specified area from the source image*, which will be included in the output mosaic. The vector polygons are used for the cutlines creation. The common boundaries of neighbouring cutlines are completely topologically coincide, i.e. the areas of source images, selected using the cutlines, which are the single area without overlaps and “holes”.
- Throughout this User Manual, the *sheet* is the *output mosaic area*, which is saved in the separate output format file. The vector polygons are used for creation of sheet boundaries.

2.2. Features at a Glance

The program provides the following features:

- The cutlines creation in automatic mode to define the area of the source images, which were be included in the output mosaic;

- The global and local brightness adjustment of areas;
- Smoothing area along the cutlines;
- Merging area in the neighborhood of the cutline by tie points using the correlator;
- Splitting into sheets of mosaic;
- The coordinate system selection, pixel size and sheets export format of output mosaic.

2.3. Input data

The sources data for mosaic creation in the GeoMosaic program are the orthoimages, referenced to the coordinate system, in the files of following formats:

- Tag Image File Format (TIFF) – TIFF и GeoTiff format, included tags for saving of georeference information;
- Windows Bitmap File (BMP);
- VectOr Raster Maps (RSW) – praster formats of PHOTOMOD VectOr program;
- ERDAS IMAGINE (IMG) – ERDAS system raster format;
- NITF (NITF);
- JPEG (JPEG);
- GIF (GIF);
- PNG (PNG);
- USGS DEM (DEM);
- PCIDSK (PIX) – raster format with georeference in the heading developed by PCI Geomatics company;
- JPEG2000 (JP2) – raster format with jpeg compression and georeference in the heading developed[1].

The program also provides the ability to load and process of palette images in TIFF, GIF and BMP files format.

The source images can be placed to resources of the active profile as well as to conventional file system.[2]

[1] The limitation on output file size of JPEG2000 format – no greater then 500 Mb.

[2] See “PHOTOMOD system” User Manual

2.4. Output data

The program provides the supporting of multiple raster formats to export the output mosaic sheets; the program also provides the output formats to export the georeference data. The cutlines, sheet boundaries and tie points, created in the mosaic project, are stored in vector files of internal format. The program supports the multiple import/export formats of vector data.

Table 1. Output data

Output data	File formats	File placement
Mosaic project	X-GMOS internal format	in the active profile resources[2]
Cutlines and tie points (vector data)	X-DATA internal vector format	in the active profile resources[2]
External georeference data for mosaic sheets	• PHOTOMOD GEO • MapInfo TAB • ArcWorld (*.TFW, *.PBW)	in Windows file system
Mosaic sheets (orthoimages)	• TIFF и GeoTIFF (*.TIFF, *.TIF) • Windows Bitmap File (*.BMP) • ERDAS IMAGINE (*.IMG) • NITF (*.NITF) • JPEG (*.JPG, *.JPEG) • PNG (*.PNG) • Microstation (*.DGN) • JPEG2000 (*.JP2) • PCIDSK (*.PIX) • PHOTOMOD MegaTIFF (*.PRF) • VectOr Raster Maps (*.RSW)	in Windows file system

3. Preparation

Define the folder, in which are placed the sources data before the beginning work in the program. The program allows to place the files with the source data in the folders of Windows file system, as well as in the profile resources. Activate this profile when the source images placing in the profile resources.

Supported file formats list of source images see in Section 2.3.

Description of resource system see in the PHOTOMOD system User Manual.

4. Start of work

Do one of the following actions to start the program:

- Choose the **Start › Programs** to select the Geomosaic program.
- Double click the PHOTOMOD Geomosaic icon on the desktop.
- Choose the **Geomosaic** in PHOTOMOD System Monitor context menu in the Windows system tray by clicking the  button.
- Start the PHOTOMOD system and choose the **Service › GeoMosaic**.[3].

5. GUI elements

The GUI contains the following elements:

- The main menu, which contained the all program functionality;
- The main toolbar is used for quick main program functions access;
- The optional toolbars is used for quick miscellaneous program functions access;
- The **2D** window, used for data displaying, contains the following elements:
  - The toolbar is used for the **2D** window modes managing;
  - The work area is used for viewing and processing with loaded data of mosaic project;
  - The navigation bar is used for fast moving on the specified block images area of mosaic project;
  - The Layer manager is used for managing of mosaic project layers;
  - The status bar is used for viewing current real (ground) and pixel marker coordinates and brightness, contrast and gamma data adjustment in the work area.

[3] If the PHOTOMOD system is installed on the workstation.

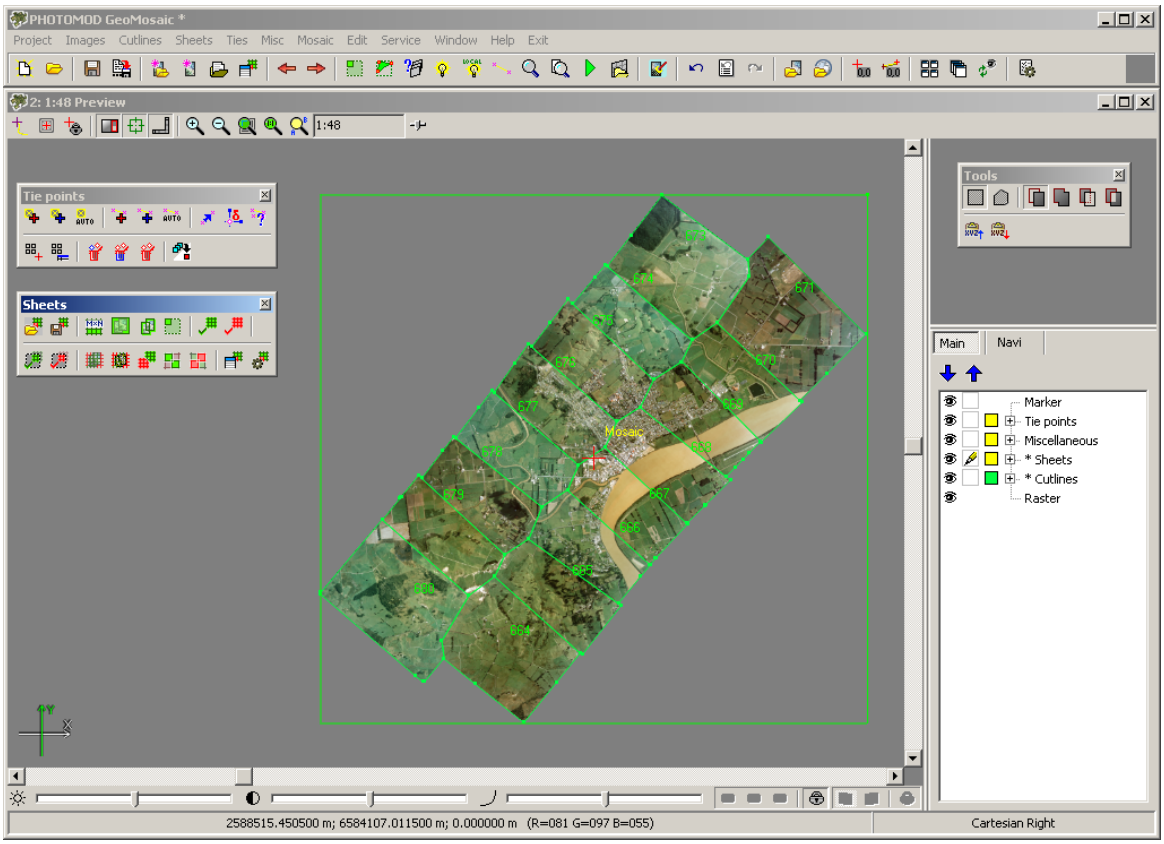

Fig. 1. GeoMosaic

5.1. Brief description of main menu

The program main menu contains the menu items for mosaic creation, vector data processing, additional applications starting and setting parameters.

Table 2. Main menu

Menu	Purpose
Project	The menu is purposed for creation, opening and mosaic project saving, and also obtaining information about project.
Images	The menu is purposed for images block forming of mosaic project.
Cutlines	The menu is purposed for cutlines creation – the vector polygons defining areas of source images, which will be included in output mosaic. The *Cutlines* layer is provided for cutlines creation.
Sheets	The menu is purposed for mosaic splitting – the mosaic areas saving in the separate output format files. The sheet boundaries are specified using vector polygons in *Sheets* layer.

Menu	Purpose
Ties	The menu is purposed for searching and tie points measurement in the cutlines region to adjust the stitching along the neighbour cutlines. Stitching from tie points is provided the images transforming in the specified region. The *Tie points* vector layer is provided for tie points measurement.
Misc	The menu is purposed for additional data viewing: images boundaries (with or without the background), grid of fragments, which is used to gather statistics for local brightness adjustment. All the miscellaneous data are the vector objects and placed on the *Miscellaneous* layer.
Mosaic	The menu is purposed for defining the output parameters of mosaic and creating the sheets of mosaic with saving in output format files.
Edit	The menu is purposed for vector data creating, editing and importing/exporting. See description of menu in “Project processing” User Manual.
Service	The menu is purposed for starting of additional applications and setting of general parameters . See description of menu in “Project processing” User Manual.
Window	The menu is purposed for opening the optional toolbars and windows (new **2D** window, Marker and Measurements windows, Objects attributes window). See description of menu in “Project processing” User Manual.
Help	The menu is purposed for starting of Help system.
Exit	The menu is purposed for closing of GeoMosaic program.

6. Workflow of mosaic creation

Creation of mosaic implies a number of following actions:

1. Gathering of input data (see Section 3).
2. Starting of Geomosaic program (see Section 4).
3. Creating of mosaic project (see Section 7).
4. Loading of images in the mosaic project: adding, viewing and setting of transparency for the input background color of images (see Section 8).
5. Gathering of output raster channels. It specified in the **Mosaic parameters** window on the **Mosaic** tab (see Section 13.2).

6. Defining of the output coordinate system for mosaic and using it for storing of vector data (the cutlines, sheets boundaries and tie points). The output coordinate system for mosaic is defined in the **Mosaic parameters** window on the **Mosaic** tab (see Section 13.2). Use the **Misc** tab to specify the save parameters of vector data in output coordinate system (see Section 13.5).

7. The cutlines creation: automatic cutlines creation (also using the relief from DEM); creating and editing of cutlines (see Section 9).

8. [optional] Adjustment of mosaics area: global and local brightness adjustment, smoothing area along the cutlines (see Section 13.3).

9. [optional] Stitching of the area from the tie points in the cutlines region manually or using correlator in the automatic/semi-automatic modes (see Section 11).

10. Splitting of the images area into sheets and selection for creating of output files (see Section 10).

11. Defining of the output parameters for mosaic creation: pixel size, map scale, file format for the mosaic sheets and etc. (see Section 13.2 and Section 13.4).

12. The mosaic creation (also in the distributed processing mode) with saving of the mosaic sheets in the files of selected format (see Section 13.6).

7. Mosaic project creation

Choose the **Project › New** or click the button to create the mosaic project. The four clear vector layers: *Tie points*, *Miscellaneous*, *Sheets* and *Cutlines* are created automatically and displayed in the Layer manager.

7.1. Project menu

Table 3. Brief description of Project menu

Project menu	Purpose
New	This menu item is used for creation of the new mosaic project
Open	This menu item is used to open the saved mosaic project from file with the *x-gmos* extension in the resources of active profile
Save	This menu item allows to save the opened mosaic project in the file with the same name and the *x-gmos* extension in the resources of active profile
Save as	This menu item allows to save the opened mosaic project in the new file and the *x-gmos* extension in the resources of active profile
Statistic	This menu item is used to open the window with information about selected project

8. Loading images in the mosaic project

The step forming of source images block follows after the mosaic project creation. It implies a number of following actions:

1. Loading source images and forming block images of mosaic project.
2. Setting transparency for the background color of source images to exclude the background from the output mosaic.

The current section contains the following descriptions:

- Modes of the loading source images;
- View images;
- Setting of the source images background color;
- Editing of the block images;
- Working with the list of images;
- Brief description of the **Images** menu.

8.1. Adding images

Depending on the source images placement the following modes of the loading images in mosaic project are possible:

- Adding images from the resources of active profile;
- Adding images from the Windows file system.

Irrespectively of the source images placement the following modes of selecting raster images to load in project are possible:

- Selection of images manually;
- Automatic selection of supported raster files in the specified folder and its subfolders (optional).

Automatic selection is recommended when large number of source raster files are located in the folder along with files of other formats, and/or when source images are located in several subfolders of the selected folder.

Besides, images may be added via list of filenames stored in a text file:

The **Images** menu allows to load images in the project.

Table 4. Adding images in mosaic project

Modes of loading images	Actions
Adding source images from the resources of the active profile.	Choose the **Images › Add images (resources)** or click the button. The **Open** resource dialog opens. Select the images manually using the **Shift** and **Ctrl** keys. Click the **Open** button.
Adding source images from a resource folder.	Choose the **Images › Add images (resources) from folder**. The **Add images from folder** window opens. Click the ... button. The **Browse for folder** window opens. Select the folder, which contains the sources images, and click OK to return to the **Add images from folder** window. The path to selected folder is displayed in the **Folder** entry field. Check the **Search in subfolders** for searching the raster images in subfolders of selected folder. Click OK for automatic search of raster images in the specified folder and adding them to the mosaic project.
Adding source images from the resources of the Windows file system	Choose the **Images › Add images (files)** or click the button. The **Open** resource dialog opens. Select the images manually using the **Shift** and **Ctrl** keys. Click the **Open** button.
Adding source images from a file system folder.	Choose the **Images › Add images (files) from folder**. The **Add images from folder** window opens. Click the ... button. The **Select folder** dialog opens. Select the folder, which contains the sources images, and click OK to return to the **Add images from folder** window. The path to selected folder is displayed in the **Folder** entry field. Check the **Search in subfolders** for searching the raster images in subfolders of selected folder. Click OK for automatic search of raster images in the specified folder and adding them to the mosaic project.
Adding source images from text file, which contains the file names list of images.	Choose the **Images › Add images from files list**. The **Open** window opens. Select the text file containing the list of source image filenames (each including full path). Click the **Open** button.

8.2. Images preview

To view added images in the **Preview** window choose the **Mosaic › Preview** or click the button. By default, added images are shown immediately in the **Preview** window.

To open added images automatically in the **Preview** window during their adding to mosaic project, set the **Open preview immediately** option (seeSection 14.1).

All mosaic project images are inscribed into rectangular raster of predefined color, which is called *mosaic background color* later on. This color is visible on output mosaic sheets. It is black by default, but it is not shown in the **Preview** window (it is transparent for convenience).

You should set the **Transparent mosaic background on preview** option in the **Preview** window to manage mosaic background color *visibility* (seeSection 14.1).

Use the **Background color** option to select mosaic background color (see Section 13.2).

Moreover, mosaic project images have their own background color (near images edges), which is called *images background color* later on. For correct images binding during mosaic creation you should exclude this background, i.e. setup the transparency of images background color (see Section 8.3).

