
3D Survey Collection

Release 1.6

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3D Survey Collection is an add-on that allows to widely manage 2D and 3D survey data within the 3D environment of Blender. For the features that this add-on offers, 3DSC is suitable for users (archaeologist, architects, engineers, etc) who work with 3D meshes (such as photogrammetric models) and need to manage, visualize and edit all this information within the same space.

This add-on is a significant digital tool included within the [Extended Matrix Framework](#), an Open Source and Open Science project which has been developed to manage, visualize, represent and share data and paradata associated to the documentation and the reconstruction of an archaeological context, an object or a collection.

The add-on has been developed by E. Demetrescu at CNR-ISPC (Rome, former CNR-ITABC).

Check out the [Download - Install](#) section for information about the installation of the add-on. For the description of every panel of EMtools, see [3D Survey Collection \(3DSC\) Structure](#)

Remember

This documentation is under continuous editing.

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1.1 Download - Install

1.1.1 Download the installation folder

The installation folder of the EMtools add-on are available at the following links:

- [LTS version](#).

The two version of the EMtools add-on are also available at the [Download](#) section of the Extended Matrix website.

1.1.2 Install 3DSC in Blender

In Blender it is possible to install EMtools by following the general steps useful for the default installation of an add-on:

- download the zip folder of the add-on;
- open Blender and click on *Edit, Preferences*;
- in the *Preferences* panel, on the left side, select *Add-ons*;
- click on the *Install* button;
- locate the zip folder of the add-on and then press the *Install Add-on* button;
- search the add-on within the list of Add-ons and activate it.

Within the preference menu of Blender, the add-on offers a feature that checks for new updates and then asks user for the installation.

1.2 3D Survey Collection (3DSC) Structure

3DSC is divided into several independent panels (at least 9 panels are available on the LTS version) which are automatically displayed on the sidebar of Blender after pressing the *3DSC* tab.

- *Shifting*
- *Importers*
- *Exporters*
- *Quick Utils*

- *Segmentation*
- *LOD generator*
- *LOD Manager*
- *Model Inspector*
- *Color Correction*
- *Photogrammetry paint*
- *Texture mixer*

1.2.1 Shifting



Fig. 1.1: Shifting panel

This panel (Fig. 1.1), which is directly linked with the *Importers* panel, represents the shifting values for X, Y, Z. Shifting values indicate the translation of the objects with respect to the absolute coordinates. To automatically visualize the shift values it is necessary to create a shift file (SHIFT.txt).

This is an example of first line of the shift file: EPSG::3004 2392800.00 5069900.00 0

The *import* button allows to load the shift file.

1.2.2 Importers

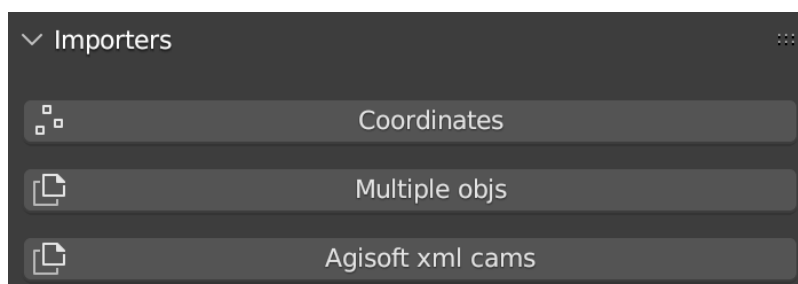


Fig. 1.2: Importers panel

This panel (Fig. 1.2) allows to import in Blender three different types of data: coordinates, objects and cameras.

In the first case, by clicking the *Coordinates* button user can import in Blender 2D point (such as .csv files) of both relative and absolute coordinates. On the menu which appears on the right side of the window, user can associate the first 4 columns of the coordinates with the correspondent values (name, X, Y, Z) and then define the separator (comma, space, semicolon). To visualize absolute coordinates within Blender, user must flag *Shift coordinates* button and 3DSC will automatically shift the file.

