

Digital Photogrammetric System

PHOTOMOD

Version 5.21

USER MANUAL

Using LIDAR data
in the system



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1. About

The current User Manual is intended to review the import of LIDAR data for use in the PHOTOMOD system. Main part of document contains the description of the loading, viewing and processing of LIDAR data modes.

2. Import of LIDAR data

Import of LIDAR data is provided to enable using LIDAR data in the system. This feature allows to convert the LIDAR data to DEM which is saved into the file of active profile.



LIDAR data - it is data obtained by lidar systems, which are installed on aircraft. Aerial LIDAR systems are represented by laser scanner for remote sensing of the earth's surface. The principle of lidar survey consists in pulsing from the laser transmitter to remote objects, signal registration and the processing of the reflected signal. Lidar data are delivered in LAS format files. LAS format files include the XYZ coordinates and attributes of the laser reflection points (for example, serial number of the reflected pulse, total number of reflections in a point, object classification data).

Points of the laser reflection from the earth's surface, which coordinates and attributes are contained in the LAS format files, will be called the *LIDAR points* in this document-ation.

3. Importing the LIDAR data into the system

3.1. Workflow

Importing the LIDAR data into the system consist of following *basic operations*:

1. Start the system with or "w/o project".
2. Use the **DEM › Load LIDAR data** menu command to open the **Load LIDAR data** window.

3. Open in Load LIDAR data window one or a few LAS format files with LIDAR data and convert it to DEM. DEM is saved in the file of active profile and displayed in 2-D window.
4. Select the **DEM › Transform to another coordinate system** menu command to put the coordinate system of building DEM to accordance with project coordinate system.

3.2. Load LIDAR data window

Load LIDAR data window is used to transform the LIDAR data to DEM. It opens during the selecting of **DEM › Load LIDAR data** menu command.

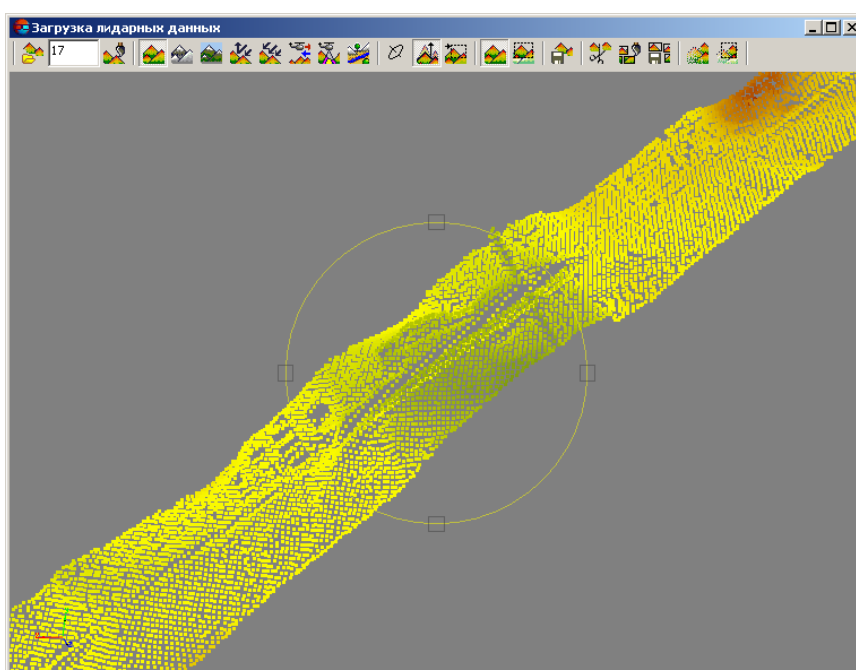























Fig. 1. Load LIDAR data window

Load LIDAR data window contains the following GUI elements:

- tool bar for loading, viewing and LIDAR data preparing for transforming to DEM (see short description [Table 1](#));
- working area for *LIDAR points* viewing, which contains in lower left corner the direction axes of the coordinate system of loaded LIDAR data.


Table 1. Toolbar of Load LIDAR data window

GUI elements	Purpose
 Open	Button for opening the LAS format files with LIDAR data
Output points per point field	Field displaying number of source <i>LIDAR points</i> per one point shown in thinned array in the Load LIDAR data window