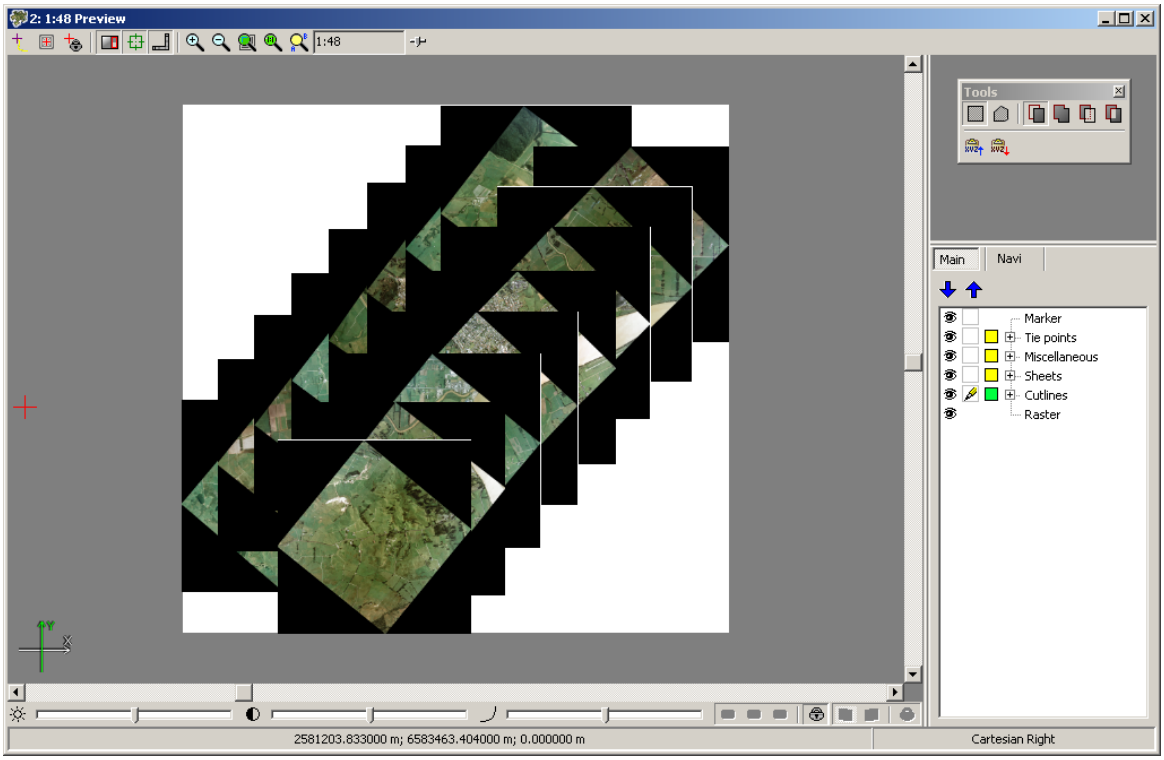

Fig. 2. Mosaic background color (white) and images background color (black)

Use the , buttons for viewing one of the mosaic project images in a separate **2D** window.

There are two ways for viewing one or several of the mosaic project images in a separate **2D** window:

1. Choose the **Misc › Source images outlines** to create images borders in the *Miscellaneous* vector layer (see Section 13.5). Select images borders and then choose the **Images › Open selected**.

   To select several images drag rectangle along with pressed **Shift** key and using one of group selection tools on the **Tools** panel.

2. Choose the **Images › Project images list** to open the **Images list** window. Select images in the list and click the button.

To select several images in the list use **Shift** and **Ctrl** hot keys, and selection tools in the **Images list** window (see Section 8.5).

Choose the **Mosaic › Open image** (duplicated by the button) and select the image in the file system folder for viewing the *any* georeferenced orthoimages of the supported raster format in the separate **2D** window.

Choose the **Images › Create pyramids** for creating the overview pyramid. That overview pyramid helps to speed up the rasters viewing in the 2D window. The pyramids are saved to the files with the *.pyr extension in the Pyramid folder.

8.3. Setting background color of the images

Setting transparency of loaded images is the next stage after the forming of block images. It provides correct stitching of images during the creation of output mosaic. Do the following actions for setting background color of images:

- Specify the background color of source images. If the background color is not uniform, set the **Source rasters background color range** option (see Section 13.2);
- Set the transparency of the input background color.

Table 5. Setting of images background color and transparency

Images background color	Actions
White background color of source images	Choose the **Images › Transparent color: white**. The block of images in the **Preview** window will be updated considering the transparency setting applied to the white background.
Black background color of source images	Choose the **Images › Transparent color: black**. The block of images in the **Preview** window will be updated considering the transparency setting applied to the black background.
All images have another (not white or black) or different background colors	Select one of two ways: 1. Choose the **Images › Transparent color: auto** to assign automatically images background color and set up transparency to all mosaic project images. 2. Choose the **Images › Project images list** (duplicated by the button) to set up the background transparency to images selected in the **Images list** window. Select the images in the list and click the button to define the images background color (see detailed description in

Images background color	Actions
	Section 8.5). This background transparency setting is applied after closing the **Images list** window.

Choose the **Images › Transparent color: none** to cancel transparency setting for images background color.

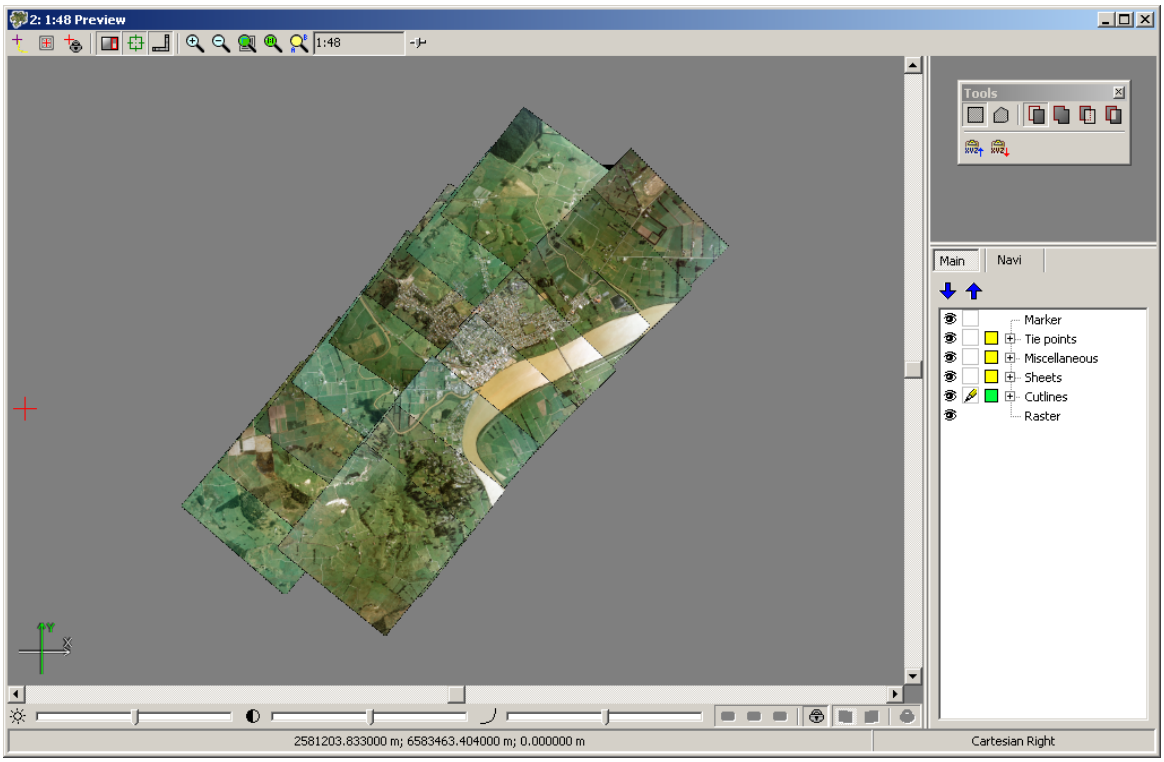

Fig. 3. Setting transparency for images background color

8.4. Processing of block images

The option for deleting of selected images is provided to edit the images block. Perform the following actions to delete the images from the mosaic project:

- Select the image in the **Preview** window. Choose the **Images › Delete selected images**.

  Perform the following actions to select the images:

  - Choose the **Misc › Source images outlines** to create the edges of the images on the *Miscellaneous* layer.
  - Select the images boundaries using the group selection tools of the **Tools** panel.

- Choose the **Images › Project images list**. The **Images list** window opens. Select the images in the list and click the button.

  Use the hot keys and tools of the **Images list** window to select the several images in the list (see Section 8.5).

The program also provides an option for deleting images not falling within frames of active sheets (see Section 10). If necessary, the images not falling within frames of active sheets can be deleted. Choose the **Images › Delete images outside active sheets** to do this.

8.5. The Images list window

The **Images list** window is provided to view and edit the images list of mosaic project. Choose the **Images › Project images list** or click the button to open the **Images list** window.

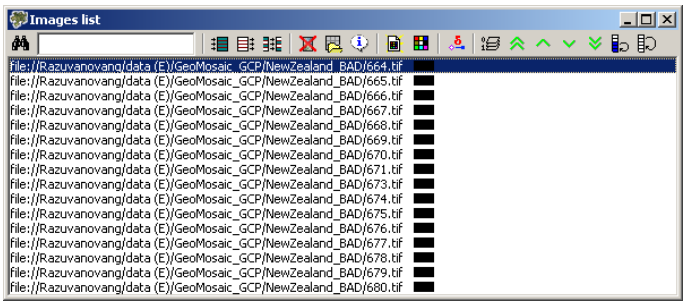

Fig. 4. The Images list window

The images list of mosaic project is displayed in the main part of window. Each line of the list contains the full path to a file and input background color for that file. The toolbar for working of the images list is located in the top part of window.

Table 6. Functions overview of the Images list window

Purpose	Actions
Searching images in the list by name	Enter the filename or part of the file name in the entry field. Click the button for searching of the image.
Selecting images in the list	Images may be selected by the mouse click. Use the **Shift** and **Ctrl** hot keys to select several images in the list, as well as the standard tools for selecting lines of the list: (**Select all**), (**Unselect all**), (**Invert selection**).
Deleting of the selected images	Select the images and click the button. Close the **Images list** window to refresh the block images in the **Preview** window.
Opening of the selected images in the separate 2D windows.	Select the images and click the button.

Purpose	Actions
Obtaining information about the selected image	Select one image and click the button. The **Statistic** window opens. It shows the information about the selected image.
Canceling transparency of the selected images background color	Select the images and click the button. Close the **images list** window to cancel the transparency of the selected images background color in the **Preview** window.
Setting transparency of the selected images background color	Select the images. Define the input background color of the selected images. Click the button. The **Color** window opens. Select the input background color in the palette of the main or additional colors or click the **Define color** button to select the other color. Click OK. The input background color of the selected images is displayed in the **Images list** window list. Close the **Images list** window to apply transparent background color of the selected images in the **Preview** window.
Showing tie points residuals of the selected image	Click the button to show error vectors for selected image in case of stitching by tie points (see Section 11).
Change images order for mosaic creation without cutlines	Change of images order in the list results in images block rebuild in the **Preview** window (only in no cutlines case). If you would like to restore the initial images order after its rearranging click the button. To move selected images to the top of the list click the button, to the bottom – , step up – , step down – . To invert order of the selected images or images groups (“mirror-like”) click the button. To invert order of all images click the button.

8.6. Images menu

Table 7. Brief description of Images menu

Images menu	Purpose
Add images (files)	This menu item is used for the selecting image files, locating in the Windows file system, and adding to mosaic project.
Add images (resources)	This menu item is used for selecting image files, locating in the resources of active profile, and adding to mosaic project.
Add images (files) from folder	This menu item is used for automatic selection of all images from the specified folder of Windows file system and adding to mosaic project.
Add images (resources) from folder	This menu item is used for automatic selection of all images from the specified folder of active profile and adding to mosaic project.
Add images from files list	This menu item allows to use the text file, containing the full network paths to the images (useful when

Images menu	Purpose
	the project files are located in different local and network folders), for adding the images to mosaic project
Delete selected images	This menu item allows to delete the selected images from mosaic (choose the **Misc › Source images outline** to select images along with pressed the **Shift** key)
Delete images outside active sheets	This menu item allows to delete the images outside active sheets from mosaic (see Section 10)
Project images list	This menu item allows to open the added images list for editing list, search images by name, view the selected image and its properties; define images background color; show tie points residuals
Open selected	This menu item is used to open in separate **2D** windows those images, with highlighted boundaries (see Section 13.5)
Check source images	This menu item is used for the checking of the project images (the file presence, georeference data presence, the correct file format)
Images › Transparent color: auto	Allows to assign images background color automatically (including also different background colors of different project images) and to set up transparency
Images › Transparent color: white	This menu item allows to set the transparency for the white images background color
Images › Transparent color: black	This menu item allows to set the transparency for the black images background color
Images › Transparent color: none	Allows to cancel transparency setting for images background color
Create pyramids	This menu item allows to create the overview pyramid set for the fast images refreshing on screen (the pyramids are saved in the files with the *.pyr extension in the Pyramid folder during this process)
Delete pyramids	This menu item allows to delete all pyramids, created for loaded images (all pyramids are deleted from the Pyramid folder during this process)

9. Cutlines creation

The stage of cutlines creation (vector polygons defining the images area, which will be included in output mosaic) follows after the forming the block images of the mosaic project. The *Cutlines* vector layer is provided for cutlines creation. Combination of automatic and manual cutlines creation means, optional use of DEM, as well as definition of the cutlines type by attributes provide high quality the stitching of the areas during the output mosaic creation. Performing the following steps is recommended for the cutlines creation:

1. Automatic cutlines creation.

2. Editing cutlines: manual editing of vector polygons and their attributes in the *Cutlines* layer.

Current section contains the following information:

- Requirements of the cutlines creation;
- Automatic cutlines creation;
- Creation/editing cutlines;
- Obtaining information about cutlines and using attributes of the *Cutlines* layer;
- The import/export of the cutlines;
- Brief description of the **Cutlines** menu.

9.1. Requirements of the cutlines creation

There are following rules to go by when creating the cutlines for building of the high quality mosaic:

- Cutlines should not have intersections and self-intersections. The common boundaries of the neighbour cutlines should be fully correspond. I.e. all areas of the source images, outlined by cutlines, form one united coverage without overlaps or holes.
- It is not recommended to draw cutlines over elevated objects (bridges, buildings, utility poles, etc). Otherwise, these objects may be lost or appear distorted in the output mosaic.
- It is not recommended to draw cutlines along extended objects (for example, along road, forest edge), i.e along brightness edges on the images. Otherwise, the blur may appear in the resulting mosaic. It is recommended either to intersect the extended objects at angle close to the direct or create the cutline at the sufficient distance from the edge of extended objects.
- It is desirable that the statistics got the necessary information on each color channel to prevent the abnormal brightness areas during the local brightness adjustment. Thus it is recommended to draw the cutline so that it passes through areas of different color, or it may as well be drawn along the line separating such areas, but far enough from it.

