



Viewer, Editor & Meter (Beta)

User manual

July 27, 2013

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1. Presentation

3DVEM – 3D Viewer, Editor & Meter software is implemented by GIFLE (Photogrammetry & Laser Scanning Research Group) at the Department of Cartographic Engineering, Geodesy and Photogrammetry, *Universitat Politècnica de València*, Valencia (Spain).

3DVEM allows an efficient management of both point clouds and three-dimensional (3D) photorealistic models obtained by different means: photogrammetry, computer vision, robotic, infography, surveying, laser scanning, etc. 3DVEM allows not only the 3D visualisation of imported data either from 3D models or XYZ coordinates with intensity and colour, but also measuring and making as users like.

Some files are provided in order to start working ElSalvador.pts and Modelo.obj.

2. Installing software

3DVEM works on Windows operating system 32/64 bits. It is an application developed on the Microsoft .NET framework, and depends on the Microsoft .NET Framework 3.5 SP1. You should update your operating system before running the software to ensure that all libraries are updated. Alternatively you can also download and install this version of the framework from the Microsoft Download Center¹. Run the application by double-clicking the file "3DVEM (Beta).exe". The program is free and does not require exclusive license, but you must register first before downloading. Registration must be made by filling out a form with your data. This form is available at the webpage of our research group² or at the software webpage³. If you find any problem downloading the program or during the installation, please send us an email to: gifle@upv.es or info@3dvem.com.

3. Main window

3DVEM user interface is split in five areas (Fig. 1):

1. Menu bar that allows selecting the different commands.
2. Toolbar that allows users to execute the most used tools of the menu.

¹ <http://www.microsoft.com/en-us/download/details.aspx?id=22>

² <http://gifle.webs.upv.es/About.php>

³ <http://www.3dvem.com>

3. Tree structure that shows the loaded data in layers.
4. 3D content rendering surface.
5. Status bar that provides useful information to users.

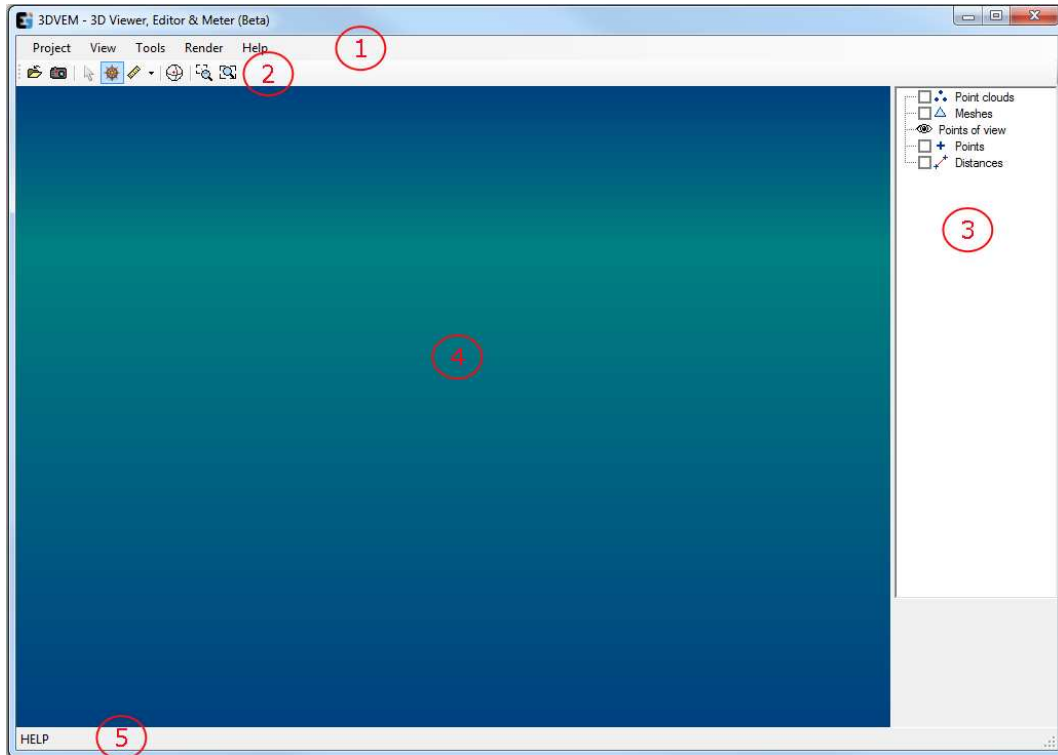


Fig. 1. 3DVEM – Viewer, Editor & Meter: Main window

3.1. Menu

The toolbar on top of the main window (Fig. 1) is organized in 5 pull-down menus:

- *Project*: contains the functions to manage the Project and import data.
- *View*: incorporates tools to visualise and navigate.
- *Tools*: measuring commands and extraction of coordinates, as well as additional tools.
- *Render*: integrates rendering options such as lighting or kind of graphic primitive.
- *Help*: shows the content of this document and provides details about the version and the copyright of the program.

The pull-down menus available in the toolbar are displayed next (Figs. 2-6).