In the second case, 3DSC allows to import several objects with a single command. By clicking on the *Multiple objs* button an import window will appear. Here, users must select the desired meshes and then select the correct options on the right side. The latter are the same options that usually appear in the default *import .obj* menu of Blender.

In the third case, by clicking the *Agisoft xml cams* user can import cameras from a project of Metashape (Agisoft xml file).

1.2.3 Exporters

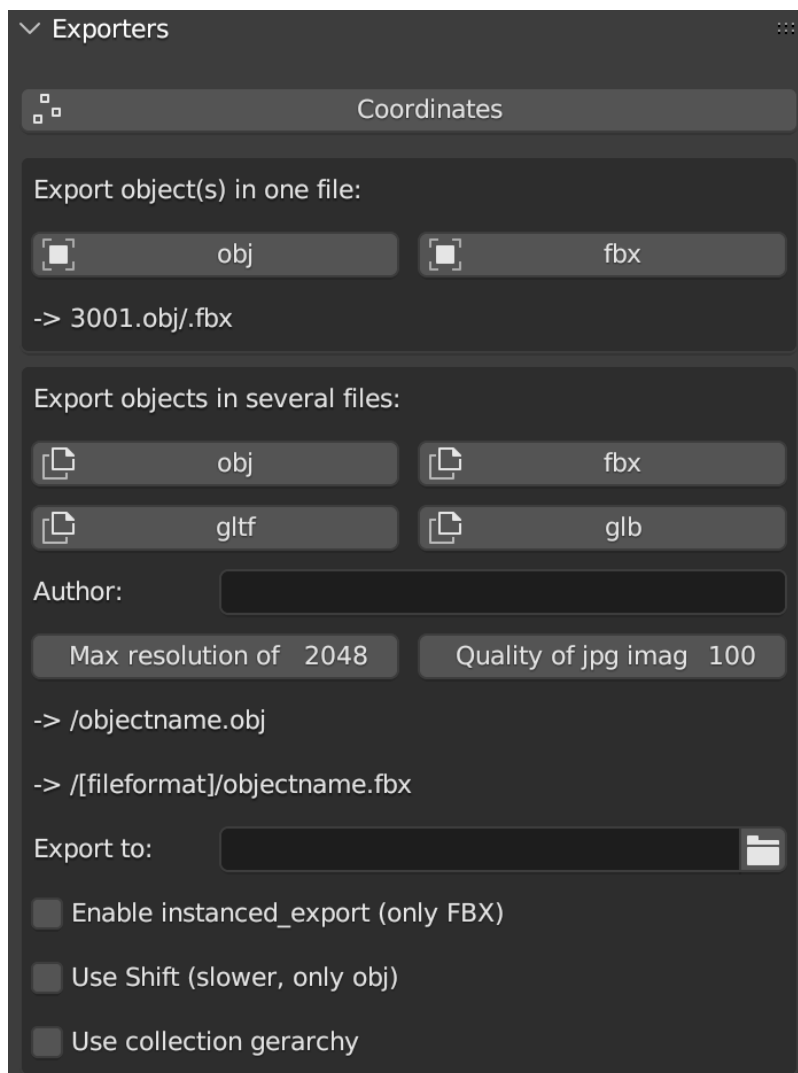


Fig. 1.3: Exporters panel

This panel (Fig. 1.3) is divided in three sub-sections: *Coordinates*, *Export object(s) in one file* and *Export objects in several files*.

The *Coordinates* button allows to export in .txt file format every type of coordinates associated to an object (such as: points, meshes, cameras etc..) within the 3D space of Blender. On the right side of the export window, user can choose to flag some precise features (*Add names of objects*; *Add coordinates of rotation*; *Export only cams*; *World shift coordinates*) to customize the exportation.

This specific tool of 3DSC allows also to export instanced objects. To export this type of objects user has to:

- place in $x=0$, $y=0$, $z=0$ the instanced object (**NB**: in this case, before starting the process, it is necessary to apply transformations to the object - such as: location, scale, and rotation -);
- select all the objects to be exported and then select the object in 0,0,0;
- click the *Coordinates* button in the *Exporters* panel of 3DSC.