9.2. Automatic cutlines creation

It is recommended to create cutlines in automatic mode. The program provides two algorithms of automatic cutlines creation: Voronoy diagram, and more detailed algorithm which consider DEM data, if any. We recommend to use at the beginning fast method (Voronoy diagram). If you are satisfied with the cutlines quality created by this method, edit the cutlines in vector objects drawing mode. Otherwise, apply detailed algorithm of cutlines creation, which is specially recommended for images with urban or rural building, since in this case cutlines are created bypassing separate objects (houses) and crossing roads at the right angle.

Perform the following actions for automatic cutlines creation:

1. Choose the **Cutlines › Build**. The **Cutlines creation parameters** window opens. Click the **Show advanced parameters** button to open parameters of detailed algorithm.

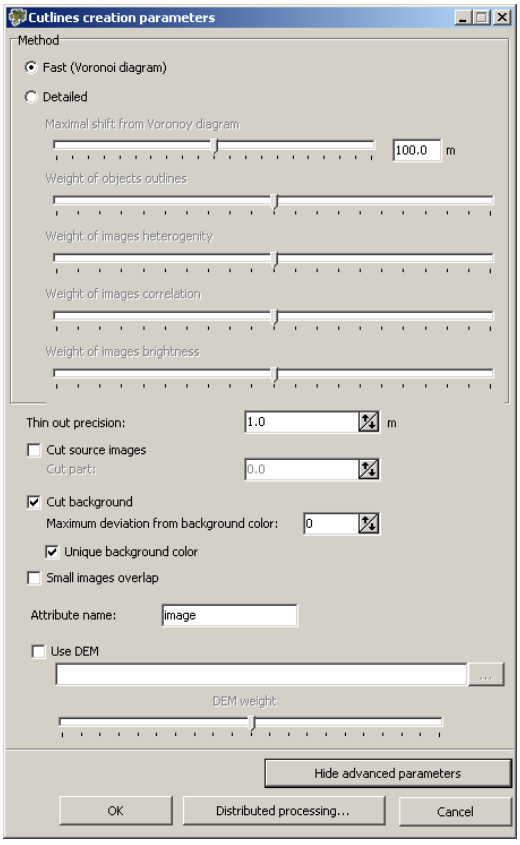

Fig. 5. Parameters of automatic cutlines creation

2. Select the algorithm of automatic cutlines creation and define the additional parameters.

Table 8. Description of parameters of the automatic cutlines creation

Parameter	Purpose
Fast (Voronoy diagram)	This parameter allows to select the algorithm of Voronoy diagram for automatic cutlines creation. Creating cutlines by this method consists in splitting all the project area into polygons based on proximity to nadir points or, if the latter are not given, to image centers.
Detailed	This parameter allows to select more fine algorithm for automatic cutlines creation. In this case edges of Voronoy's diagram, belonging to two different images, are replaced by broken lines, which provide optimal images joining. You can also adjust the following settings. Non-dimensional **Maximal shift from Voronoy diagram** parameter (from zero to one): at zero value you will get Voronoy diagram, if the value is one – maximal area is used for cutlines creation. This algorithm allows to calculate estimation function on images. Cutlines are created on lines in such a way, that maximal value of this function on them is minimal among all possible lines (minimax method). The function consists of several summands, with specified weight (from zero to one) each. The **Weight of objects outlines** parameter allows to avoid separate objects (houses) during cutlines creation or to cross them at the right angle (in case of roads). This parameter has the maximal value on objects' outlines. The **Weight of images heterogeneity** parameter allows to avoid small cities and settlements during cutlines creation, including also urban blocks, since at certain pixel size settlements look more heterogeneous, comparing with forested areas, agricultural fields, etc. The **Weight of images correlation** parameter: the bigger the differences of point's neighborhood on adjacent images, the bigger this component for each point. The **Weight of images brightness** parameter is used for cutlines creation in darkened areas of images, where human eye is less receptive to images inconsistency.
Thin out precision	This parameter allows to define the thin out coefficient of polylines. Polylines with segment length of 1 pixel appear in the process of creation. Then, they are thinned out so that the thinned lines were deviated from the sources by not more than the specified value (in meters on the ground).
Source images cutting	This parameter allows to exclude the edges of the image during the cutlines creation. The size of the edge images (in fractions) is determined

Parameter	Purpose
	by the value in the **Cut part** entry field during the cutting.
Background cutting	This parameter allows to exclude the edge images with input background color during the cutlines creation, i.e exclude the no-data areas of images (cut edge of film images or areas during the previous stages). The background color is defined automatically, cutting edge is performed from the polylines. The value in the **Maximal shift from background color** entry field allows to specify the background color range of images. I.e, if the color of any pixel is different from the calculated background color no more than the specified value, then this pixel is also part of the background color.
Unique background color	This parameter allows to take into account the uniqueness of image's background color while creating cutlines. This checkbox should be activated if there are no pixel having background color.
Small images overlap	This parameter allows to take into account the small overlap images while cutlines creation. This checkbox should be activated if project images have insufficient overlap.
Attribute name	This parameter allows to define the attribute name of vector object (cutline) containing full network path to image.
Use DEM	This parameter allows to take into account while creating cutlines (if DEM is present). Using DEM is recommended for mountain terrain imagery. It is not recommended to use the DEM for the urban area.

3. Click OK. The process of cutlines creation starts. The vector polygons are created in the *Cutlines* layer after the process completion. The *Cutlines* layer becomes editable and marked by asterisk, this means that the layer has been edited but not saved. Created cutlines are displayed in the **Preview** window.

4. Perform the following actions:

   - If necessary, modify the parameters of cutlines creation and/or edit the cutlines considering thecutlines requirements and data peculiarities (areas or objects) in the mosaic images (see Section 9.4).

   - Choose the **Cutlines › Save** to save the created cutlines in the internal file format of the active profile resources. Choose the **Edit › Export** to export the cutlines into other formats (see Project processing User Manual).

9.3. Cutlines creation in distributed processing mode

The Distributed processing mode provides the saving of time while cutlines creation by making optimal use the hardware computing capacity. This mode is recommended to use in case of large volume of source images in the mosaic project.

Perform the following actions to create cutlines in distributed processing mode:

1. Define the structure and role of the workstations to participate in distributed processing. Detailed description of distributed processing mode organizing see in PHOTOMOD System User Manual.

2. Choose the **Cutlines › Build**. The **Cutlines creation parameters** window opens.

3. Choose the auto cutlines creation algorithm and define the additional parameters (see parameters description in Section 9.2). Click the **Distributed processing** button. The **Cutlines distributed processing** window opens.

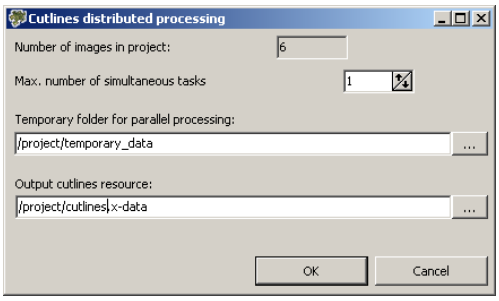

Fig. 6. Cutlines distributed processing parameters

4. Define the number of tasks, folder of temporal data, name and placing of vector file for cutlines storing.

Table 9. Description of cutlines creation parameters in distributed processing mode

Parameter	Purpose
Number of images in project	Field displaying the number of source project images.
Max. number of simultaneous tasks	Entry field for defining tasks number on which the process of cutlines creation will be divided.
Temporary folder for parallel processing	Entry field for defining the folder in the resources of active profile for temporary data storing. The ... button is used for folder selecting or new folder creating in the resources of active profile.
Output cutlines resource	Entry field for defining placing and the name of output vector file for storing cutlines in the resources of active profile. The ... button is used for selecting of folder and file name.

5. Click OK. The process of cutlines creation starts. After its completion, the output vector file with cutlines will be created in the specified folder. Created cutlines are added into the *Cutlines* layer and displayed in the **Preview** window.

9.4. Editing cutlines

The following options are provided for cutlines editing:

- Deleting all created cutlines, i.e all vector objects from the *Cutlines* layer by choosing **Cutlines › Clear**.
- Manual editing/drawing vector objects (see Project processing User Manual).
- Editing of attribute values for cutlines: cutline's name, type, etc. (see Section 9.5).

9.5. Using attributes of Cutlines layer

The attributes of *Cutlines* layer attributes extend the capabilities of editing cutlines. Basing on file attributes, the cutline gets the name and the area type of cutline is defined: area with current image, transparent area for using another image; area with filling by background for blurring of some terrain objects. In the case, where the imported objects have another attributes, the capability of setting attributes provides the correct import of cutlines, created in other programs.

The *Culines* layer has following attributes by default:

- *image* – the filename image attribute;
- *image_title* – the cutline name attribute;
- *rgn_type* – the cutline type attribute;
- *ref_image_name* – the filename of reference image attribute.

Choose the **Cutlines › Parameters** for viewing and editing of the attribute's name. The **Cutlines parameters** window opens. Select the name in the list or specify the new attribute name using the ... button to modify the attribute name. Modifying attributes name may be required during the importing cutlines to coordinate the attributes of imported objects and attributes of the *Cutlines* layer (see description of the vector data import in the Project processing User Manual).

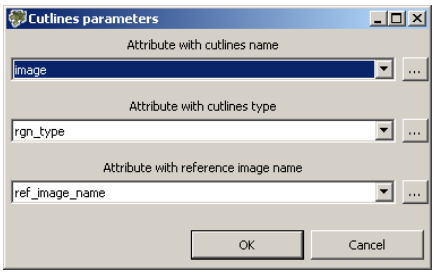

Fig. 7. Attributes of the Cutlines layer

Perform the following actions to obtain the information about cutline and edit attributes value of selected *cutline*:

- Select cutline in the **Preview** window by double click;
- Choose the **Cutlines › Cutline info**. The **Cutline info** window opens.

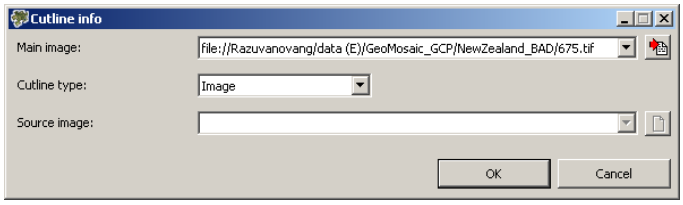

Fig. 8. The attributes value of cutline

Window contains the following entry fields:

- Reference to the **Main image** is contained in the *image* attribute.

  Full path to file associated with the cutline is shown in this entry field by default. Open the list, which contains all mosaic project images, to modify the field value. Click the button on the right to return to the current image.

- Reference to the **Cutline type** is contained in the *rgn_type* attribute.

  The type of cutlines area is defined in this entry field. Use the list contained the follows: **Image**, **Transparent**, **Background** to choose the type of cutline area. Choose the **Image** in the list to use in the cutline area of main image. Choose the **Transparent** type to make the cutline area transparent. It is possible to use the reference image, falling within cutline area, in the transparent cutline area. Choose the **Background** to fill the cutline area by background. As the background is used the output background color, defined in the parameters window of output mosaic (see Section 13.2).

- Reference to the **Source image** is contained in the *ref_image_name* attribute.

Full path to reference image file, falling within cutline area, is specified in this field. Using reference image is available in the transparent cutline area only; i.e the **Source image** field is available in the case if the **Transparent** value is specified in the **Cutline type** field. Open the list, containing all mosaic project images, to select the reference image. Click the button on the right to delete the value from the entry field.

Perform the following actions to view and edit the attributes value of selected cutline:

- Select the cutline using double click in the **Preview** window;
- Choose the **Window › Objects attributes** or click the button in the **Vectors** toolbar. The **Object attributes** window opens.

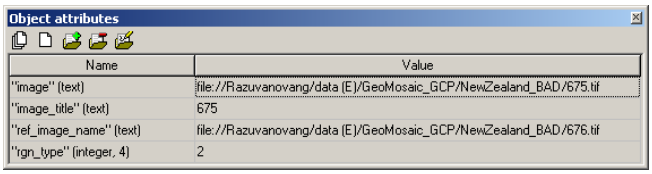

Fig. 9. Cutlines attributes

The following attributes are provided:

- *image* – full path to the main image file;
- *image_title* – cutline name (is generated automatically from the filename of source image);
- The following values of cutline area type are allowed for the *rgn_type* :

  1– The main image in the cutline area

  2 – The transparent area

  3 – The background in the cutline area

- *ref_image_name* – full path to reference image file, provided that the cutline area is transparent, i.e *rgn_type*=2.

9.6. Cutlines menu

Table 10. Brief description of Cutlines menu

Cutlines menu	Purpose
Clear	This menu item allows to delete the cutlines, i.e completely clean the *Cutlines* layer (without closing of this layer)

Cutlines menu	Purpose
Open	This menu item allows to open the cutlines, previously saved in the vector file with *.x-data extension in the resources of active profile.
Save	This menu item allows to save the cutlines in vector file with the previously defined name and the *.x-data extension in the resources of active profile.
Save as	This menu item allows to save the cutlines in new vector file with the *.x-data extension in the resources of active profile.
Build	This menu item allows to specify the parameters of automatic cutlines creations and start the process of cutlines creation; The vector polygons are created in the *Cutlines* layer after the cutlines creation process is complete.
Compute in distributed mode	This menu item allows to specify the parameters of auto cutlines creation and run the process of cutlines creation in distributed processing mode. After its completion, the vector polygons are created in the *Cutlines* layer with saving into the specified file in the resources of active profile.
Parameters	This menu item allows to redefine the attributes of the *Cutlines* vector layer
Cutline info	This menu item is used for viewing and editing attribute values of the selected cutline
Check cutlines	This menu item is used for checking the correspondence between cutlines and project images.

10. Splitting into sheets

The program allows cutting the output mosaic into sheets for saving them in the separate files of output raster formats. On the other hand existence of at least one sheet covering all or part of the block is required for creating the mosaic. The *Sheets* vector layer is provided for the creation of sheets boundaries. The program provides the different splitting options, the capability of sheets selection for creating output files and setting output parameters.

Throughout this User Manual, the *Active sheet* is referred to as sheet, from which the output mosaic file will be created. The sheet status is defined by the attributes value of sheets status.

It is recommended to pass the following number of actions during the mosaic sheets creation:

1. Definition of the mosaic output coordinate system (see description of the **Output coordinate system** panel in Section 13.2).

2. Splitting block images into sheets, i.e creating sheets boundaries (the vector objects with the attributes for storing information about sheets in the *Sheets* layer).

3. Editing attribute values and sheets boundaries.

4. Managing sheets status.

5. Setting output parameters of sheets.

6. Creating output sheets of mosaic (see Section 13.6).

To create mosaic sheets use the **Sheets** menu or the **Sheets** toolbar, that provide a quick access to sheets creation operations. To open the **Sheets** toolbar choose the **Window › Toolbars › Sheets**.

The current section contains following information:

- Mosaic splitting methods:
  - splitting into sheets by the specified parameters;
  - creating a single sheet covering all block images;
  - splitting into sheets by the images;
  - creating a single sheet with an arbitrary boundaries for any block images area;
  - standard and custom splitting;
- Editing attribute values of the Sheets layer and sheets boundaries;
- Managing sheets status;
- Setting output parameters of sheets;
- Brief description of the **Sheets** menu.