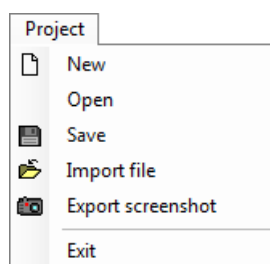


Fig. 2. Project menu

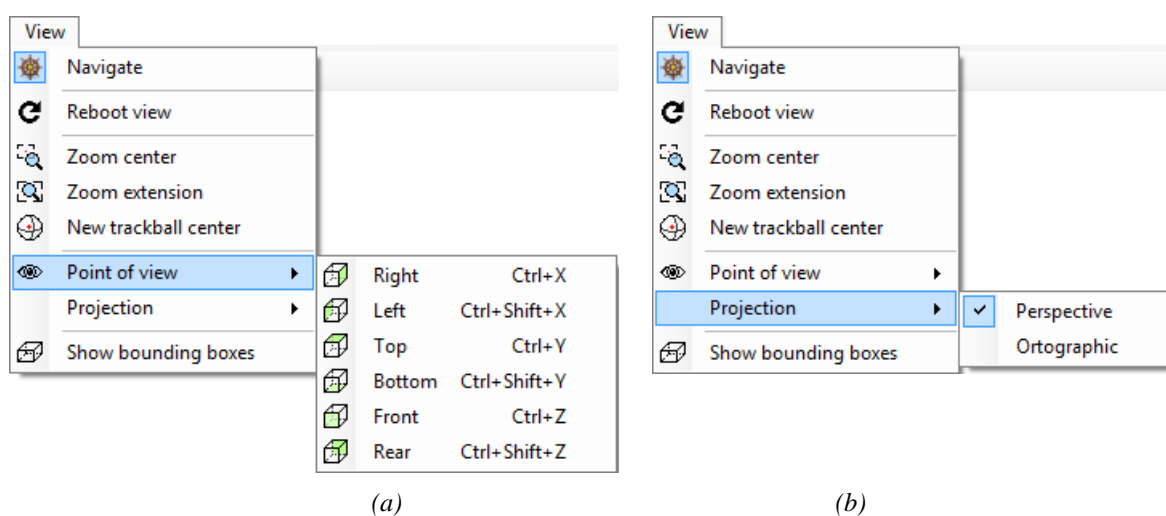


Fig. 3. View menu

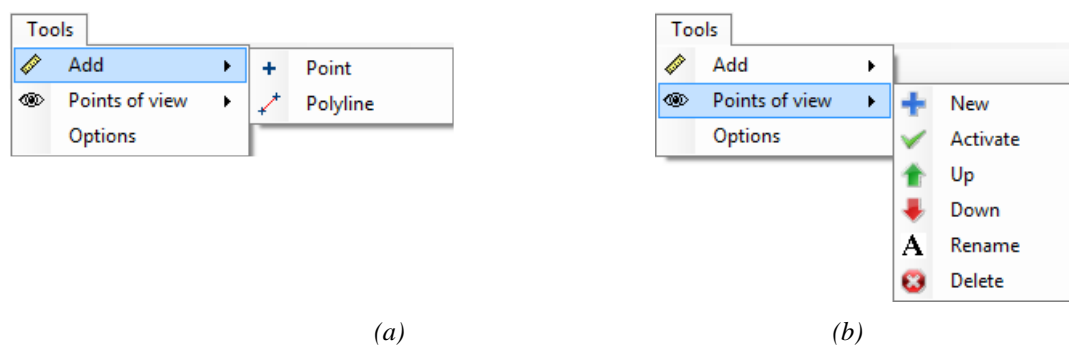


Fig. 4. Tools menu

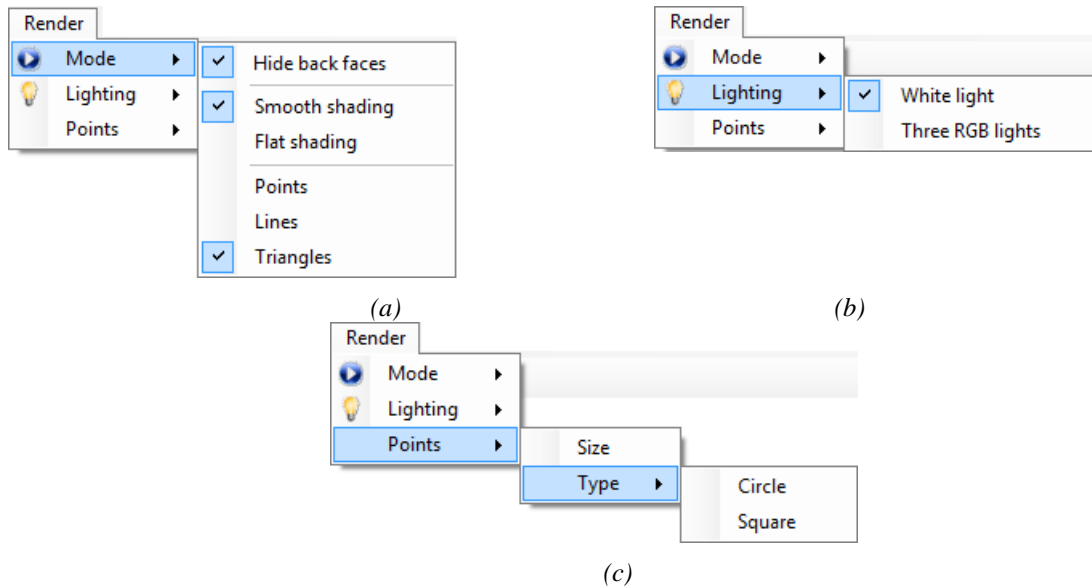


Fig. 5. Render menu

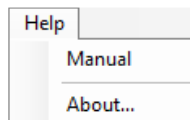


Fig. 6. Help menu

3.2. Toolbar

The toolbar placed below the menu allows a fast way to click the most used commands (Fig. 1). The icons allow:

- Importing point clouds or 3D models in a wide range of formats.
- Exporting a snapshot of the desktop.
- Selecting a point or a polyline.
- 3D navigation.
- Adding a point or a polyline.
- Changing the trackball center for rotation and zooming.
- Zoom center that allows zoom in the selected area.
- Zoom extent that allows users to view all the active layers.

3.3. Tree structure

The tree structure on the right-hand side of the main window shows all the loaded objects (Fig. 1) such as point clouds, meshes, points of view, points and polylines. Every object has its own node, and every node has its own context menu strip, which

provide different options depending on the nature of the object (Figs. 7-11). Those context menu strips are shown by clicking the right button on the existing nodes.