GUI elements	Purpose
 Display	Button for loading all opened LAS files and displaying <i>LIDAR points</i> in working area
 Elevation	Button for displaying <i>LIDAR points</i> in coloring mode to accordance with its Z-coordinate values
 Intensity	Button for displaying <i>LIDAR points</i> in gray scale mode (if source LAS file contains such data)
 RGB	Button for displaying <i>LIDAR points</i> in RGB mode (if source LAS file contains such data)
 Return number	Button for displaying <i>LIDAR points</i> in coloring mode to accordance with serial number of reflected pulse per one point (if source LAS file contains such data)
 Number of returns	Button for displaying <i>LIDAR points</i> in coloring mode to accordance with number of reflected pulse per one point (if source LAS file contains such data)
 Scan direction	Button for displaying <i>LIDAR points</i> in coloring mode to accordance with aircraft scan direction when sounding the earth surface (if source LAS file contains such data)
 Edge	Button for displaying <i>LIDAR points</i> in coloring mode to accordance with edges (if source LAS file contains such data)
 Classification	Button for displaying <i>LIDAR points</i> in coloring mode to accordance with objects classification (if source LAS file contains such data)
 Control	Button to enable rotation mode and rotate <i>LIDAR points</i>
 Scaling along Z axis	Button to enable stretching along Z axis
 Selection	Button to enable selection of any part of <i>LIDAR points</i>
 Show all	Button to enable displaying of all loaded <i>LIDAR points</i>
 Show selection	Button to enable displaying of <i>LIDAR points</i> within selected area
 Save selection into LAS	Button to save the LIDAR data from selected area into new LAS format file
 Splitting settings	Button to split the loaded LIDAR data
 Show splitting grid	Button to enable/disable displaying of splitting grid
 Split into LAS-files	Button to save parts of LIDAR data corresponding to created splitting into separate LAS files
 Build DEM	Button to transform all opened files with LIDAR data into one DEM file
 Build DEM from selected area	Button to transform selected area of LIDAR data into DEM

3.3. Opening files with LIDAR data

To open files with LIDAR data in **Load LIDAR data** window perform the following operations:


1. Push the  button. **Open** window opens.

2. Select one or few LAS format files and push the OK button. LIDAR data from selected files is loaded, but not displayed in the **Load LIDAR data** window working area. See description of LIDAR data importing in [Section 3.4](#).





Transform into DEM option is available at once after opening files with LIDAR data (see description in [Section 3.7](#)). It allows to save time on importing LIDAR data for displaying in the **Load LIDAR data** window.









3.4. LIDAR data displaying

Push the  button to show of opened LIDAR data in the **Load LIDAR data** window. Process of LIDAR data loading, which which may consume a long time. *LIDAR points* are displayed in working area after the completion process of LIDAR data loading. Large volumes of LIDAR data are thinned out for display. The thin out coefficient displays in the **Output points per point** uneditable field of **Load LIDAR data** window.

System provides the following features to control the display of loaded *LIDAR points* in the **Load LIDAR data** window:

- Use the mouse wheel for scaling.
- Initially, push the  button to rotate and then move cursor in the working area with the pressed left mouse button.
- Initially, push the  button to stretch along Z axis and then move the cursor vertically in the working area with the pressed left mouse button.



System provides the following modes for coloring *LIDAR points*:

-  – Height coloring mode.
-  – Gray scale coloring mode.
-  – RGB coloring mode.
-  – Coloring mode to accordance with serial number of reflected pulse per one point.
-  – Coloring mode to accordance with number of reflected pulse per one point.
-  – Coloring mode to accordance with aircraft scan direction when sounding the earth surface.
-  – Coloring mode to accordance with edges.
-  – Coloring mode to accordance with objects classification.

3.5. Selection of loaded LIDAR data


The **Load LIDAR data** window allows to select any part of loaded LIDAR data for viewing, saving in separate LAS format file and/or transforming to DEM.


To select the area do the following actions:

1. Push the  button to enable the area selection mode.
2. Stretch a rectangle with the pressed left mouse button. Displaying mode of current selected area turn on automatically (the  button is pressed); The *LIDAR points* of selected area only are displayed in the working area. Depending on the size of selected area the thin out coefficient of *LIDAR points* decreases.



Push the  button to display of all loaded *LIDAR points*.




Push the  button to save the LIDAR data of selected area in the new LAS format file. The **Save as** window opens. Specify the folder and name of new LAS format file. Push the OK button to save the data of selected area in specified file.

Push the  button to transform LIDAR data of selected area to DEM (see description in [Section 3.7](#)).

3.6. Splitting

The **Load LIDAR data** window provides the splitting into sheets of loaded LIDAR data. Splitting feature allows to split all loaded LIDAR data and save in the separate LAS format files. Using of splitting feature is optimally if the source LAS format file contains a large amount of LIDAR data. Splitting feature allows to select one or another parts of source LAS format file for DEM building.

To split the LIDAR data into sheets do the following actions:

1. Push the  button in the **Load LIDAR data** window to open one or few LAS format files for splitting.
2. Push the  button in the **Load LIDAR data** window to load LIDAR points.
3. Push the  button to specify splitting settings. **Splitting settings** window opens ([Fig. 2](#)). In the list on the left select the one of opened files with LIDAR data for splitting. In the **Splitting type** panel select the splitting type by check box and specify the parameters.