10.1. Splitting into sheets by the specified parameters

This mode allows splitting specified area of block images in accordance with specified number of sheets and/or sheet size.

Perform the following actions for splitting block images into sheets by specified parameters:

1. Choose the **Sheets › Sequential splitting** or click the  button in the **Sheets** toolbar. The **Sheets splitting parameters** window opens.

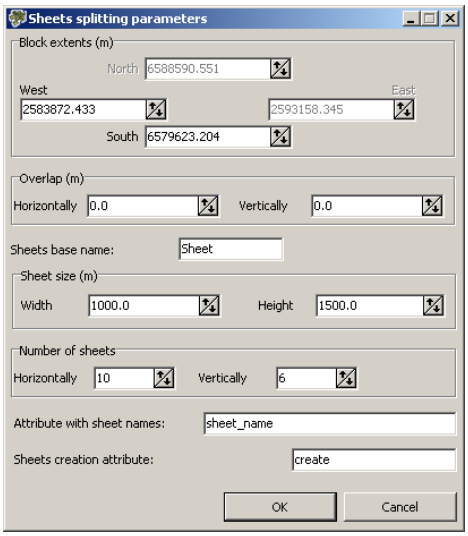

Fig. 10. Parameters of sequential splitting

2. Define the splitting area, parameters of sequential splitting and attributes name of the *Sheets* layer.

Table 11. Description of the sequential splitting parameters

Parameter	Purpose
Block extents	This parameter allows to specify the area boundaries (in meters) for splitting.
Overlap	This parameter allows to define the overlap size (in meters) by width and/or height. By default the sheets are created without overlap (dock).
Sheets base name	This parameter allows to define the sheets name prefix. By default the *Sheet* is proposed. The rest of the sheet name is generated by program automatically. It contains the serial number of sheets row (upward) and serial number of the sheet in a row (left to right).
Sheet size	This parameter allows to specify sheet size (in meters) by width and/or height. The modifying sheet size leads to recalculation of sheets number in the specified splitting area.
Number of sheets	This parameter allows to specify the number of sheets by width and/or height. The splitting begins from the bottom left corner of the specified splitting area (see the **Block extents** parameter) in accordance with specified number of sheets and sheet size (see the **Sheet size** parameter). Thus, sheet size not recalculated when the modifying number of sheets.
Attribute with sheet names	This parameter allows to define the name of attribute for storing the sheet names.

Parameter	Purpose
Sheets creation attribute	This parameter allows to define the attribute name for storing information about sheet status. By default the *create* is proposed.

3. Click OK. The process of sheets creation starts. The sheets boundaries are created in the *Sheets* layer after this process completion. The *Sheets* layer becomes editable and marked by asterisk, this means that the layer has been edited but not saved. The sheet boundaries are displayed in the **Preview** window. All sheets are signed in accordance with the specified template for sheet name (*Sheets base name+Row number+"_"+Number of the sheet in a row*). All sheets, falling within block images, are active, i. e. selected for creating output mosaic files.

   Active sheet is shown by green outline and has not color filling. Inactive sheet is shown by red outline and red transparent filling, by default. You can select color and set up transparency options for inactive sheets on the **Preview** tab of the **Settings** window (seeSection 14.1).

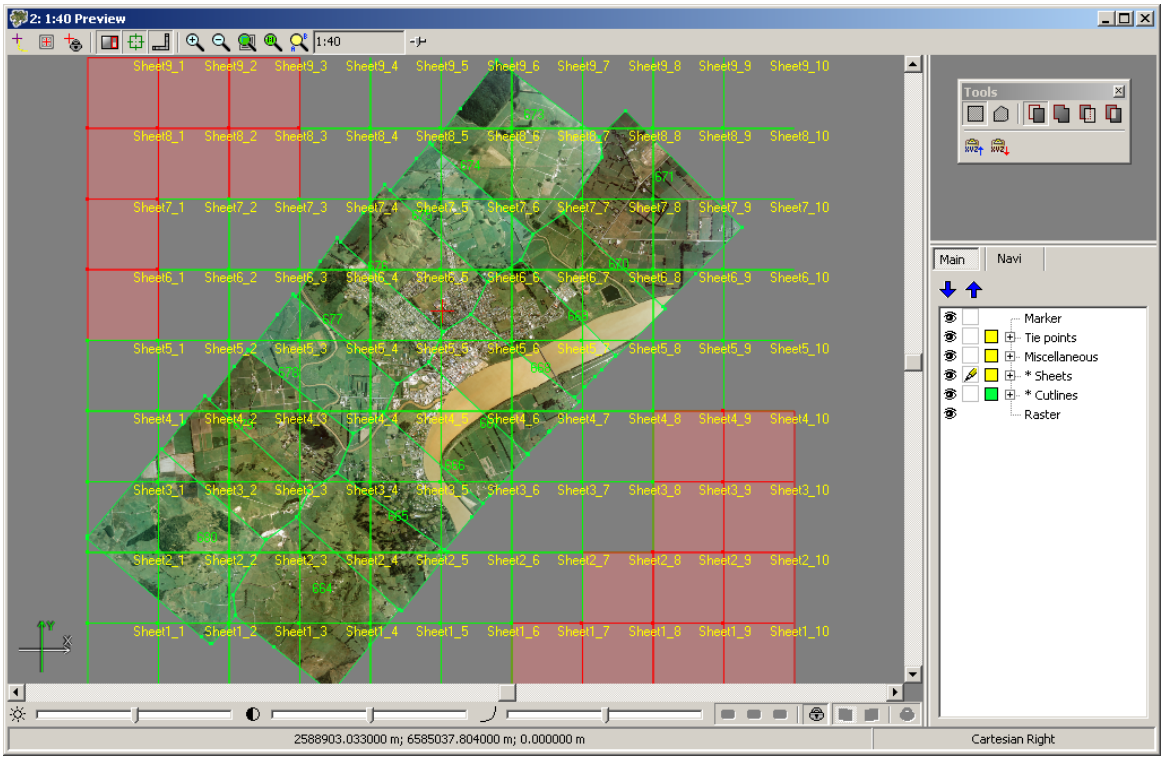

Fig. 11. Sequential splitting

See also Section 10.5 and Section 10.7.

10.2. Creating the single sheet covering all images block

This mode allows creating the single sheet covering all images block of mosaic project.

Choose the **Sheets › Full mosaic sheet** or click the  button in the **Sheets** toolbar for creating the single sheet covering all images block of mosaic project. The sheet boundary that is the vector polygon which includes all images of mosaic project, is created in the *Sheets* layer. Sheet boundaries are displayed in the **Preview** window. *Mosaic* is a sheet name. The sheet status is active, since it is selected for creating of output mosaic file.

See also Section 10.5 and Section 10.7.

10.3. Splitting by images

This splitting mode allows to create sheets covering each image of the mosaic project.

Choose the **Sheets › Split into sheets by images** for creating sheets covering each image. The sheet boundaries are created in the *Sheets* layer and displayed in the **Preview** window. Each sheet includes one of the project images. The name of image is used as the sheet name. All sheets are active, i.e. are selected for creating of output mosaic files. The **Build sheets by images** parameter on the **Mosaic** tab in the **Mosaic parameters** window has the effect on creating output mosaic sheets (see Section 13.2).

See also Section 10.5 and Section 10.7.

10.4. Creating the single sheet with arbitrary boundaries

Creating the single sheet mode allows to create it from the any part of block images. Perform the following actions for creating the single sheet:

1. Choose the **Sheets › Full mosaic sheet** or click the  button in the **Sheets** toolbar.

2. Stretch the rectangle in the **Preview** window along with pressed **Shift** key. The boundaries of single sheet are the single vector polygon with attributes of sheet name and sheet status. They are created in the *Sheets* layer. *Mosaic* is a sheet name. The sheet status is active, i.e sheet is selected for creating output mosaic file.

See also Section 10.5 and Section 10.7.

10.5. Editing sheets

The following capabilities are provided for editing the *Sheets* layer:

- Refreshing sheets take into account while changing the parameters or splitting mode.

The program provides saving the already created sheets boundaries in the file of the profile resources while refreshing sheets. The *Sheets* layer is refreshed automatically with take into account the specified parameters or splitting mode after the confirmation or cancellation saving.

- Deleting all created sheets, i.e deleting all vector objects from the *Sheets* layer.

  Choose the **Sheets › Clear** for deleting all sheets boundaries.

- Manual editing/drawing vector objects (see Project processing User Manual).

- Editing sheet's features (values of attributes): name of a sheet, is it active or not. See Section 10.6.

10.6. Working with the attributes of the Sheets layer

Each sheet is given the name and defined sheet status using the attributes of the *Sheets* layer. The capability of presetting provides correct import of sheets, which were created in third party software, in case when the imported objects have another names of attributes for storing information about sheet (see Project processing User Manual).

By default the *Sheets* layer contains the following names of attributes:

- *create* – for storing information about sheet status;

- *sheet_name* – for storing sheet name.

Choose the **Sheets › Parameters** or click the  button in the **Sheets** toolbar for changing default attributes names of the *Sheets* layer, *before* the splitting into sheets. The **Parameters** window opens. Choose the **From attribute** option and define the new name of attribute for storing sheets name: select the name from list or specify it using the ... button. The same way change the name of attribute for storing information about sheet status in the **Attribute name** input field of the **Sheets activity** panel. Click OK. Thus, after the completion of splitting process, the data about the sheet name and sheet status will be stored in the defined attributes irrespective of splitting mode.

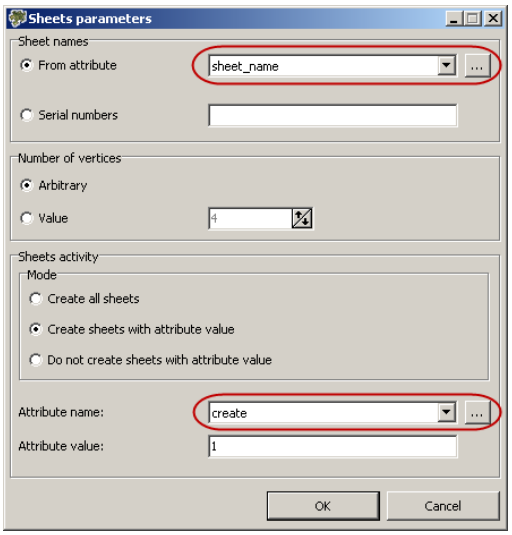

Fig. 12. Setting attributes names

Perform the following actions for obtaining and editing information about a sheet:

- Select the sheet boundaries by double click in the **Preview** window;
- Choose the **Sheets › Sheet info**. The **Sheet info** window opens.

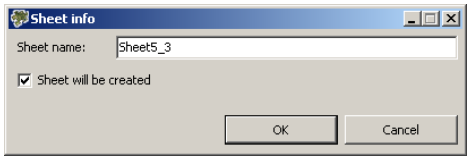

Fig. 13. Values of cutline attribute

Window contains the following information:

- The sheet name in the **Sheet name** field corresponds to the *sheet_name* attribute value.
- Set **Sheet will be created** checkbox corresponds to the “1” value in the *create* attribute, i.e. the sheet status is active. Cleared checkbox corresponds to the “0” value, i.e. the sheet status is not active.

Perform the following actions for viewing and editing attributes values of selected sheet:

- Select the sheet boundaries by double click in the **Preview** window;
- Choose the **Window › Object attributes** or click the button in the **Vectors** toolbar. The **Object attributes** window opens.

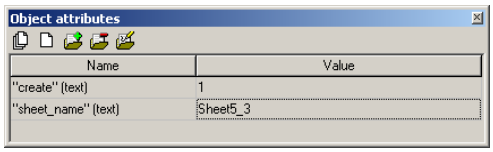

Fig. 14. Values of sheet attributes

The “1” value in the *create* attribute corresponds to the active sheet status, the “2” value corresponds to the inactive sheet status. The image name in the attribute is generated automatically and depends on the splitting mode and parameters. Click the string of the **Value** input field and insert another value for changing of attributes value.

There are also other facilities in the program interface that provide fast managing of the sheet activity status (see Section 10.6.1).

10.6.1. Sheets status management

In the **Sheets** menu and in the **Sheets** toolbar the following facilities provided to change sheets status:

- To assign ’active’ status to all sheets choose the **Sheets › Activate all sheets** or click the button.
- To assign ’non-active’ status to all sheets choose the **Sheets › Deactivate all sheets** or click the button.
- To assign ’active’ status to selected sheets choose the **Sheets › Activate selected sheets** or click the button.
- To assign ’non-active’ status to selected sheets choose the **Sheets › Deactivate selected sheets** or click the button.
- To invert sheets status choose the **Sheets › Invert sheets status** or click the button.
- To assign ’active’ status to sheets, which fall into images entirely including their background, and to simultaneously assign ’non-active’ status to the rest of sheets, choose the **Sheets › Set sheets status by rasters** or click the button.
- To assign ’active’ status to sheets, which fall into images without their background, and to simultaneously assign ’non-active’ status to the rest of sheets, choose the **Sheets › Set sheets status by useful areas** or click the button.

In order to use provided modes of sheets activation you should activate the *Sheets* layer and choose in the **Sheets › Sheets activation mode** menu one of three modes:

- **Select for activation** – by default, this mode assumes standard selection of sheets and further assigning them 'active' or 'non-active' status. In order to select sheets drag a rectangle along with pressed **Shift** key, and use one of group selection modes from the **Tools** toolbar.

- **By first sheet** – this mode allows to change sheets status without sheets selection. When you drag a rectangle in this mode along with pressed **Shift** key, the sheets that fall into the rectangle, obtain the status of the first sheet of the rectangle created.

- **Use selection mode** – this mode allows to change sheets status without sheets selection too. At that, status of sheets that fall into rectangle created, depends on a group selection tool selected in the **Tools** toolbar.

To select sheets use the following modes:

- To select 'active' sheets choose the **Sheets › Select active sheets** or click the button.

- To select 'non-active' sheets choose the **Sheets › Select non-active sheets** or click the button.

10.7. Saving sheets

Choose the **Sheets › Save** for saving sheets boundaries and specify the filename of internal vector format in the resources of active profile. Choose the **Sheets › Save as** for creating a new file.

Choose the **Edit › Export** to export sheets boundaries into other vector format files (see Project processing User Manual).

10.8. Setting output parameters

The output parameters allow to define the method of *output files* naming and criteria of selection sheets for creating *output files*. After splitting the block, and editing sheets boundaries and attributes, choose the **Sheets › Parameters** or click the button in the **Sheets** toolbar. The **Sheets parameters** window opens.