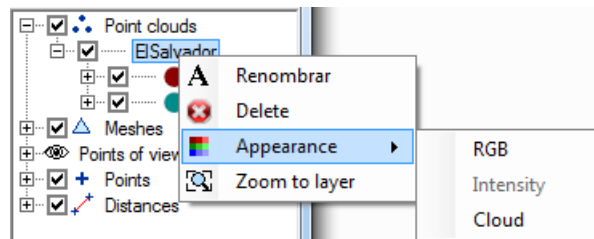


Fig. 7. Context menu of the tree structure. Point clouds

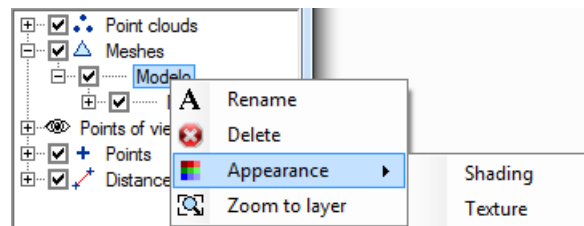
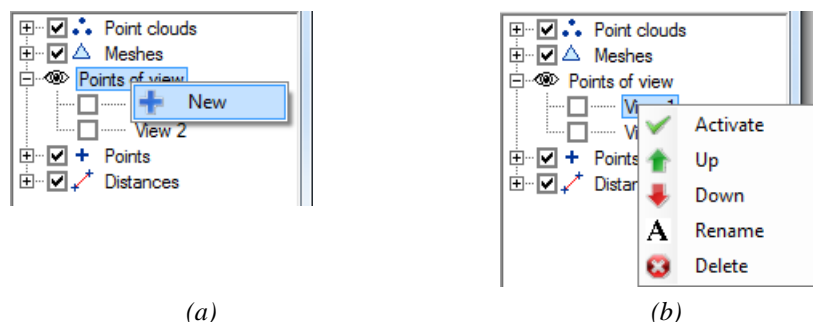
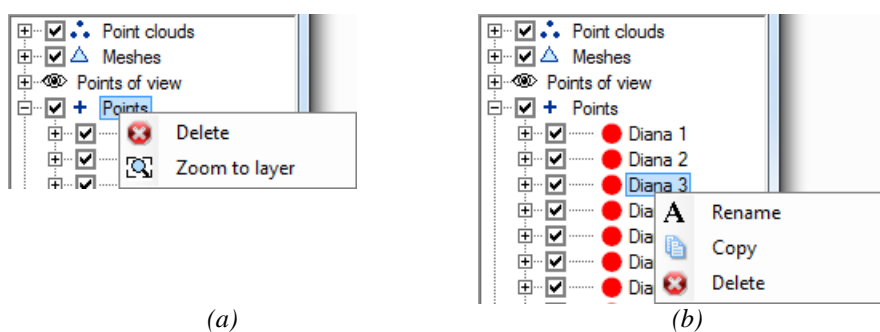


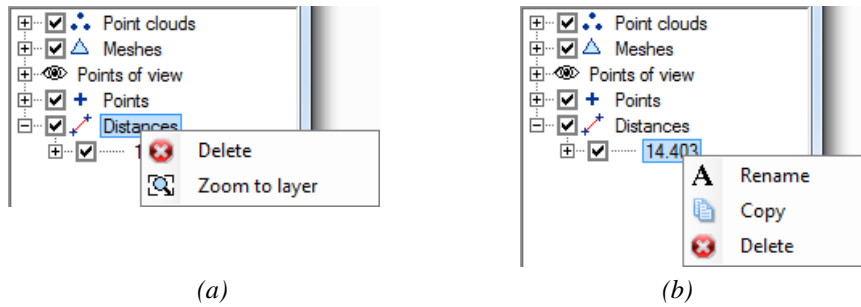
Fig. 8. Context menu of the tree structure. Meshes



(a) (b)
Fig. 9. Context menu of the tree structure. Points of view



(a) (b)
Fig. 10. Context menu of the tree structure. Points



(a) (b)
Fig. 11. Context menu of the tree structure. Distances

3.4. Graphic display

The desktop is the working area where the user interacts with the models (Fig. 1). The bar that splits the tree content can be moved to adjust the desktop size in order to maximize the visualization area.

3.5. Status bar

The status bar is placed at the bottom of the main window (Fig. 1). It is used to comment actions tools.

4. Project menu

The application works with VEM project files written in XML language that allows saving the main project features. The *Project* menu (Fig. 2) allows users to create a new project, open an existing project and save the actual project. More commands of the *Project* menu are:

1. Import data in ASCII format (Fig. 1). The following files can be imported:
 - Point clouds in PTS and PTX format. Furthermore, it imports point clouds in the following ASCII formats (.ASC):
 - a. X Y Z
 - b. X Y Z I
 - c. X Y Z R G B
 - d. X Y Z I R G B
 - Triangulated models with or without texture in OBJ and VRML format.
 - The software also allows importing data in ASCII Grid format with an ASC file extension. This format is used to export data from ESRI GIS applications or LAS data processing tools such as LAStools (Fig. 12).
 - Points in formats PTS, ASC.

The following table shows the maximum number of points and triangles (meshes) loaded into the program, considering two different computers.

Operating system	Millions of points	Million triangles
Windows 7, 64 bits, 12 GB RAM	48	6
Windows XP, 32 bits, 3.50 GB RAM	6	1

2. Export screenshots in BMP, JPEG or PNG format.
3. Exit application.

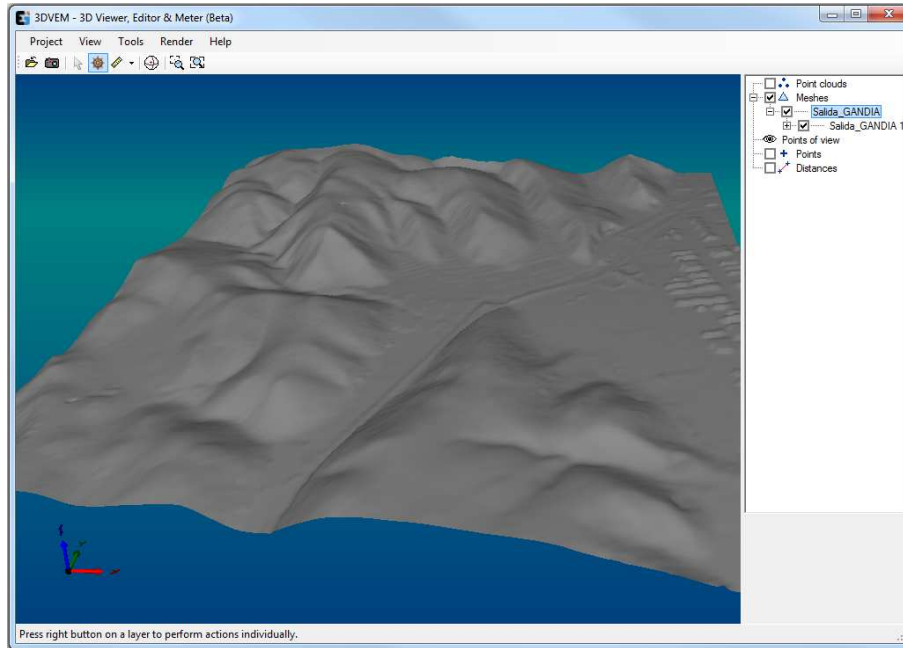


Fig. 12. Importing ASCII Grid data

5. View menu

The *View* menu holds visualisation and navigation tools (Fig. 3). Some functions are reported next:

1. Browse through the three-dimensional space. Mouse handling:
 - Rotation → Left button + mouse movement.
 - Translations → Pressing mouse wheel + mouse movement.
 - Zoom → Turning the wheel of the mouse.
2. Reset the initial view of the model.
3. Zoom center: it is mandatory to click the center and move it until covering the area to zoom in.
4. Zoom extension: allows users to view all the active layers.
5. Change TrackBall: a new trackball point can be selected to set a new rotation and zoom center.
6. Select default views (Right / Left / Top / Bottom / Front / Rear), Fig. 13.
7. Selection of Projection (Perspective/Orthographic).
8. Show bounding boxes (Fig. 14).