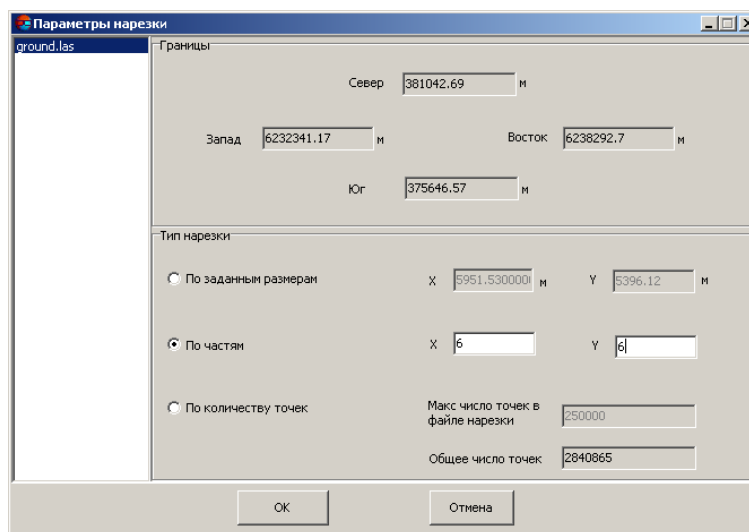



Fig. 2. "Splitting settings" window

Splitting type	Settings
By part size	Splitting sheet's size along X and Y axes in meters.
By parts number	Number of splitting sheets along X and Y axes.
By points number	Max number of <i>LIDAR points</i> per single splitting sheet in the Max points per single file entry field.



Use the info in **Bounds** panel and **Total points quantity** field for the splitting settings assessment.

4. Push the OK button. **Splitting settings** window closes. Sheet frames for selected file are displayed in **Load LIDAR data** window (Fig. 3). Use the  button for turning on/off the sheet frames displaying mode.

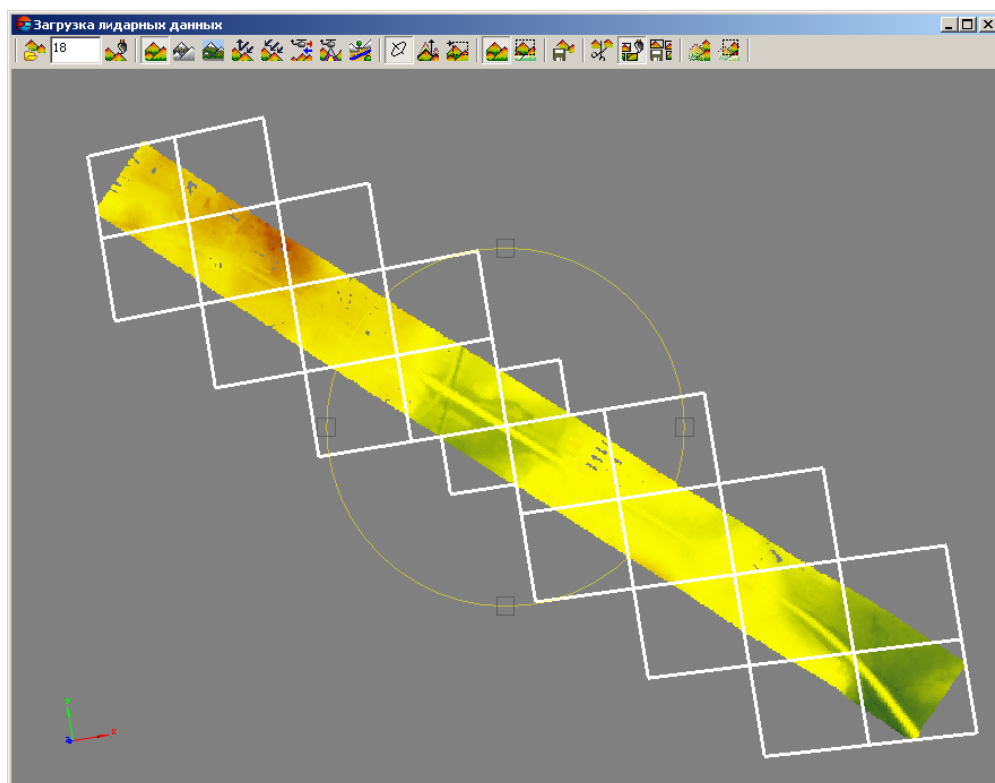




Fig. 3. Splitting sheets displaying


5. Push the  button to save the LIDAR data from splitting sheets in the separate LAS format files. **Save** window opens. Specify the folder of active profile and *left part* of the name for creating the LAS format files. Push the OK button. The file is created for each sheet. The name of this file is created from the specified initial part, the filename of splitting of LIDAR data and the serial number in accordance with the number of the splitting sheets.