The other two *Exporters* execute the same (export) action but with two different results. The *Export object(s) in one file* section allows to export single or multiple objects in one file. Two different file formats are available for the export, user can choose these formats by clicking on *obj* or *fbx* button.

Before starting the export process, user has to define the path of the folder where the exporter must save files (**NB**: before closing the path windows remember to uncheck *relative path* within the settings. Alternatively, it is possible to paste the entire path within the empty line).

The second option *Export objects in several files* allows to export a selection of objects in single files. The available file formats are *obj*, *fbx*, *gltf* and *glb*, they can be chosen by clicking on the correspondent buttons.

In the lower part of the panel user can also select three different types of options: *enable instanced_export (only FBX)*, *Use Shift (slower, only obj)*, *use collection gerarchy*.

The option *enable instanced_export (only FBX)* allows to export FBX file with instaced objects: select a group of objects and the add-on will generate a single file *[name]-inst.txt* using the name of the active object.

The option *Use Shift (slower, only obj)* permits to export obj file with shift values. This process may be slower with big obj file.

The option *use collection gerarchy* consents to apply collection gerarchy for creating a tree of subfolders useful for Game Engines.

1.2.4 Quick Utils

This panel (Fig. 1.4) permits to customize some features of the 3D objects with a series of batch processes that can assist users organize objects within the Blender file.

The *Rename 4 GameEngines* button allows to automatically modify the name of a list of selected objects by adding the prefix *OB_* *actual name of the object*, which stands for *OB(JECT)_*.

The *Remove selected suffix (if any)* tool allows user to organize the list of objects in the scene by simply removing the selected suffix (.001, .002, .003). First, to use this tool it is necessary to select the objects to be cleaned and then add the prefix *OB_* by clicking on the *Rename 4 GameEngine* button. Second, select the suffix to be clean and then press on the *X* button.

The *Batch material settings* tool consents to automatically change four characteristics of the material of a mesh. First, select single or multiple objects. Second, select the option to change (*opaque*, *transparent*, *roughness*, *Metalness*) in the material.

By clicking on the *opaque* button 3DSC will change the Blend mode of the material (located in: *Material Properties*, *Viewport Display*, *Settings*, *Blend Mode*) into *Opaque*.

By clicking on the *transparent* button 3DSC will change the Blend mode of the material (located in: *Material Properties*, *Viewport Display*, *Settings*, *Blend Mode*) into *Alpha mode*.

By clicking on the *Roughness 1* button 3DSC will change the Roughness value to 1 within the Principled BSDF node.

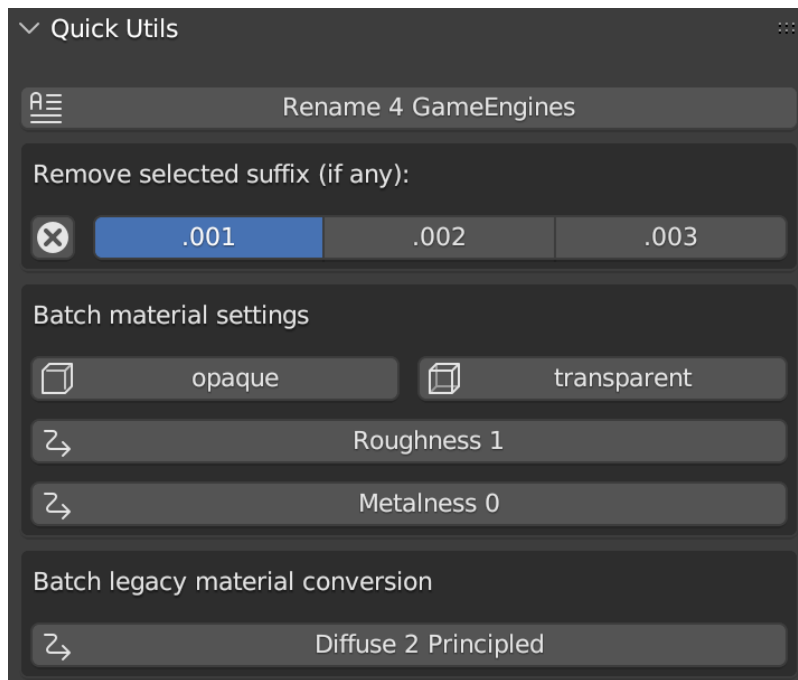


Fig. 1.4: Quick Utils panel

By clicking on the *Metalness 0* button 3DSC will change the Roughness value to 0 within the Principled BSDF node.