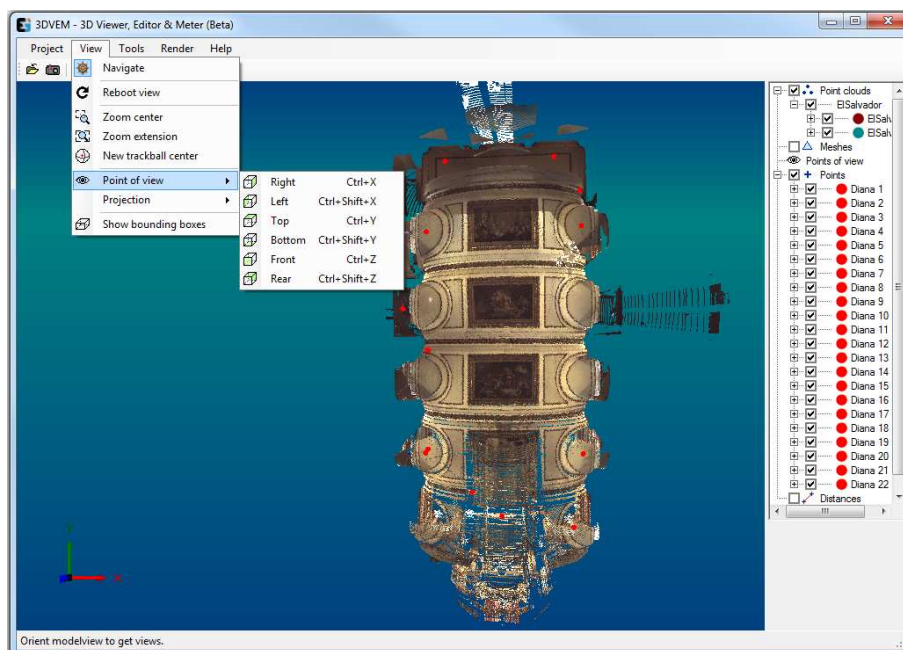


Fig. 13. Selection of predetermined views

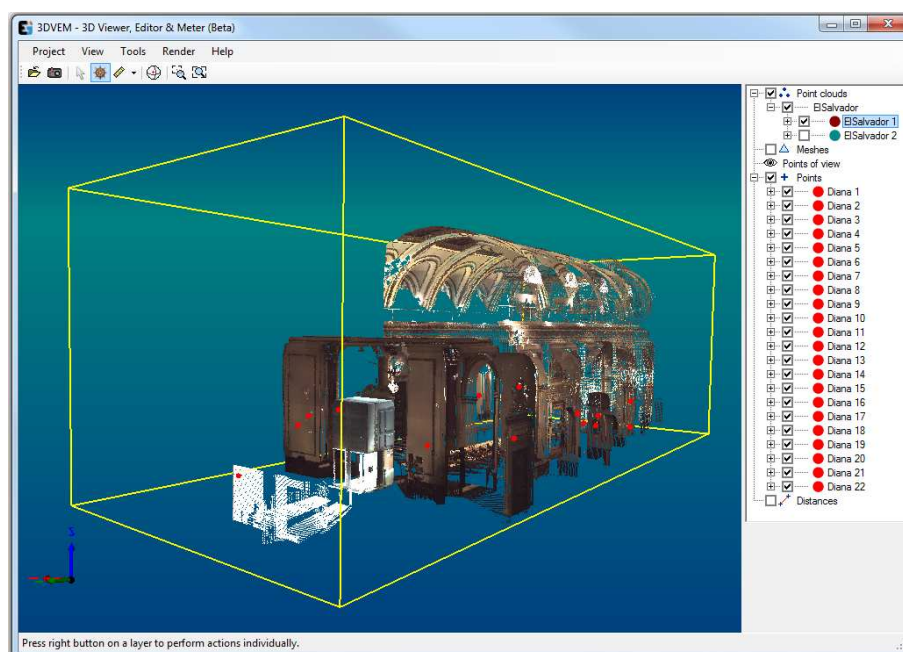


Fig. 14. Show Bounding Box

6. Tools menu

The *Tools* menu contains measuring and coordinate extraction tools, as well as additional tools (Fig. 5).

3DVEM works with the input file units in a way that if a OBJ model is imported in meters, the coordinate increments and distances are shown in meters. The steps required to measure are reported next:

1. Measure/Add points (Fig. 15). Points are introduced after clicking with the left button on points or vertices of the object. By clicking the right button on the desktop it is possible to open the context menu that allows to:
 - a. *Accept*, measured points are stored as *Points* in the tree structure.
 - b. *Cancel*, to delete the measured points.
 - c. *Undo*, to remove the last inserted point.
 - d. *End*, to end the measurement.

By right-clicking over a point in the Tree Structure, a new context menu is opened (Fig. 10b) that allows users to *Rename*, *Copy* or *Delete* the inserted point. Clicking on the *Points* text (Fig. 10a), a menu is opened that allows users to delete all the inserted points, or zooming.