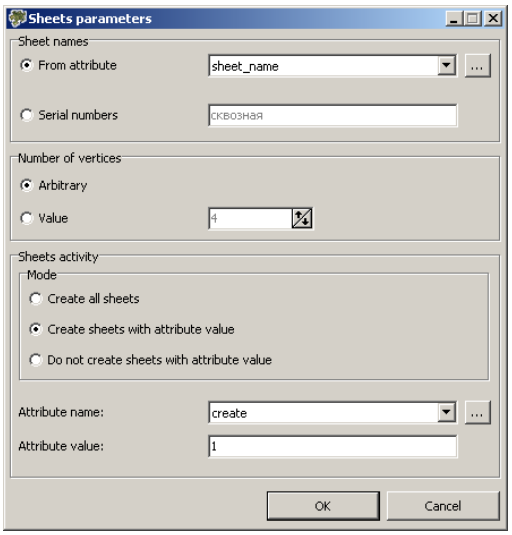

Fig. 15. Sheets parameters

Table 12. Description of the output sheets parameters

Parameters	Purpose
Sheet names	This parameter allows to define the names of output mosaic sheets. Choose the **From attribute** input field and specify the attribute of name in the input field for using names, stored in the attribute of name of the *Sheets* layer. For using the serial numbers choose the **Serial numbers** input field and define the file name prefix. In this case, while creating mosaic, the sheet names are generated as follows: *Prefix+Sheet serial number*.
Number of vertices	This parameter defines criterion of sheets selection for creating output files by number of vertices within sheets boundaries. For selecting sheets by number of vertices choose the **Value** option and specify the number of vertices in the input field. Otherwise, choose the **Arbitrary** option. In this case, sheets selection by number of vertices within the boundaries of created sheets is not performed.
Sheets activity	This parameter allows to perform the selection of sheets for creating output files by the attribute values from the *Sheets* layer. Choose the **Create all sheets** mode for creating all sheets irrespective of attribute values. Choose the **Create sheet with attribute value** mode (by default) and specify the attribute and value of it as criterion of sheets selection. For example, while selecting the “1” value for the sheets status attribute, the output files for all active sheets will be created. Choose the **Do not create sheets with attribute value** mode for excluding sheets, which are satisfied the value specified in the **Attribute name** field of specified attribute in the **Attribute value** field.

10.9. Sheets menu

The **Sheets** menu is used for splitting mosaic into *sheets* for saving their in the separate files of selected output format. The sheets boundaries are the vector polygons in the *Sheets* layer.

Table 13. Brief description of Sheets menu

Sheets menu	Purpose
Clear	This menu item allows to delete the created sheets boundaries, i.e delete all vector objects from the *Sheets* layer without closing of this layer.
Open	This menu item allows to open sheets boundaries, which were been saved in the vector file with the *.x-data extension in the resources of active profile.
Save	This menu item allows to save the sheets boundaries.
Save as	This menu item allows to save the sheets boundaries in new file with the same extension.
Sequential splitting	This menu item allows to define the sequential splitting parameters of block images area and start the process of sheets boundaries creation by the specified parameters.
Full mosaic sheet	This menu item allows to create the single sheet covering all block images.
Split into sheets by images	This menu item allows to create the sheets from each image of block.
Single sheet creation mode	This menu item allows to create the single sheet with arbitrary boundaries from any part of block images.
Activate all sheets	This menu item allows to select all sheets for creating output mosaic files, i.e the value of status attribute will be equal to “1” (active status) for boundaries of all sheets of *Sheets* layer.
Deactivate all sheets	This menu item allows to exclude all sheets from the process of mosaic creation and output mosaic files creation, i.e the value of status attribute will be equal to “0” (inactive status) for boundaries of all sheets of *Sheets* layer.
Activate selected sheets	This menu item allows to activate selected sheets for creating mosaic and creating output mosaic files, i.e the value of status attribute will be equal to “1” (active status) for boundaries of selected sheets of *Sheets* layer.
Deactivate selected sheets	This menu item allows to exclude selected sheets from the mosaic creation and creation of output mosaic files, i.e the value of status attribute will be equal to “0” (inactive status) for boundaries of selected sheets of *Sheets* layer.

Sheets menu	Purpose
Set sheets status by rasters	This menu item allows to select only sheets containing at least part of block image for creation of output mosaic files (input background color on the images edges is taken into consideration), i.e the value of status attribute will be equal to “1” (active status) for boundaries of non-empty sheets.
Invert sheets status	This menu item allows to invert the status of all created sheets, i.e the value of status attribute will be inverted (the “0” value is inverted to “1” and and vice versa) for boundaries of all sheets of the *Sheets* layer.
Parameters	This menu item allows to define the output parameters for creation of output mosaic
Sheet info	This menu item allows to obtain and modify information about selected sheet, which is stored in the attributes of the *Sheets* layer.

11. Stitching by tie points

The program provides an option of tie points measurement for more precise correspondence of cutlines area. Adjustment of the project source images is the result of tie points measurement and transforming source images close to cutline.

Measuring ties points consists in defining correspondence between projections of the same terrain point on two or more source images of the mosaic project in the vicinity of cutlines.

Also, the program provides the option of using reference image for measuring GCPs on the source images. The reference image is the raster image on the same area, but with more accurate georeference, then source images of mosaic project. I.e the reference image is used as standard for measuring GCPs, from which is defined the correspondence between the source images. The coordinates of terrain point on the reference image is assigned the same terrain point on the source images.

The *Tie points* vector layer with the attributes for data storing about measured points is provided for storing the GCPs or tie points.

The program provides three modes of tie/GCPs measurement:

- Manual mode measurement of points without correlator;
- Semi-automatic mode measurement of points using correlator;
- Automatic mode measurement of points using correlator.

It is not recommended to measure the tie points far away from the cutlines to avoid the rough transformation of images. Also, it is not recommended measuring points on the extended objects (for example, on the roads), buildings and low-contrast areas.

The current section contains the following information:

- Tie points measurement;
- GCPs measurement;
- Editing measurement of points;
- Attributes of the *Tie points* layer;
- Brief description of the **Ties** menu.

11.1. Pre-setting

Choose the **Window › Toolbars › Tie points** for quick access to the options of GCP/tie points measurement. The **Tie points** toolbar opens, which buttons are partially duplicated in the **Tie points** menu (see buttons description in Section 11.9).

To display of images transformation in the result of stitching by the tie points (fast refreshing of images) perform the following actions in the **Preview** window before the start working:

- Choose the **Mosaic › Parameters**. The **Mosaic parameters** window opens. Choose the **Mosaic** tab.
- Set the **Use tie points** checkbox.

Previously define the transformation type, which is used automatically on the edges of block images while the accumulation of GCPs measurement data. Perform the following actions:

- Choose the **Mosaic › Parameters**. The **Mosaic parameters** window opens. Choose the **Mosaic** tab.
- Set the **Apply shift only to image edges when use GCPs** checkbox to apply the shift on the **Mosaic** tab. Clear this checkbox to apply projective transformation type.

For measurement of GCPs/tie points using the correlator in semi-automatic or automatic modes are used the correlator parameters. Choose the **Ties › Parameters** for viewing and editing parameters of correlator (see Section 11.5).

11.2. Tie points measurement

A pre-requisite for measurement of tie points is the presence of cutlines created in the *Cutlines* layer (see Section 9). Otherwise, the message about that cutlines must be created is shown. And measuring of tie points is not possible.

Set the **Use tie points** checkbox for dynamic displaying of cutlines during the adding of tie points (see Section 11.1).

11.2.1. Manual mode measurement of tie points

Perform the following actions for measuring tie point in manual mode without correlator:

1. Select the point in the vicinity of cutlines in the **Preview** window and set the marker in this place to add the tie point.

2. Choose the **Ties › Add tie points › Add without correlation** or click the  button of the **Tie points** toolbar. The **2D** windows with source images are opened. New tie point is added in the specified place. The visual non-conformities of tie points are displayed in the **2D** windows on the source images, because the points are displayed by the data of georeference.

3. Select the new placement of selected tie point on the source images in the each of **2D** windows for editing of its measurement. Choose the **Ties › Remeasure** or click the  button of the **Tie points** toolbar. (see also Section 11.3).

4. For measuring the next point: select the another terrain point on the images in the each of the **2D** windows and click the  button of the **Tie points** toolbar. A new point is added as a result. Repeat the “3” item for editing of tie point measuring.

   

   For measuring of the next point using correlator: select the terrain point on the images in the each of **2D** windows and choose the **Ties › Add tie points › Add with correlation** or click the  button of the **Tie points** toolbar (see “2” item in Section 11.2.2).

5. Choose the **Ties › Finish measurement** or click the  button for completing of measuring tie points in 2D windows and displaying of the stitching results in the **Preview** window. The areas stitching is performed in the middle of the interval between points in the **2D** windows.

11.2.2. Semi-automatic mode measurement of tie points

The semi-automatic mode implies the automatic computing of tie points using correlator in the marker placement. If necessary, set the Correlator parameters before the start working. Perform the following actions for measuring of tie points in semi-automatic mode:

1. Select the terrain point in the vicinity of cutlines in the **Preview** window for adjustment of stitching areas and set the marker in this place.

2. Choose the **Ties › Add tie points › Add with correlation** or click the button of the **Tie points** toolbar. Tie point may be measured by correlation in one of the following ways:

   - In case of successful correlation the tie point is added on the *Tie points* layer. The images of the **Preview** window are refreshed taking into account coinciding cutlines areas by the specified tie point. Repeat the “1” and “2” items for measuring new tie point or edit the point (see Section 11.3).

   - The message about the point is far away from the cutlines is displayed. Select the another terrains point closer to the cutlines and repeat the “1” and “2” items.

   - Change the corresponding correlation parameters, if the message about the low correlation coefficient and/or about high autocorrelator coefficient is shown (see Section 11.5) or select more contrast point on terrain and repeat the “1” and “2” items.

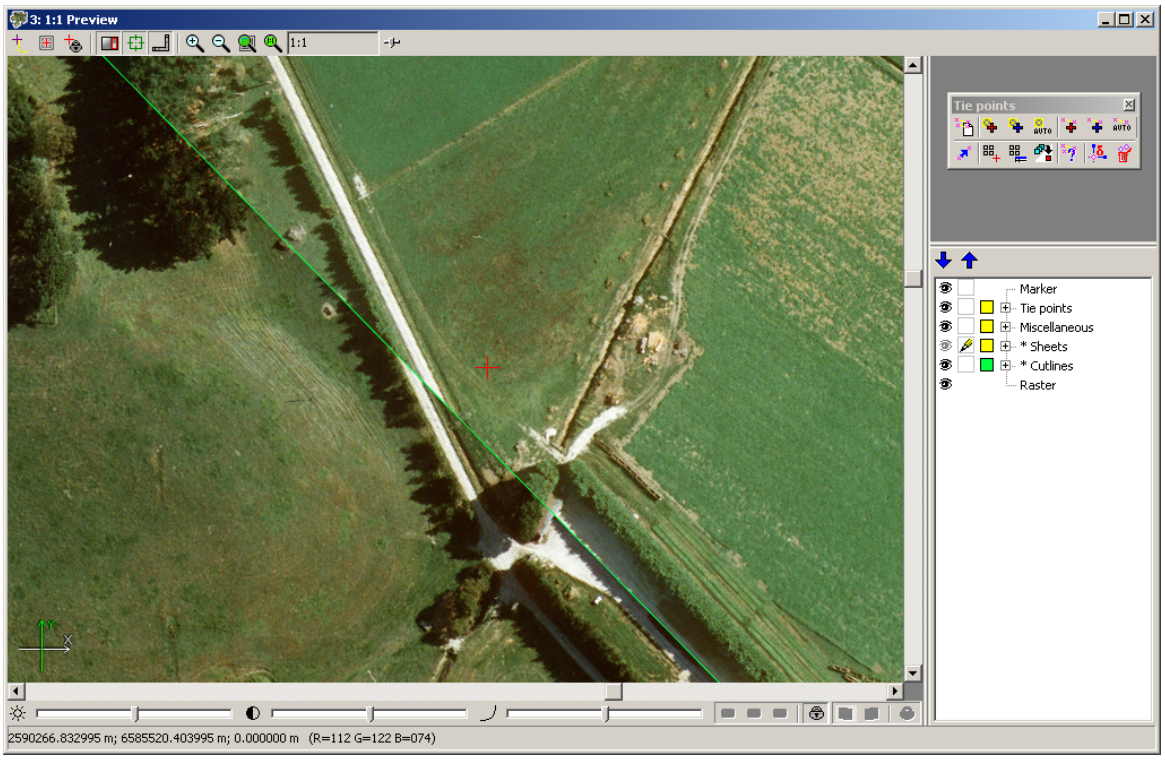

Fig. 16. Coinciding source areas of cutlines

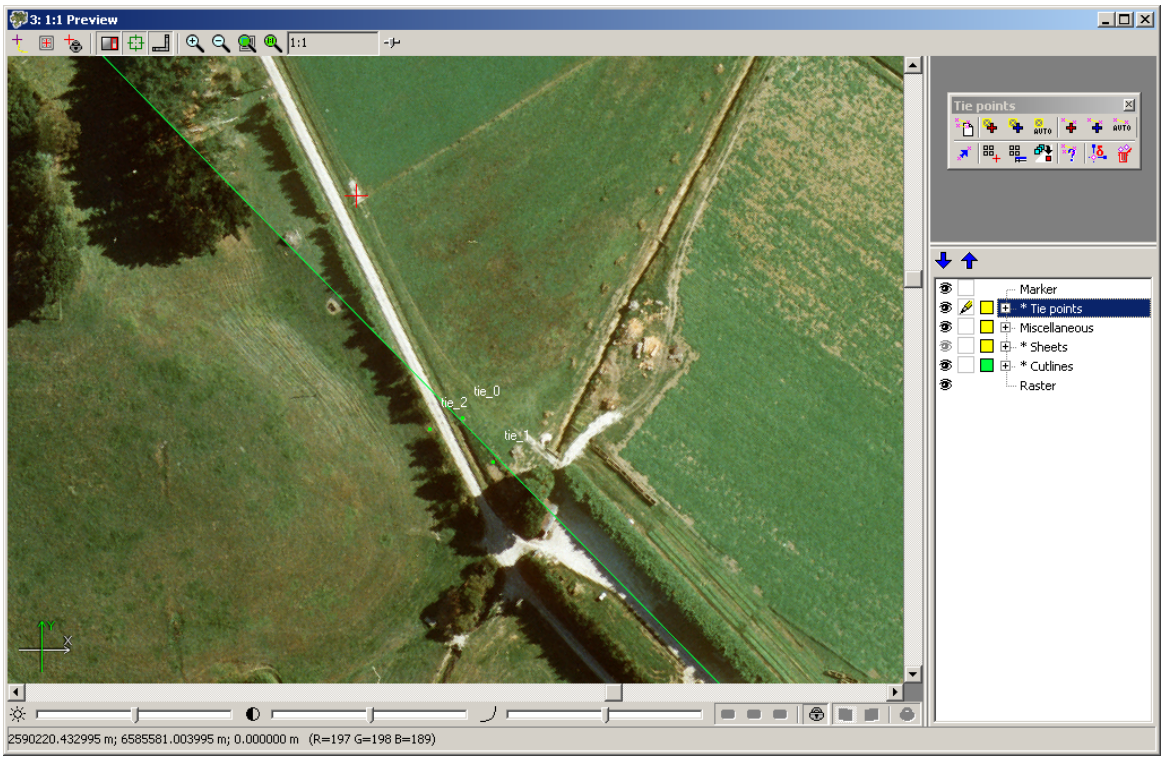

Fig. 17. Stitching areas from two tie points

11.2.3. Automatic mode measurement of points

The automatic mode implies the automatic searching of tie points using correlator on all block images of project in the vicinity of cutlines. If necessary, set the correlator parameters before the start working. Choose the **Ties › Add tie points › Add automatically** for start automatic measuring of tie points or click the AUTO button of the **Tie points** toolbar. View the stitching quality in the **Preview** window and, if necessary, edit the tie points measurements (see Section 11.3).