3.7. Building of DEM


The **Load LIDAR data** window provides the DEM building from the opened LIDAR data or selected area of loaded LIDAR data.

Perform the following actions for DEM building:




1. Push the  button in the **Load LIDAR data** window for opening one or several LAS format files.
2. Define the creation area of DEM:
 - Building of DEM for all LIDAR data of opened LAS format files.

Push the  button. The **DEM parameters** window opens.



Loading of LIDAR data into the window (using the  button) is not a prerequisite in case of the DEM building for all opened LIDAR data.

- Building of DEM for selected area of LIDAR data.

Push the  button for loading the *LIDAR points* into the window work area. Push the  button and stretch the rectangle of selection. The *LIDAR points* of selected area are displayed in the window. Push the  button. The **DEM parameters** window opens.

3. Estimate boundaries (Fig. 4), size and calculated number of cells for output DEM in the **DEM parameters** window. Specify the cell size of output DEM in the X, Y fields (in meters). Automatic recalculation the number of cells is performed while change the cell size. Push the OK button. The **Save** window opens.

Fig. 4. “DEM parameters” window

4. Define folder in the active profile and filename of output DEM in the **Save** window. Push the OK button. The process of DEM building starts. The created DEM is saved in the specified file and displayed in **2D** window when the process completes. (Fig. 5).

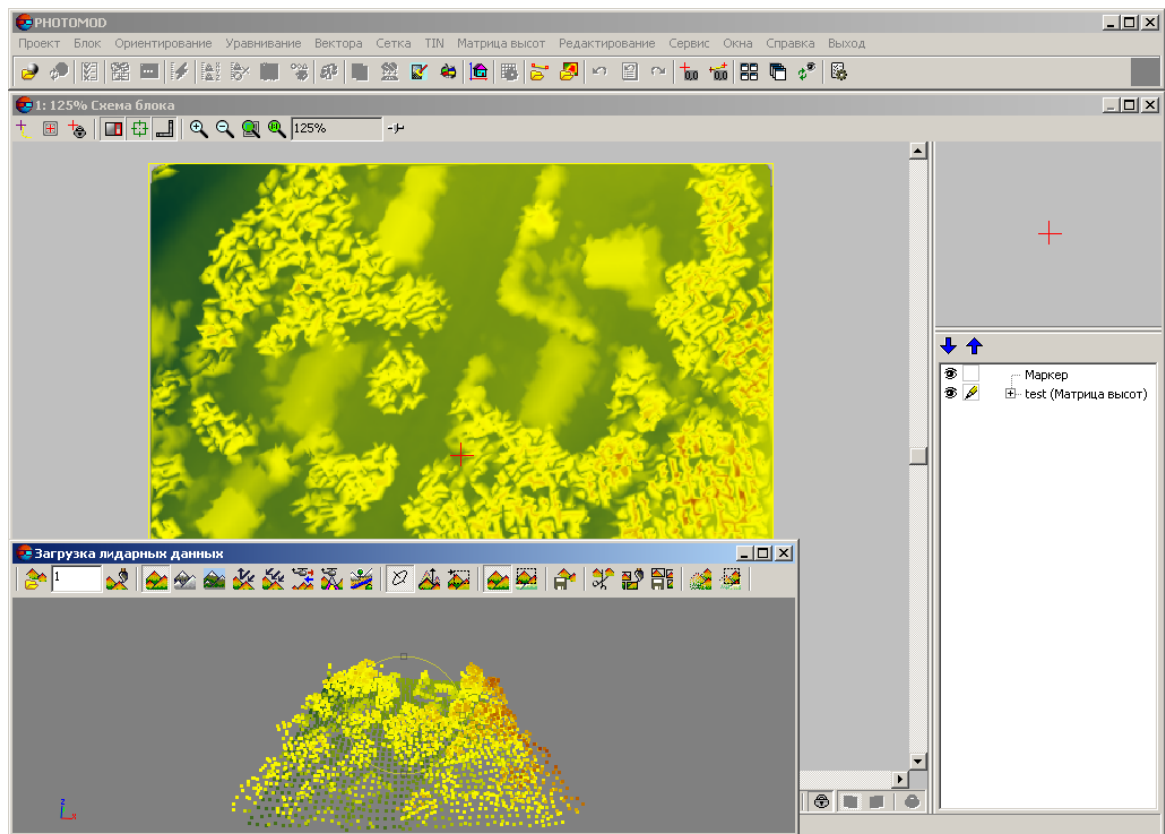


Fig. 5. Conversion of LIDAR data to DEM



Coordinate system of the DEM, created from LIDAR data, must correspond to coordinate system of user's project. The **DEM** > **Transform to another coordinate system** menu command use for recalculation of DEM coordinate system.