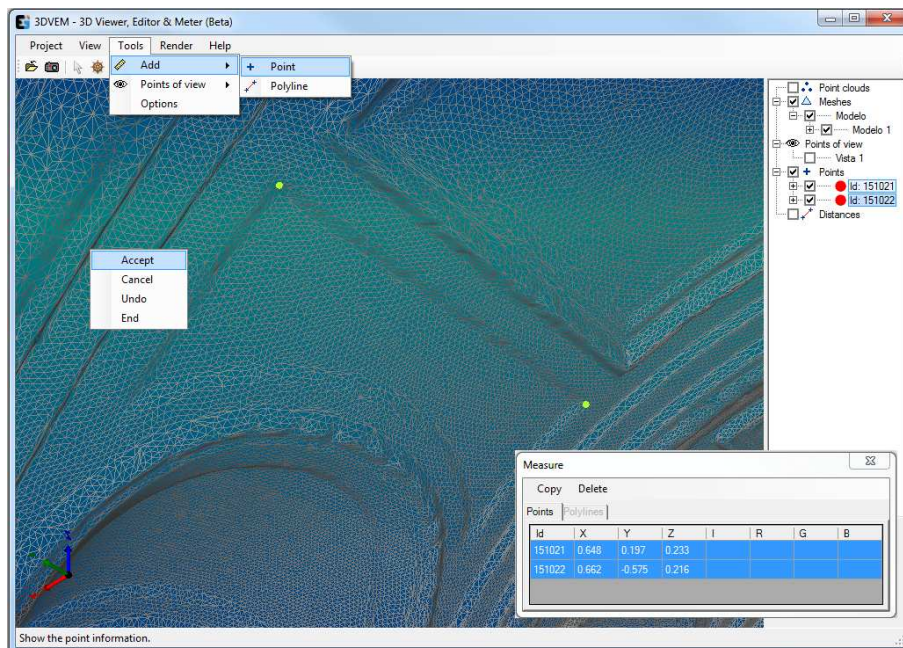


Fig. 15. Inserting points

2. Measure distances/Add polylines (Fig. 16). Add polyline vertices by clicking the left button. Select the option *Accept* to add the drawn polyline as *Distances* in the tree content.

By right-clicking on the polyline in the tree structure, it is possible to open the context menu (Fig. 11b) that allows *Rename*, *Copy* or *Delete* the polyline. Clicking on the *Distances* text (Fig. 11a), a menu is opened that allows deleting all the inserted points, or making zoom.

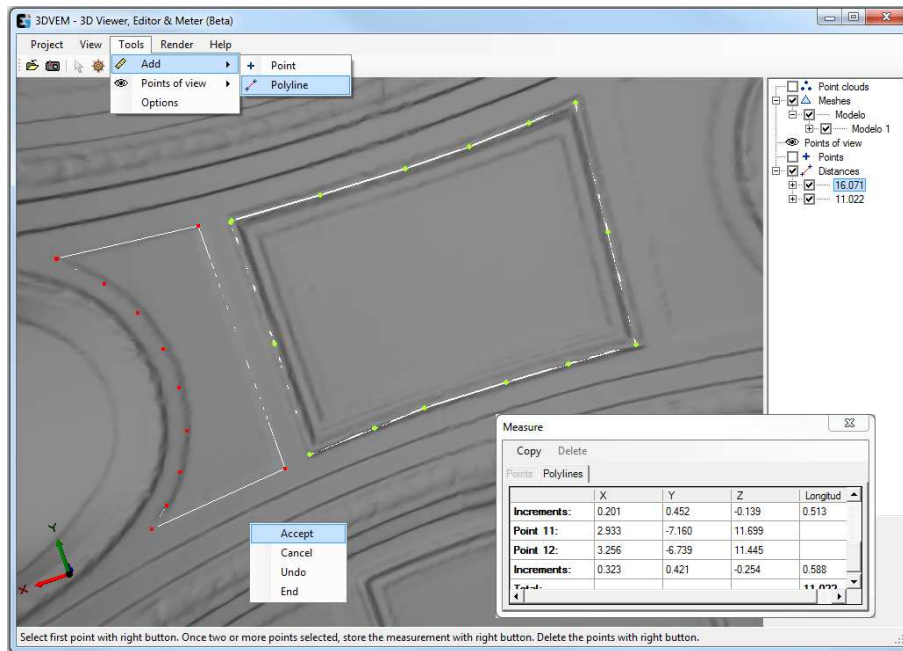


Fig. 16. Inserting polylines

There are additional tools that allow:

1. Inserting various Points of view (Fig. 17). To add a view select in the *Tool menu* the option *Points of view/New*. The new views are incorporated as *Points of view* in the tree content. By right-clicking on the tree nodes, a new context menu is opened (Fig. 9b) that allows users to either *Activate*, *Up*, *Down*, *Rename* or *Delete* the view.

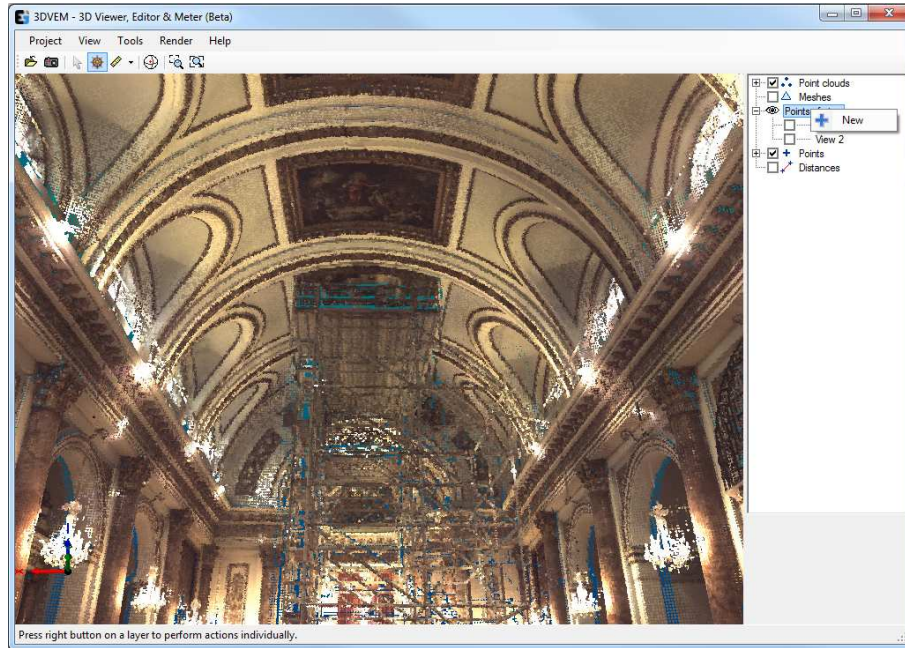
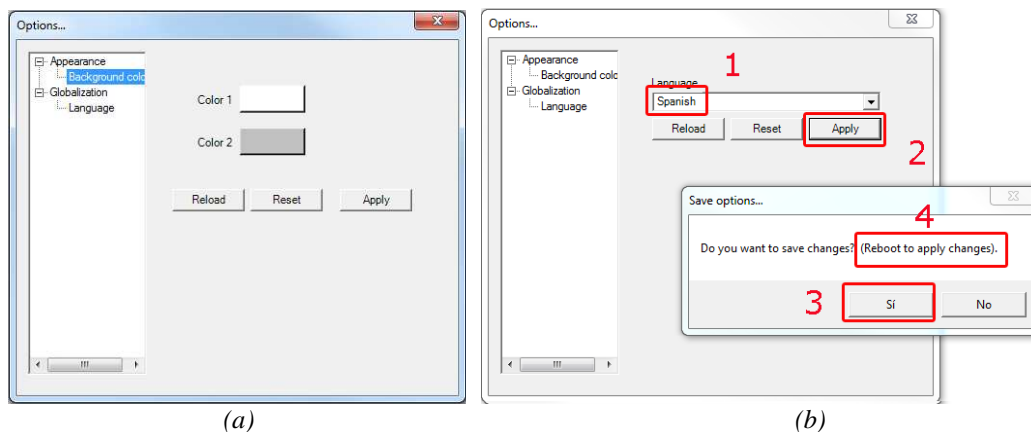