11.2.4. Measuring of tie points in the distributed processing mode

The Distributed processing mode provides time saving while cutlines creation by making optimal use the hardware computing capacity. This mode is recommended to use in case of large volume of source images in the mosaic project.

Perform the following actions for measuring points in the vicinity of cutlines in the distributed processing mode:

1. Define the structure and role of the workstations to participate in distributed processing. Detailed description of distributed processing mode organizing see in PHOTOMOD System User Manual.

2. Choose the **Ties › Add tie points › Add in distributed mode**. The **Points measure parameters** window open.

3. Define the values of automatic points collection and correlator parameters (see description of parameters in Section 11.5). Click OK. The **Ties points distributed processing** windows opens.

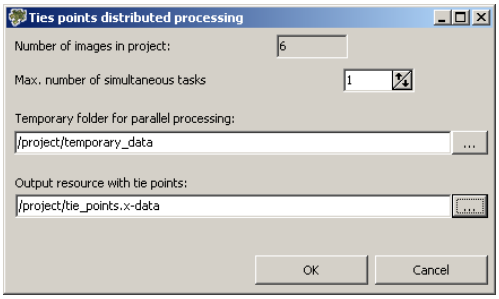

Fig. 18. Parameters of distributed processing for measuring tie points

4. Define the number of tasks, folder of temporary data, name and location of vector file for the tie points storing.

Table 14. Description of tie points measuring parameters in distributed processing mode

Parameter	Purpose
Number of images in project	Info field for displaying number of created cutlines in the mosaic project.
Max. number of simultaneous tasks	Entry field for defining number of tasks, into which the entire auto searching process and tie points measuring is split.
Temporary folder for parallel processing	Entry field for defining the storing folder of temporary data. Click the ... button to select the folder or create the new folder in the resources of active profile.
Output resource with tie points	Entry field for defining location and name of output vector file to store the tie points in the resources of active profile. Click the ... button to select the folder and file name.

5. Click OK to start the process of creating an automatic searching and measuring of tie points in the vicinity of cutlines. After the completion of this process an output file of tie points is created in the specified folder. The measured point is added in the *Tie points* layer and displayed in the **Preview** window.

6. Estimate the stitching quality of cutlines in the result of the automatic measuring of tie points. If necessary, edit the measurement of added tie points (see Section 11.3).

11.3. Editing measurements of points

Perform the following actions for editing measurements of point:

- Make editable the *Tie points* layer in the **Layer manager**.
- Select the point in the **Preview** window by mouse clicking. Choose the **Ties › Show windows by current point** or click the button of the **Tie points** toolbar. The **2D** windows with source images are opened. They are showing the selected point.
- Insert the marker in another terrains point on the source images in each of the **2D** windows. Choose the **Ties › Remeasure** or click the button of the **Tie points** toolbar. The tie point will move in new placement and show in the **Preview** window.

The visual non-conformities of tie points are displayed in the **2D** windows on the source images, because the points are displayed by the data of georeference.

Perform the following actions to delete point:

- Make editable the *Tie points* layer in the Layer manager.
- Select the point in the **Preview** window by mouse clicking and press the **Del** key.

Choose the **Ties › Clear** or click the button of the **Tie points** toolbar for deleting all measuring points on the *Tie points* layer.

The **Objects attributes** window is used for viewing and editing tie points data from attributes (see Section 11.7).

Choose the **Ties › Show residuals** to show residuals as the measurement point data is accumulating or click the button of the **Tie points** toolbar. Analysis of error vectors reveals “bad” points, having error vectors noticeably different from other points in size and direction.

Choose the **Ties › Delete by maximal residual** or click the button of the **Tie points** toolbar for rejection the points, the measurement of which causes the noticeable shift of images relative to each other. The **Delete parameters** window opens. Specify the maximal tie points residuals (in meters) for rejection points, the measurement of which causes the noticeable shift of images at the distance greater than the specified (in meters).

11.4. Measurement of GCPs

In case there is an image (reference image) with more accurate georeferencing covering the same area as source images, this reference image can be used for measuring of ground control points on the source images.

The program provides three measurement modes of GCPs: manual (without correlation), semi-automatic and automatic (using the correlation). The correlator parameters are defined in the **Points measure parameters** window (see Section 11.5).

For GCP measurement you should define in advance a type of transformation which will be applied automatically on edges of images block while GCP measurements are accumulating. Perform the following actions to choose a transformation type:

1. Choose the **Mosaic › Parameters**. The **Mosaic parameters** window opens. Choose the **Mosaic** tab.

2. In order to apply shift as a transformation type set the **Apply shift only to image edges when use GCPs** option on the **Mosaic** tab. Or clear this option to apply projective transformation.

Perform the follows for defining correspondence between the source images by control point on reference image in the manual mode:

1. Choose the **Service › Load georeferenced images**. Specify the file with reference image and click the OK button. The **Load georeferenced images** window opens. If necessary, convert the coordinate system and set the background color for reference image. Click the OK button.

2. Hide the layer with reference image in the Layer manager and make active the *Tie points* layer.

3. In the window with the source images insert the marker in the place of adding point on the one of the images in the vicinity of cutline. Choose the **Ties › Add ground control points › Add without correlation** or click the  button of the **Tie points** toolbar. Turn on visibility of the layer with reference image. Move up the *Tie points* layer in the Layer manager for displaying the added point on the reference image.

4. Specify the point placement on the reference image corresponding selected terrain point on the source images. For this move the point use the mouse and pressed **Ctrl** key. Press **Enter** to confirm measurement.

5. Hide the layer with reference image in the Layer manager.

6. Repeat the “3” item to measure point on the neighbour image.

7. Repeat the “4” item. Hence we get a tie point on the source image with coordinates taken from the reference image. The source images in the **Preview** window are refreshed taking into account the stitching by added point.

For measuring GCPs in the semi-automatic mode choose the **Ties › Add ground control points › Add with correlation** (duplicated by the  button of the **Tie points** toolbar).

For automatic searching of corresponding points on the reference image and source images of mosaic project choose the **Ties › Add ground control points › Add automatically** (duplicated by the  button of the **Tie points** toolbar).

11.5. Parameters of points measurements

For measuring of tie/ground control points in semi-automatic and automatic mode you can use and adjust the following correlator parameters. For automatic mode you can use parameters for automatic points search in cut-lines neighborhood.

To view and setup parameters of tie points measurements choose the **Ties › Parameters** or click the  button on the **Tie points** toolbar. The **Points measure parameters** window opens.

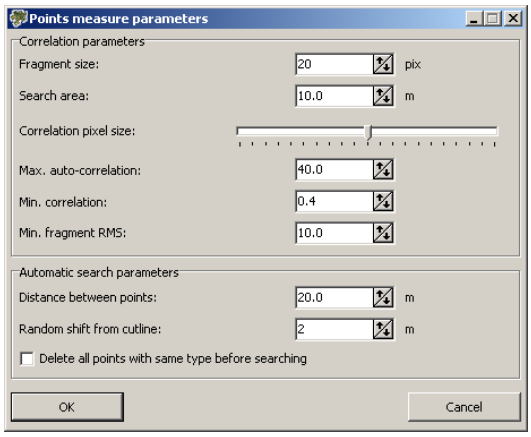

Fig. 19. Points measure parameters window

Table 15. Description of point's measurement parameters

Parameter	Description
Fragment size	Allows to define a size (in pixels) of a fragment which contains the point indicated on one image in cutline neighborhood.
Search area	Allows to define a search area (in meters) of appropriate point on another image. A search area is scanned by defined fragment-mask to find a similar point.
Correlation pixel size	Allows to define a value of a pixel size of images, where correlation to be performed, if the images have different pixel size.
Max. auto-correlation	Allows to control auto-correlation of a point, i. e. a degree of point's uniqueness in some its neighborhood on the left image. The more the auto-correlation radius value, the less the point's uniqueness and the more probable its incorrect comparison with the right image even when the correlation coefficient is high.
Min. correlation	Allows to define minimal acceptable value of correlation coefficient.
Min. fragment RMS	Allows to define a brightness value of image fragment. The less the value, the worse the correlation.

Parameter	Description
Min. distance between points	Allows to define a minimal distance between points during automatic points measurement.
Distance between points	Allows to define a step along cutline for point search in automatic mode.
Random shift from cutline	Allows to define acceptable deviation from cutline when searching a point in automatic mode.
Delete all points with same type before searching	Allows to clear the *Tie points* layer from GCP or tie points before start a search of GCP or tie points (correspondingly) in automatic mode.

11.6. Information about tie point

In order to obtain the information about tie/ground control point, select the point on editable layer *Tie points* and choose the **Ties | Point info**. In the opened **Statistic** information window you can see the following data:

- point's name (with *tie* prefix for tie point, and *GCP* – for GCP);
- number of images where the point is measured;
- path to file of each image where the point is measured.

Fig. 20. Information about a point

11.7. Attributes of Tie points layer

After tie/gcp point measuring the information about measured point is saved to attributes of the *Tie points* layer. To view point's attributes data perform the following actions:

1. Make the *Tie points* layer editable and select a point.
2. Choose the **Window › Object attributes**. The **Object attributes** window is open.

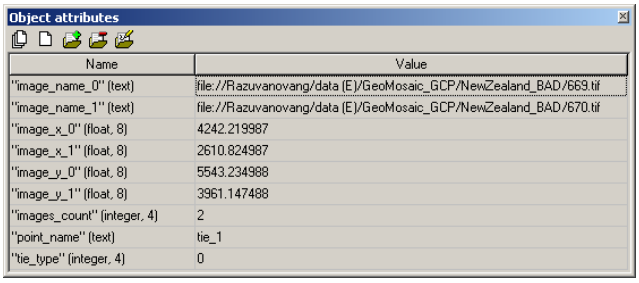

Fig. 21. Point's attributes data

Point's attributes contain the following data:

- *image_name_image_number* – contains a path to one of the image files where the point is measured;
- *image_x_image_number* – contains X-coordinate of the point on one of the images;
- *image_y_ image_number* – contains Y-coordinate of the point on one of the images;
- *image_count* – shows a number of images where the point is measured;
- *points_name* – contains a name of point (with tie prefix for tie point, and GCP – for GCP);
- *tie_type* – contains information about type of point (with 0 value for tie point, and 1 – for GCP).

11.8. Ties menu

Table 16. Brief description of the Ties menu

Ties menu	Description
Clear	allows to delete all tie/gcp points from Tie points layer
Open	allows to open tie/gcp points previously saved in vector file with x-data extension in active profile resources
Save	allows to save tie/gcp points to vector file in active profile resources with the same name and x-data extension
Save as	allows to save tie/gcp points to vector file in active profile resources with different name and x-data extension
Add ground control points	opens sub-menu for measurement of GCP in manual, semi-automatic and automatic modes
Add tie points	opens sub-menu for measurement of tie points in manual, semi-automatic and automatic modes
Remeasure	allows to edit a measurement of selected tie/gcp point
Show windows by marker	allows to open 2D windows with initial images containing marker position
Show windows by current point	allows to open 2D windows with initial images containing selected tie point
Finish measurement	used to close the **2D** windows with the sources images and return to the **Preview** window for viewing the results of cutlines stitching by measured points.

Ties menu	Description
Show residuals	used to display residuals reveals “bad” points, having error vectors noticeably different from other points in size and direction.
Delete by maximal residual	used to remove blunders of tie/gcp points automatic measurement: allows to reject those points, which measurement value results in shift of images relatively each other at distance more than specified (in meters)
Parameters	allows to setup correlator’s parameters for measurements of tie/gcp points in semi-automatic or automatic mode
Point info	shows brief information about selected tie/gcp point

11.9. Tie points toolbar

For quick access to options of tie/gcp points measurements you can use an additional **Tie points** toolbar. Some of its buttons duplicate items of the **Tie points** menu. Choose the **Window › Toolbars › Tie points** to open the **Tie points** toolbar.

Fig. 22. Tie points toolbar

Table 17. Brief description of the Tie points toolbar buttons

Buttons	Description
	allows to clear the *Tie points* layer
	allows to measure ground control point in manual mode without correlator
	allows to measure ground point in semi-automatic mode using correlator
	allows to run automatic search and measurement of GCP on the whole images block using correlator
	allows to measure tie point in manual mode without correlator
	allows to measure tie point in semi-automatic mode using correlator
	allows to start operation of tie points automatic search and measurement for the entire images block using correlator
	allows to edit a measurement of selected tie/gcp point
	opens 2D windows with initial images, which contain marker position
	opens 2D windows with initial images, which contain selected tie point

Buttons	Description
	used to close the **2D** windows with the source images and return to the **Preview** window for viewing the results of cutlines stitching by measured points.
	allows to setup correlator parameters used for tie/gcp points measurement in semi-automatic or automatic mode
	used to display residuals reveals “bad” points, having error vectors noticeably different from other points in size and direction.
	used to remove blunders of tie/gcp points automatic measurement: allows to reject those points, which measurement value results in shift of images relatively each other at distance more than specified (in meters)

12. Using auxiliary data

12.1. Misc (Miscellaneous) menu

Misc menu is used to show in the **Preview** window an auxiliary data that may be considered during mosaics creation. For auxiliary data (that is vector data) the *Misc* layer is provided.

Table 18. Brief description of Misc menu

Misc menu	Description
Clear	allows to delete all vector objects created in the *Misc* layer
Save as	allows to save the *Misc* layer data to vector file with different name and x-data extension in active profile resources
Local adjustment	allows to show in the **Preview** window a grid of fragments for preliminary estimation. The grid of fragments is intended for collecting of statistics data of local brightness adjustment (see Section 13.3.1)
Source images outlines	allows to show in the **Preview** window boundaries of source images with background. You may use the boundaries for cutlines creation or for images selection in order to show them in separate **2D** windows using **Images › Open selected** menu item.
Source images useful areas	allows to show in the **Preview** window boundaries of source images without background. You may use the boundaries for cutlines creation or for images selection in order to show them in separate **2D** windows using **Images › Open selected** menu item.

13. Mosaic creation

Perform the following actions to build mosaic:

1. If some mosaic's areas differ considerably in brightness and contrast, you should perform their brightness adjustment, which includes global and/or local brightness adjustment, and seams feathering (see Section 13.3).

2. Split the mosaic into sheets and specify active sheets for output files creation (see Section 10).

3. Setup output parameters of mosaic's building: main parameters and output file parameters (see Section 13.2 и Section 13.4).