Fig. 17. Inserting points of view

2. Modify the desktop colour (Fig. 18a). Select the *Options* in the *Tools menu*. The command *Background colour* is used to modify the desktop colours. The option *Reset* assigns the colours by default, while the *Reload* option places the selected colours assigned by users. To apply changes click the *Apply* button.
3. Change the language (Fig. 18b). Select *Options* in the *Tools menu*. Choose between Spanish or English. You will need to close and re-run the program to display the menu in another language.



(a) (b)
Fig. 18. Window Options: a) Background colour; b) Language

7. Render menu

The *Render* menu contains all the lighting and appearance tools (Fig. 4). Some of the functions are listed below:

1. Hide back faces: it allows users to show or hide the back faces of the model.
2. Smooth/Flat shading: it allows to apply different shadings on each face, unique colour (flat) or interpolated (smooth).
3. Render model as points, lines or triangles. The vertices of the model are namely shown in Fig. 19. In Figs. 15 and 16 the lines and the triangles are shown, respectively.

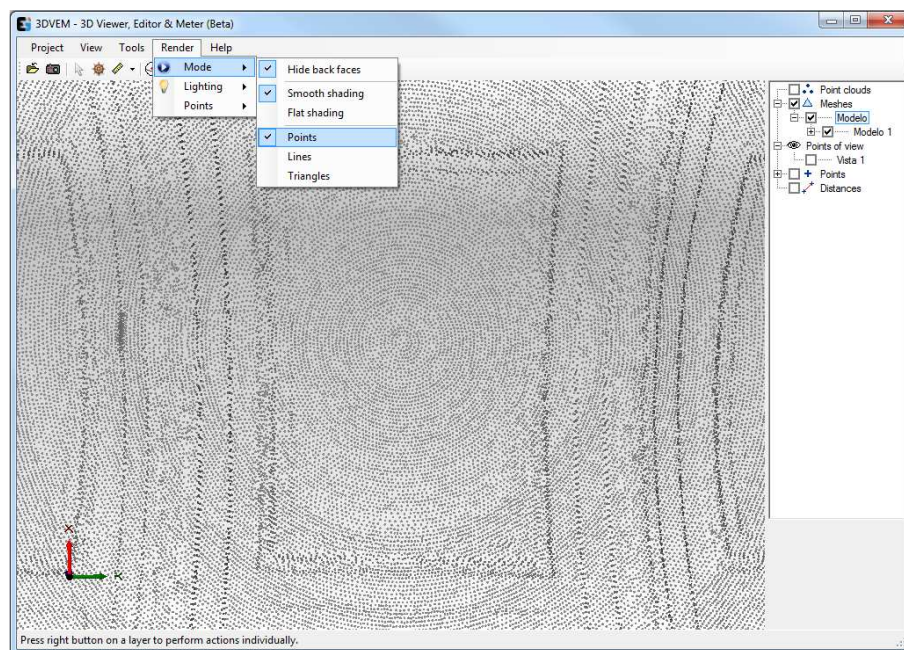


Fig. 19. Model displayed as points

4. Different types of lighting: while light (Fig. 8) or three RGB lights (Fig. 20).
5. Modify the point size (Fig. 21).
6. Change the point shape (Fig. 5c). It can be selected circle and square.