4. Start mosaic's output sheets creation (see Section 13.6).

13.1. "Mosaic parameters" window

If you would like to setup mosaic building parameters, choose the **Mosaic › Parameters** or click the button. The the **Mosaic parameters** window opens. The window contains the following groups of parameters:

1. Main parameters of mosaic building on the **Mosaic** tab (see Section 13.2).

2. Parameters of local and global brightness adjustment on the **Brightness adjustment** tab (see Section 13.3).

3. Parameters of output mosaic sheets on the **Output** tab (see Section 13.4).

4. Additional parameters on the **Misc** tab (see Section 13.5).

In order to save current mosaic settings made in the **Preview** window for the purpose of their further use in other projects choose the **Mosaic › Save parameters preferences**.

To load saved mosaic settings into the **Mosaic parameters** window at the program start, set the **Use saved mosaic settings** checkbox on the **Geomosaic** tab in the **Settings** window (see Section 14). Otherwise, the default mosaic parameters will be loaded at the program start.

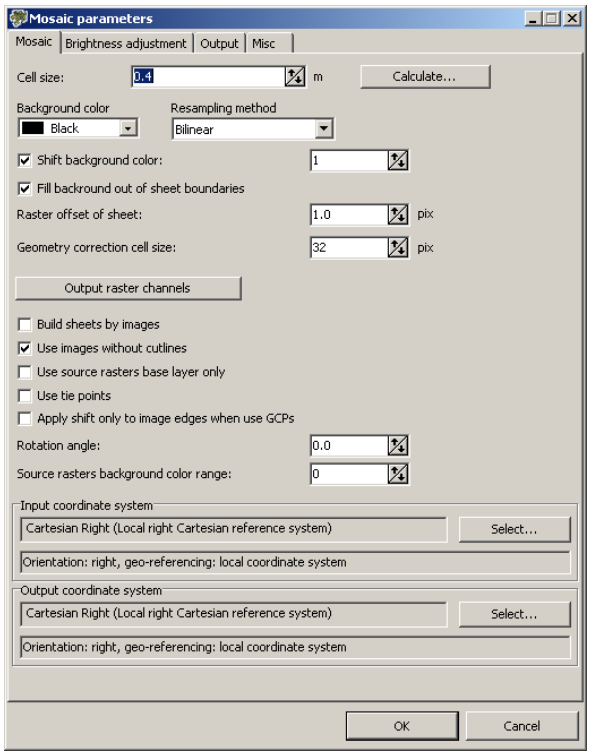

Fig. 23. “Mosaic parameters” window

13.2. Mosaic’s main parameters

If you would like to setup main options of mosaic building, choose the **Mosaic › Parameters** or click the button. The **Mosaic parameters** window opens. Click the **Mosaic** tab.

Table 19. Description of options on the Mosaic tab

Parameter	Description
Cell size	Allows to specify the size of output mosaic cell on the terrain. The cell size by default is equal to the cell size of the first image of mosaic project. The **Calculate** button opens a dialog used to set a mosaic size in pixels and recalculate its cell size accordingly.
Background color	Allows to set a color for mosaic background, since output mosaic always inscribes into a rectangular raster shape. The **Transparent mosaic background on preview** parameter influences on background color of mosaic in the **Preview** window (see Section 14.1).
Resampling method	Allows to choose the brightness interpolation mode during orthomosaic creation: bilinear, cubic or nearest neighbor.

Parameter	Description
Shift background color	Allows to specify a shift of color on the image if this color coincides with defined color of mosaic's background.
Fill background out of sheet boundaries	Allows to specify a type of filling outside of sheet boundaries in the output mosaic. If the option is set this area is filled with mosaic background color. Otherwise, the images of adjacent sheets are used for the filling.
Raster offset of sheet	Allows to specify a tolerance distance (in pixels) of raster extend beyond the sheet borders.
Geometry correction cell size	Allows to setup a fragment size (in pixels) when creating mosaic using fragments with projective dependence. The larger the fragment, the faster the mosaic building and the lower the accuracy of output mosaic. The value of 32 pixels is optimal for "speed-accuracy" ratio.
Output raster channels	Opens the window Output image parameters, used for specifying of channels for output mosaic.
Build sheets by images	Defines a content of sheets when creating a mosaic that is split on sheets by images (see Section 10.3). If the option is on, each sheet will contain the only image corresponding to the sheet, i.e. the mosaic will be not created. If the option is off, each sheet will contain all images that fall into this sheet. At that after splitting of sheets by images, sheets names in attributes of the Sheets layer should be the same as images names. The option is helpful when you only need to perform export of initial images into different coordinate system or export to files of other raster formats.
Use images without cutlines	Allows to use images without cutlines for preview and mosaic creation. See also a description of means of images order change when creating mosaic without cutlines in Section 8.5.
Use source rasters base layer only	Allows to use a base layer of initial images pyramid if the mosaic is created using docking (not overlapped) images without creating cutlines. If this option is off the program uses a pyramid layer corresponding to specified resolution, i. e. the pyramid layer is taken based on the **Cell size** parameter value.
Use tie points	Allows to immediately show results of merging along cutlines in the **Preview** window when measuring tie/gcp points.
Apply shift only to image edges when use GCPs	Allows to define a type of transformation which is applied automatically on the images block edges while collecting GCP measurements. If the option is off, projective transformation is applied, if it is on – just shift.

Parameter	Description
Rotation angle	Allows to setup a rotation angle (in degrees) of mosaic's images. This option is used if a block of initial images has elongated shape and you need to remove unnecessary background area in rectangular window of created mosaic.
Source rasters background color range	Allows to define a deviation from selected background color of initial images, i. e. to specify a range of color, existing in initial images background (see Section 8.3).
Input coordinate system	Allows to define coordinate system of initial images.
Output coordinate system	Allows to define coordinate system of output mosaic. If you would like to re-calculate an output mosaic into different coordinate system, it is highly recommended to specify output coordinate system before splitting it into sheets (see Section 10).

13.3. Brightness adjustment parameters

If you would like to adjust brightness and contrast features of cutline areas during their merging, choose the **Mosaic › Parameters** or click the button. The **Mosaic parameters** window opens. Click the **Brightness adjustment** tab, allowing to setup the options of global brightness adjustment of output mosaic, to turn on local brightness adjustment, and to feather seams in cutline's areas.

Global brightness adjustment means transformation equally applied to all pixels of each source image.

Local brightness adjustment means transformation applied along merging lines of individual images with gradual smoothing going down to the image central point and mosaic edges (i. e. processing of each pixel during local adjustment depends on its coordinates).

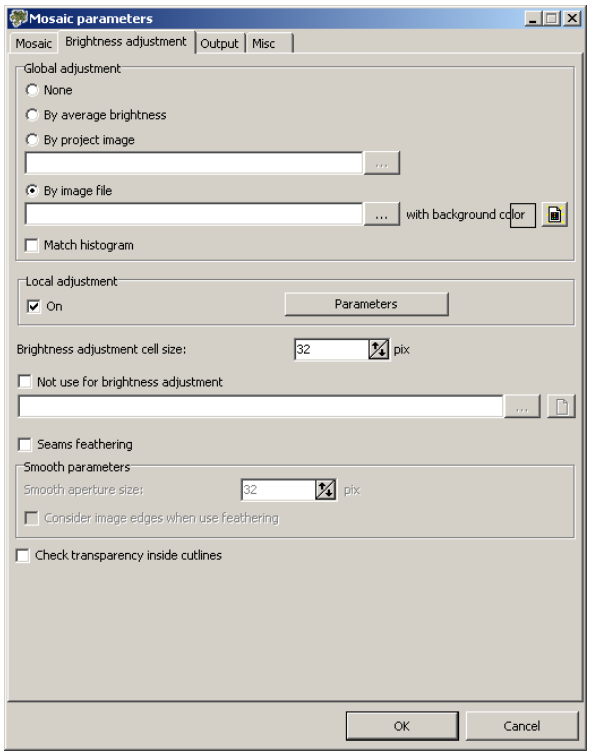

Fig. 24. Brightness adjustment parameters

Table 20. Description of brightness adjustment parameters shown on the Brightness adjustment tab

Parameter	Description
None	Allows to use un-adjusted images.
By average brightness	Allows to apply brightness adjustment using average images brightness. At that brightness and contrast of all images are set to values, found using averaging of brightness and contrast values calculated over all mosaic images. This method is recommended when there are big differences between brightness' of images, but each of them contains relatively smooth scenes. It should be noted that in case of scenes with sharp different brightness within one image (for example "sea" and "coast") this method may produce incorrect brightness adjustment results.
By project image	Allows to apply global brightness adjustment corresponding to selected image, i. e. brightness and contrast of images are adjusted in accordance with parameters of selected ("reference") image. Use the button ... to select the reference image. It is recommended to use image located in the middle of images block as a reference. It is not recommended to use this method in case of abnormal local brightness fluctuations ("trends") on images, since in this case you can face a problem of smooth increasing or reducing of the brightness and contrast

Parameter	Description
	from the reference image to the block edges right up to complete “lightening” (“blackening”).
By image file	Allows to apply global brightness adjustment corresponding to selected image, i. e. brightness and contrast of images are adjusted in accordance with parameters of selected (“reference”) image. Click the ... button to select the reference image. You should specify the background color for selected image.
Match histogram	An additional parameter of brightness adjustment allows to apply full (nonlinear) adjustment with histograms matching.
Local adjustment	Allows to apply local brightness adjustment along cutlines of images that are merged into mosaic. If you would like to specify local brightness adjustment parameters click the **Parameters** button (see Section 13.3.1).
Brightness adjustment cell size	Allows to specify a size of a cell (in pixels), which is used for brightness estimation and correction.
Not use for brightness adjustment	Allows to omit brightness adjustment on mosaic areas, specified by borders of vector polygons. Vector polygons created in advance are saved to file of active profile resources. Click the ... button to open the file with polygons.
Seams feathering	Allows to smooth seams on images cutlines and in the narrow zone around. The size of smoothing zone along cutlines is defined by the **Smooth aperture size** parameter. Set the **Consider image edges when use feathering** option to smooth seams on the edges of images block, where may be no statistics enough for correct smoothing.
Check transparency inside cutlines	Allows to consider image color in a cutline, coincident with input image background. If the option is set, the transparency for cutline sections with the same color is applied. Otherwise, the cutline will include sections with background color.

13.3.1. Local brightness adjustment

Local brightness adjustment is a transformation applied along cutlines of images that are merged into mosaic with a smoothing going down to the image central point and mosaic edges. Thus during local brightness adjustment each pixel of the image is processed depending on its coordinates. At that the program performs simultaneous change of brightness (additive component) and contrast (multiplicative component) of initial images.

For preliminary estimation of local brightness adjustment choose the **Misc › Local adjustment**. In the **Preview** window you will see a grid of fragments (rectangles), used

for statistics collection for local brightness adjustment. Fragments for statistics collection between images in the same strip are shown by green color, between strips – by blue, on the mosaic edges – by red, inside separate images – by yellow. The fragments are vector objects located on the *Miscellaneous* layer. You can make the *Miscellaneous* layer editable when necessary and change the fragments grid (see the chapter “Редактирование векторных объектов” в Руководстве пользователя “Обработка проекта”).

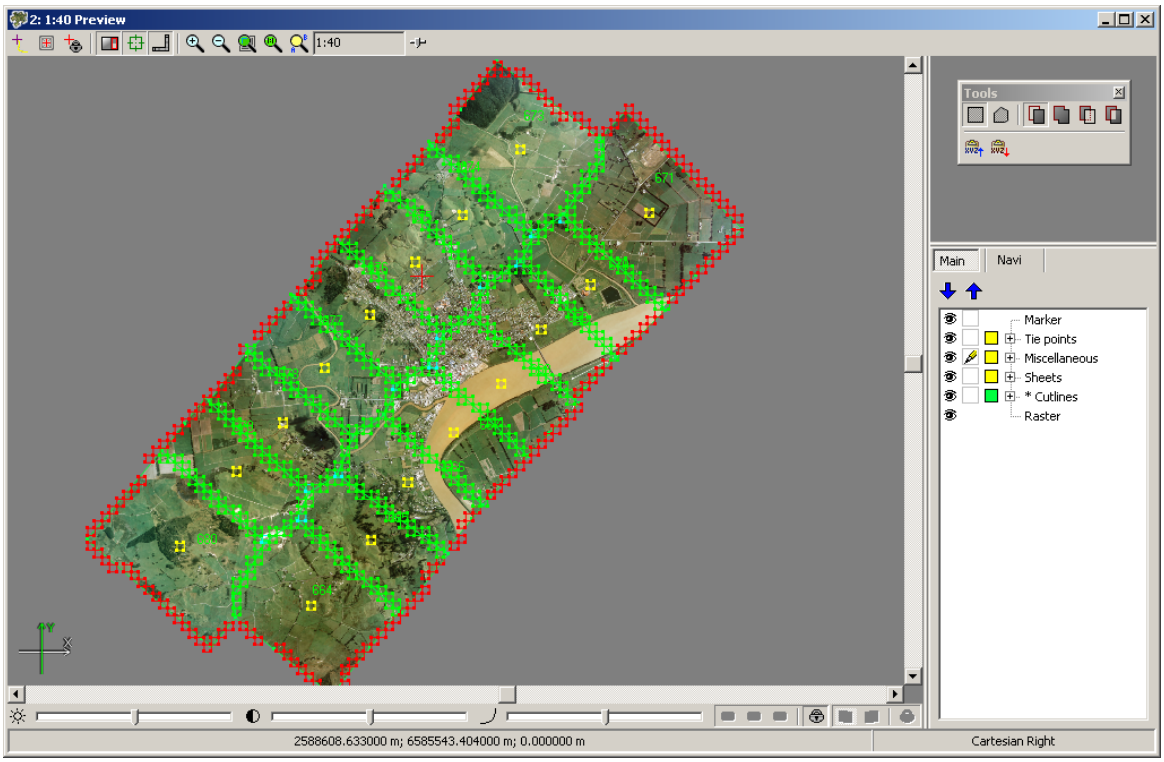

Fig. 25. Preliminary estimation of local brightness adjustment

To apply local brightness adjustment you should perform the following:

1. Choose the **Mosaic › Parameters**. The **Mosaic parameters** window is open.

2. Click the **Brightness adjustment** tab. In the **Local adjustment** panel set the **On** checkbox and then click the **Parameters** button. The **Local adjustment parameters** window is open.

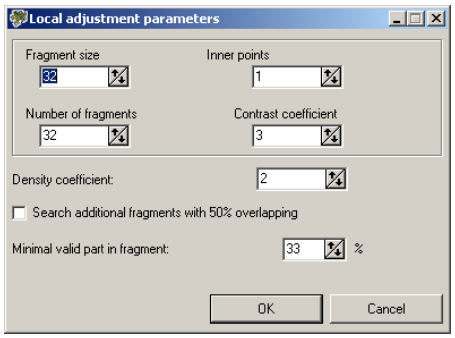

Fig. 26. Local brightness adjustment parameters

Table 21. Description of local brightness adjustment parameters

Parameter	Description
Fragment size	Allows to setup a size of image fragments used to create a model of local brightness adjustment. The bigger the fragment size the better the adjustment, but the slower the processing.
Number of fragments	Sets the number of fragments located on each image. The greater the number the better the adjustment, but the slower the process of parameters calculation and mosaic creation.
Inner points	Sets the number of points inside the image and on the edges of output mosaic, where the brightness should be preserved. Lack of inner points leads to brightness anomalies when moving away from the cutlines. Excess number of inner points causes the brightness un-adjustment along the cutlines.
Contrast coefficient	In some cases when the contrast of initial images is defined incorrectly it causes poor brightness adjustment or errors in creating of local brightness adjustment model. You can increase the value of this parameter from 2 to 7 to improve the result.
Density coefficient	Sets the amount of tie points on the edges of mosaic used for adjustment. Lack of these points leads to brightness anomalies when moving away from the cutlines. Excess number of tie points causes the brightness un-adjustment along the cutlines.
Search additional fragments with 50% overlapping	If you have insufficient statistics amount, the parameter allows to shift fragments grid in relation to cutlines with 50 % overlap, that may help to collect additional local adjustment statistics.
Minimal valid part in fragment	The parameter is used for space borne images processing which usually have small overlap areas. In this case a cutline may lie too close to the image edge, so that image background falls into cutline area. In this case the parameter

Parameter	Description
	defines a minimal part of terrain image in a fragment, at which the local adjustment statistics will start to collect.

If after cutlines editing you need to rebuild only local adjustment, choose the **Mosaic › Rebuild local adjustment**.

13.4. Mosaic output parameters

If you would like to setup options of mosaic output, choose the **Mosaic › Parameters** or click the button. The **Mosaic parameters** window is open. Click the **Output** tab.

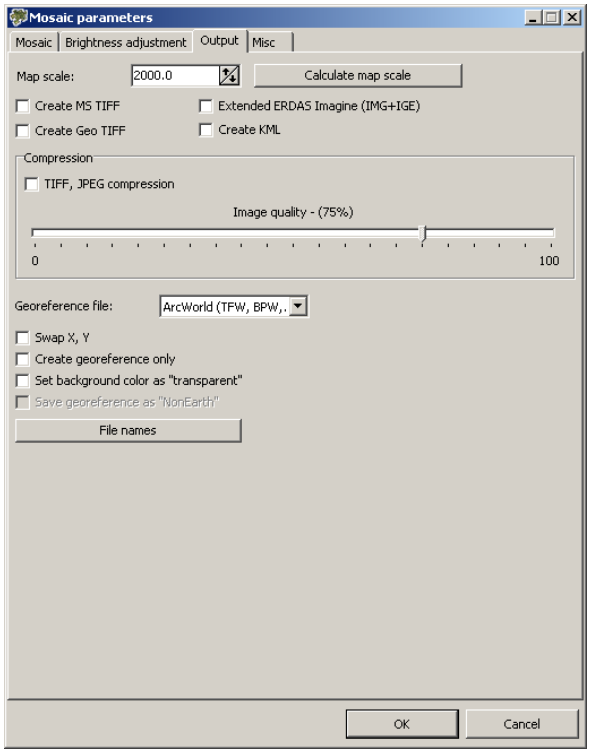

Fig. 27. Mosaic output parameters

Table 22. Description of mosaic output parameters

Parameter	Description
Map scale	Allows to setup a scale for output mosaic sheet. Click the Calculate map scale button to open the window where you can specify a scale and calculate a map sheet size (in meters) and print resolution.
Create MS TIFF	Allows to create output mosaic sheets in MS TIFF format with pyramid that helps to redraw images more quickly on a screen, when using systems with MS TIFF format support.

Parameter	Description
Create Geo TIFF	Allows to create output mosaic sheets in Geo TIFF format with pyramid.
Extended ERDAS Imagine (IMG+IGE)	Allows to create output mosaic sheets in IMG files format for heading and IGM format for image (with no limitations for size).
Compression	Allows to compress files with output mosaic sheets (JPEG-compression for TIFF files is used). You can select a compression level using the **Image quality** slider. Default compression level is 75 %, that provides the 5-7 times compression of initial image volume.
Georeference file	Allows to select the format of the additional file created along with output mosaic and containing the information for mosaic referencing to coordinate system.
Swap X, Y	Allows to swap X,Y coordinates to obtain output mosaic in left coordinate system.
Create georeference only	Allows to create just georeference files of sheets without building mosaic sheets (i. e. without files creation).
Set background color as “transparent”	When saving the resulting mosaic in MapInfo format (or “Map 2011”), you can set the background color which is shown in MapInfo system, as transparent.
Save georeference as “NonEarth”	Allows you to save georeference as NonEarth coordinate system, when saving the resulting mosaic in MapInfo format. Used if MapInfo system does not support coordinate system of mosaic project.
File names	Allows to open the **Sheets files** window to select format and target folder of output mosaic sheets (see also a list of output formats in Section 2.4).

13.5. Additional parameters

If you would like to setup additional options, choose **Mosaic › Parameters** or click the button. The **Mosaic parameters** window is open. Click the **Misc** tab.

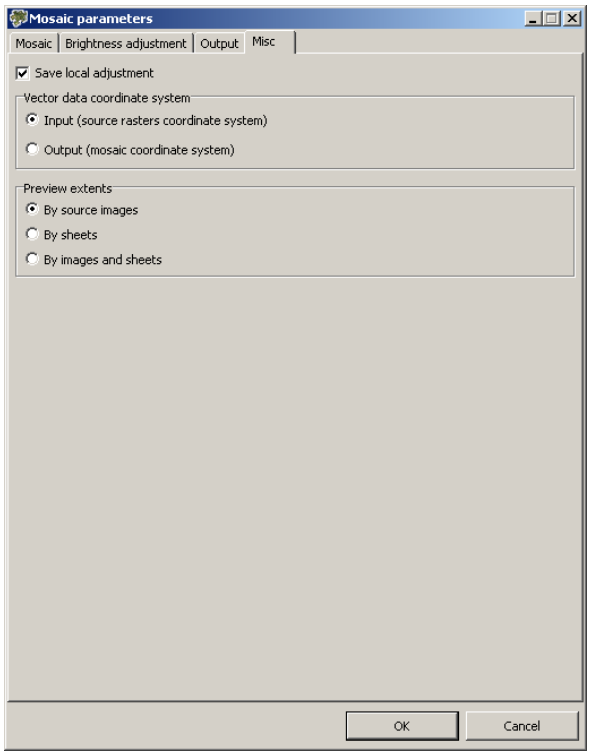

Fig. 28. Additional options

Table 23. Description of miscellaneous parameters

Parameter	Description
Save local adjustment	Allows to turn on/off saving of parameters and settings of local brightness adjustment to file of mosaic project.
Vector data coordinate system	Allows to select input or output coordinate system of a project for storing of vector data (cutlines, sheets boundaries, tie points etc.). It is recommended to select output coordinate system (by default), since it is impossible to re-calculate coordinate system during sheets creation. Coordinate system of initial images and output mosaic are specified on the **Mosaic** tab.
Preview extents	The panel allows to define a type of mosaic project data to be shown in the **Preview** window, if sheets borders are out of initial images block (after coordinate system re-calculating, for instance). Choose the **By source images** option to show images of mosaic project, choose the **By sheets** option to show sheets borders (vector polygons), choose the **By images and sheets** option to show both sheets borders and project images.

13.6. Creation of output mosaic sheets

For creation of resulting output product – georeference files and sheets of mosaic (orthophotos) in specified coordinate system and scale – perform one of the following actions:

- To create output orthophoto for current sheet perform the following:
  - On the *Sheets* layer select a border of a sheet, for which the output file will be created.
  - Choose the **Mosaic › Build current sheet**. The **Save as** window is open, where you can specify name, format and target folder of output file. Default file name is a name of sheet stored in attributes of the *Sheets* layer.
- To create output orthophotos for several mosaic sheets perform the following:
  - Define active sheets on the *Sheets* layer, for which the output files will be created (see Section 10).
  - Choose the **Mosaic › Build full mosaic** or click the button. The **Sheets file** window is open. Specify format and target folder for output files.
- To create output mosaic in distributed processing mode choose the **Mosaic › Distributed processing** or the **Mosaic › Distributed processing with sheets splitting** to start mosaic creation using distributed processing with sheets splitting.

13.7. Mosaic menu

Table 24. Brief description of Mosaic menu

Mosaic menu	Description
Parameters	allows to setup parameters of mosaic preview and creation, as well as brightness adjustment and output data save
Preview	allows to open **Preview** window for the entire block of loaded images considering data processing results
Preview (current sheet)	allows to open **Preview** window for the selected sheet of mosaic
Rebuild brightness adjustment	allows to rebuild local adjustment after cutlines change
Build full mosaic	is used for start of mosaic building and creation of output files for selected active sheets
Build current sheet	is used for start of mosaic building and creation of output file for selected sheet

Mosaic menu	Description
Distributed processing	allows to start mosaic creation for specified active sheets considering user settings and parameters in parallel (distributed) processing mode
Distributed processing with sheets splitting	allows to start mosaic creation using distributed processing with splitting of active sheets
Open image	allows to open any image of acceptable raster format for preview in the application window
Save parameters preferences	allows to save mosaic parameters setting for further use them in other mosaic projects (see a description of the **Use saved mosaic settings** option in Section 14).

14. Common parameters

For convenient work the program provides adjusting of common parameters and mosaic visualization parameters in the **Preview** window (see Section 14.1). Perform the following actions to set up common program parameters:

1. Choose the **Service › Settings** or click the button. The **Settings** window opens.

2. Click the **Geomosaic** tab.

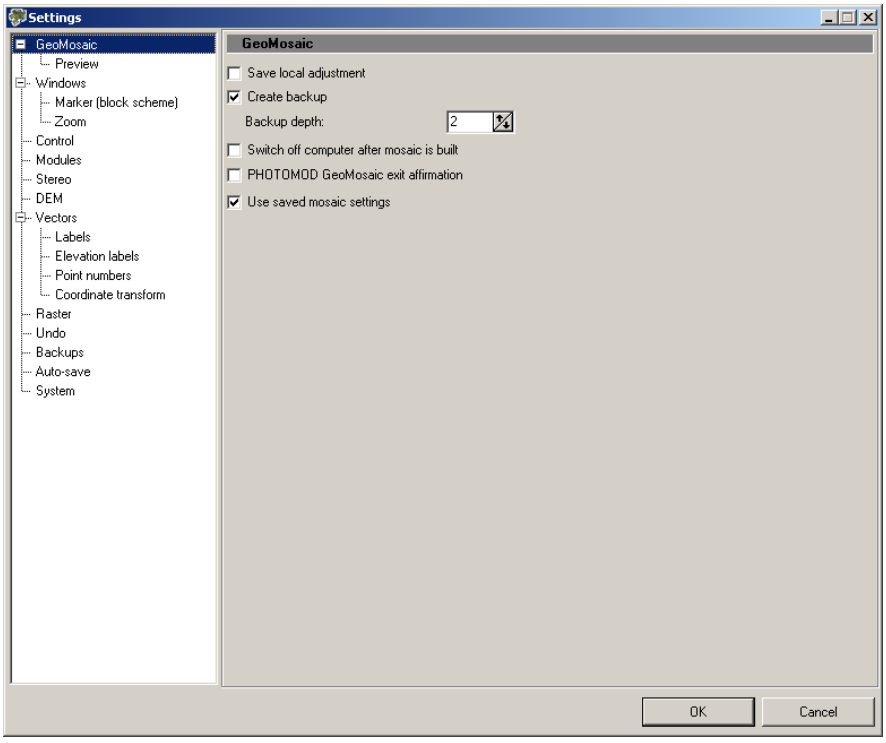

Fig. 29. Common parameters

Table 25. Description of common parameters

Parameter	Description
Save local adjustment	Allows to turn on/off saving of parameters and settings of local brightness adjustment to file of mosaic project.
Create backup	Allows to setup automatic save of mosaic project backups to active profile resources.
Switch off computer after mosaic is built	Allows to setup computer automatic switch off after completion of mosaic creation.
PHOTOMOD Geomosaic exit affirmation	Allows to show a prompt on confirmation of exit from the program when user tries to close main program window.
Use saved mosaic settings	Allows to load mosaic settings (saved by choosing the **Mosaic › Save parameters preferences**) during the program start.

14.1. Preview parameters

Perform the following actions to setup mosaic visualization options in the **Preview** window:

1. Choose the **Service › Settings** or click the button. The **Settings** window opens.

2. Click the **Preview** on the **Geomosaic** tab.

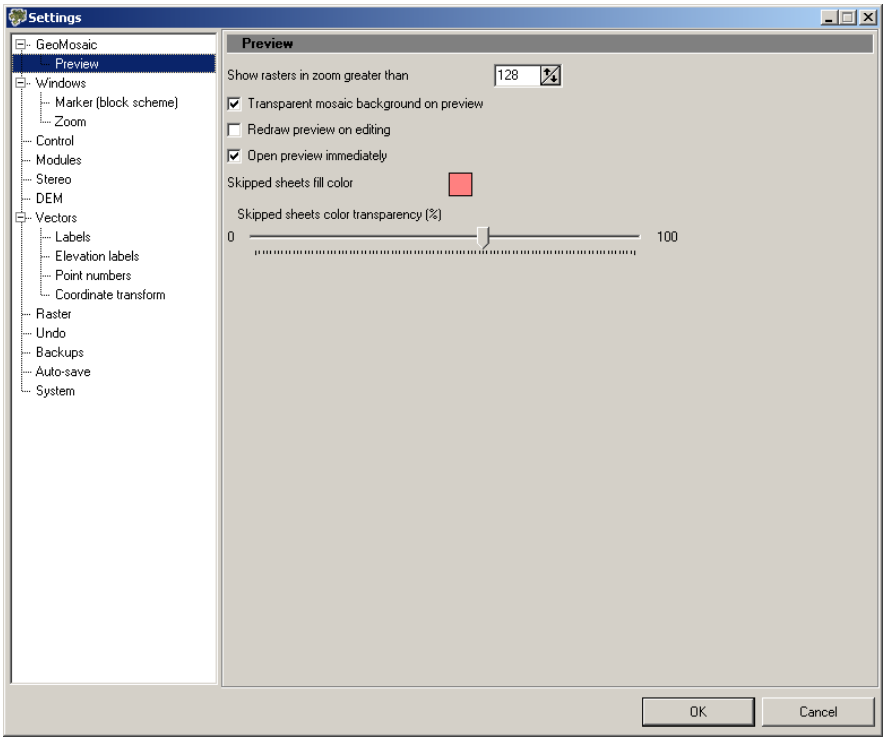

Fig. 30. Preview parameters

Table 26. Description of preview parameters

Parameter	Description
Show rasters in zoom greater than	Allows to setup a zoom at which a visualizing of mosaic project images in the **Preview** window begins.
Transparent mosaic background on preview	Allows to setup a transparency of output mosaic background visible in the **Preview** window.
Redraw preview on editing	Allows to setup automatic refresh of mosaic data in the **Preview** window during editing of this data.
Open preview immediately	Allows to show added images in the **Preview** window right away (the option is set by default). See also Section 8.2.
Skipped sheets fill color	Allows to select a fill color to show inactive sheets of mosaic (i.e. sheets excluded from output files creation). You can adjust the transparency degree for selected color using the **Skipped sheets color transparency** slider (in percent). See also Section 10.6.