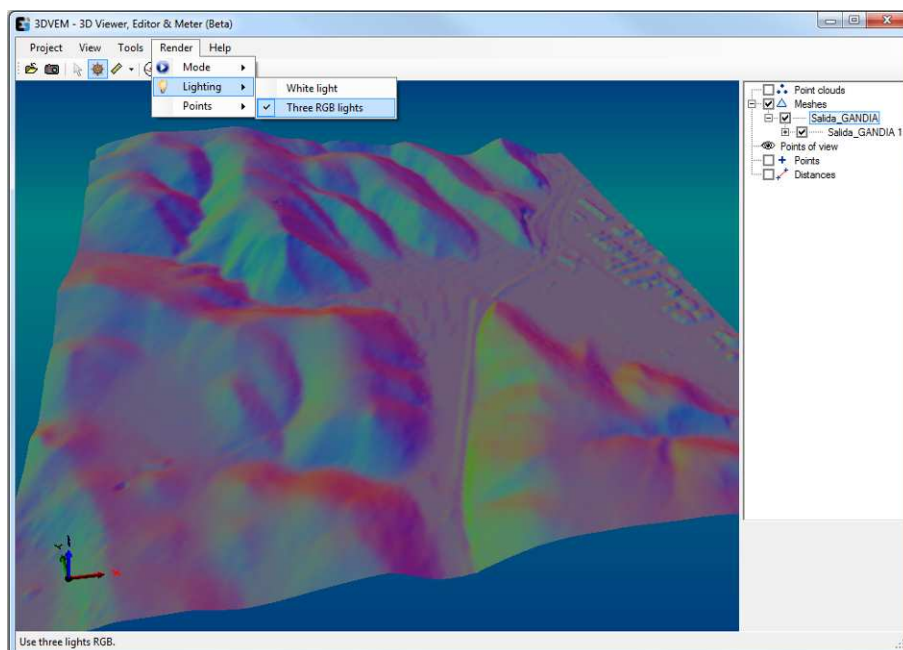


Fig. 20. Triple lighting in RGB

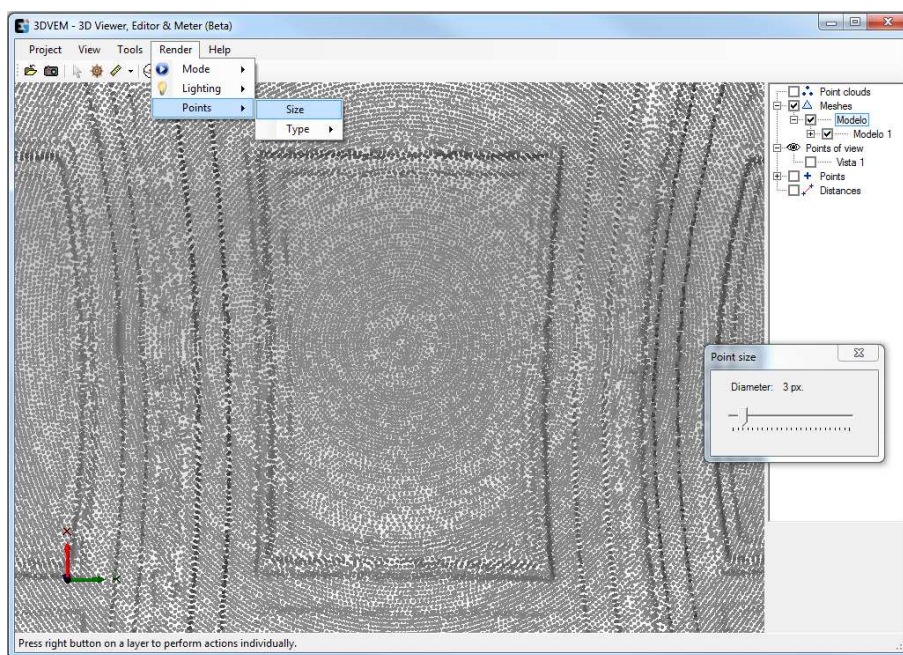


Fig. 21. Modify the point size

8. Context menu of the tree structure

The context menu for *Points* and *Meshes* (Figs. 7 y 8) allow users to render the models:

1. Show the point clouds in *RGB*, *Intensity* or *Cloud* after selecting the option *Appearance* in the *Clouds* context menu (Fig. 7). Fig. 22 displays the point clouds with intensity values; Fig. 23 in colour RGB. The colour assign to each point cloud can be modified after clicking on the circular icon placed on the left hand side of the name (Fig. 23). Fig. 24 shows point clouds coloured with a single colour each.

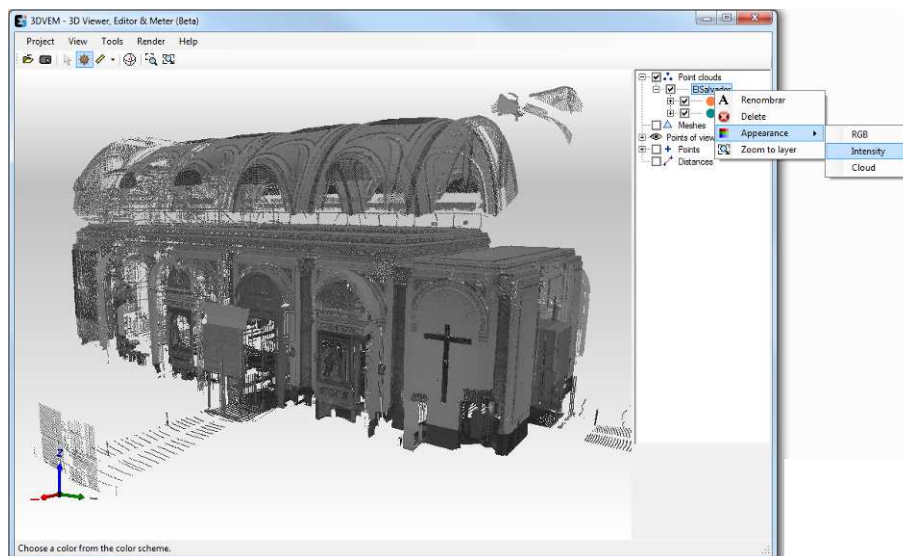


Fig. 22. Visualisation of the point clouds with intensity values

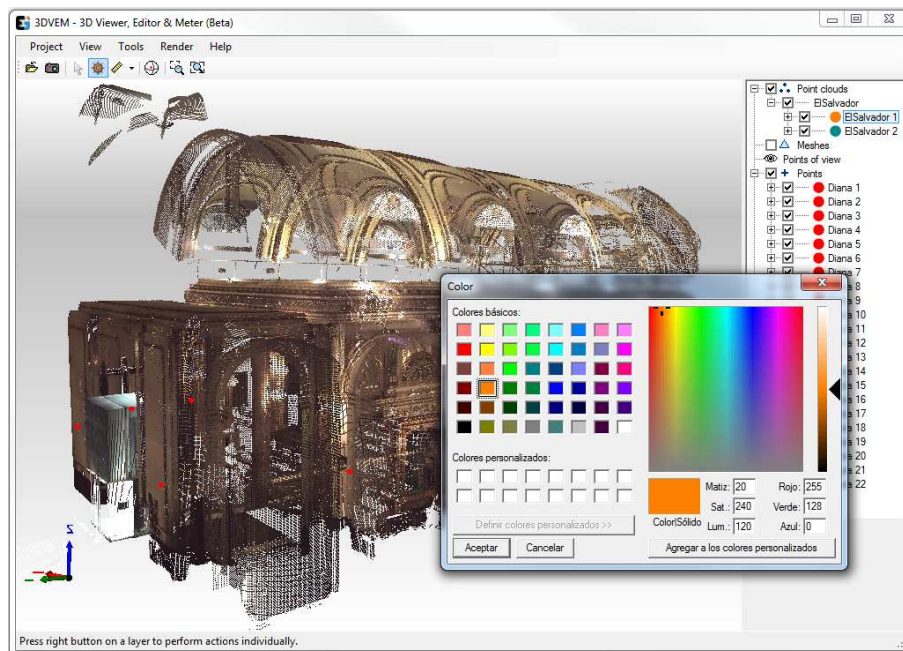


Fig. 23. Selection of a unique colour for each point cloud

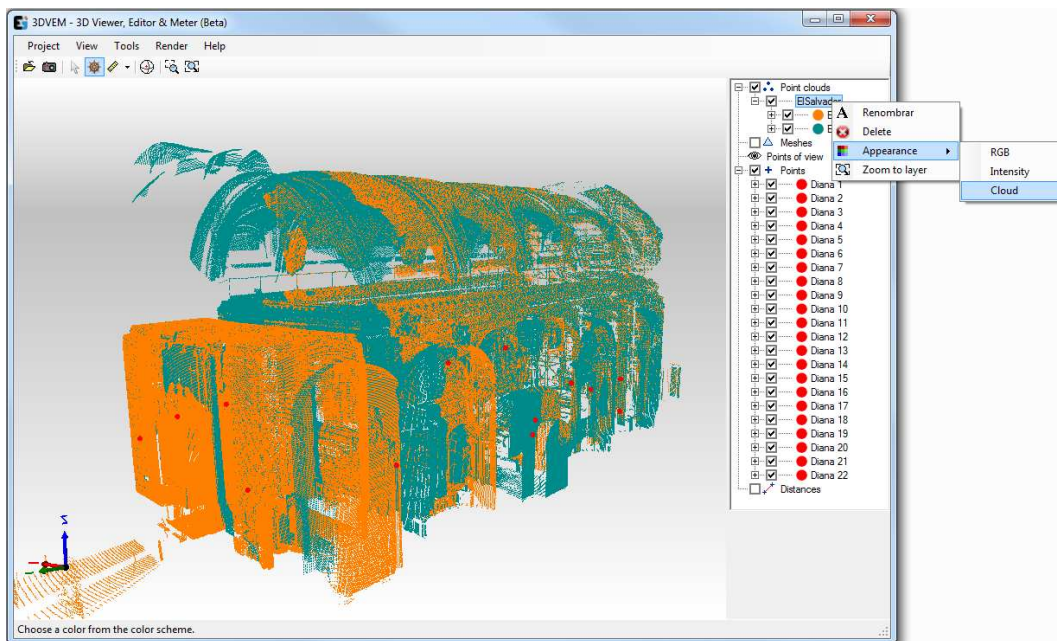


Fig. 24. Visualization of each scan with a unique colour

2. Showing the shading of a model with or without texture can be carried out after selecting the *Appearance* option in the context *Meshes* menu (Fig. 8). Figs. 25 and 26 show the texturized 3D model and the shading respectively.

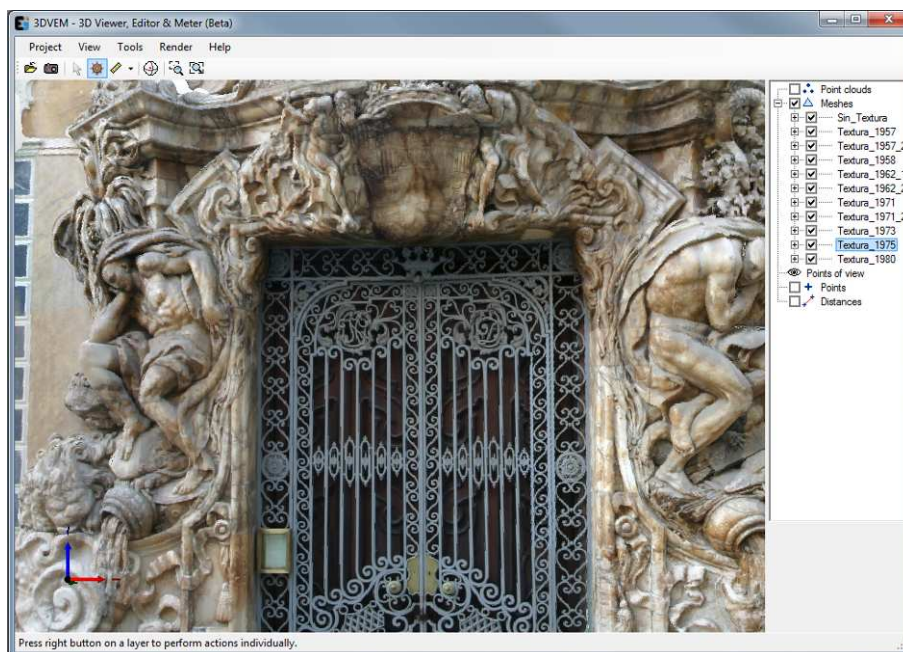


Fig. 25. Photorealistic 3D model

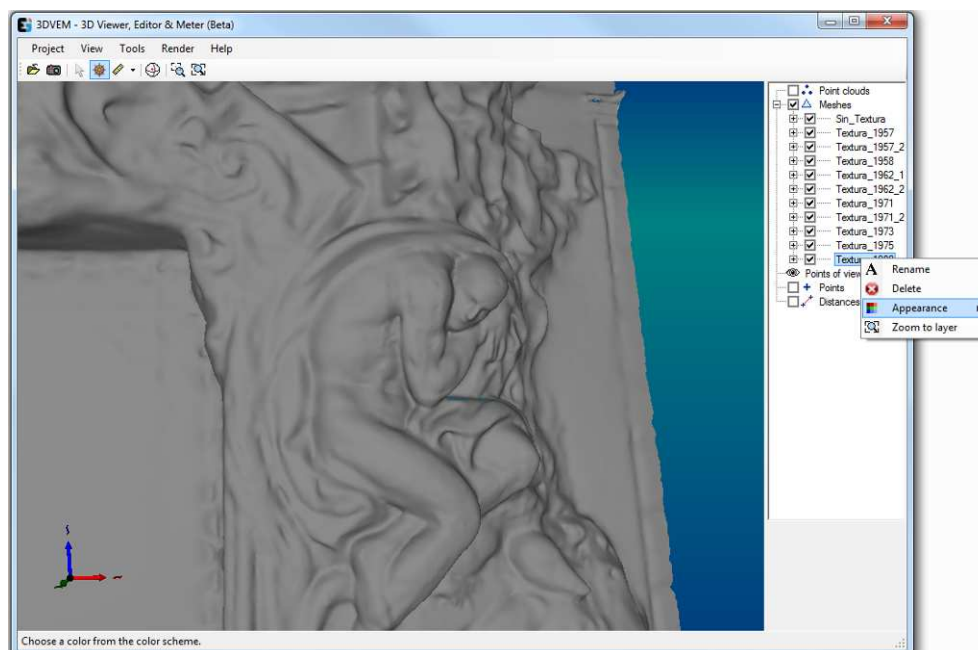


Fig. 26. Shaded model