The *Batch legacy material conversion* tool allows to convert a simple diffuse material into a Principled BSDF. First, select single or multiple objects. Second, press on the *Diffuse 2 Principled* button.

1.2.5 Segmentation

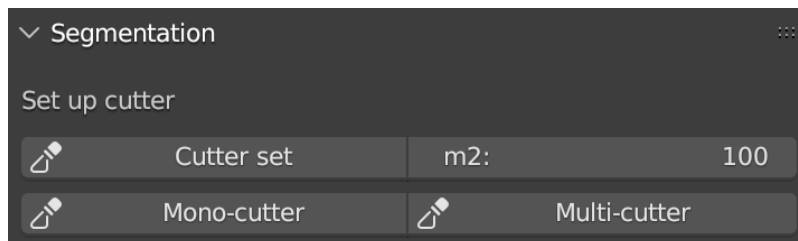


Fig. 1.5: Segmentation panel

1.2.6 LOD generator

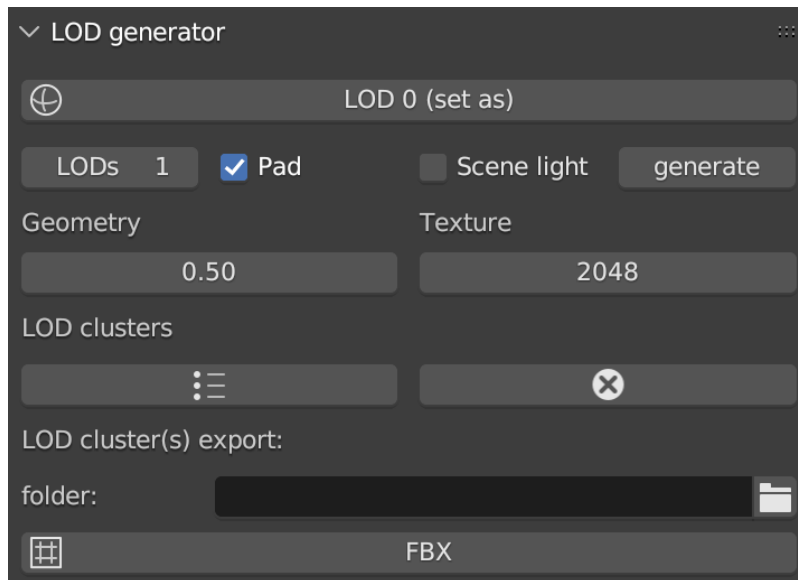


Fig. 1.6: LOD generator panel

This panel (Fig. 1.6) consents to generate Levels of Details (LODs) of a selected mesh. This type of tool is useful to manage large and detailed datasets, such as a mesh from photogrammetry or a mesh obtained with a laser scanner.

To use this tool user needs to first indicate the *LOD0*, the mesh with the highest level of detail within the Blender file. First, select the object. Second, press the *LOD 0 (set as)* button to indicate this object as the LOD 0.

Before generating multiple LODs user must follow some necessary steps: first, set the number of LOD by adding the correct number under the *LOD 0 (set as)* button; second, flag the *Pad* and/or the *Scene light* option to activate the padding ratio for the LOD and/or the scene light baking; third, set the *decimation ratio*; fourth, set the *resolution of the baked texture*; fifth, within the section *LOD cluster(s) export*, indicate the *path of the folder* where LOD will be saved (**NB**: before closing the path windows remember to uncheck *relative path* within the settings. Alternatively, it is possible to paste the entire path within the empty line). After setting these options, by pressing the *generate* button LODs will be created in the desired folder.

If necessary, the *LOD generator tool* permits to create a group of LODs, by clicking on the *LOD clusters* button, and remove it, by pressing the *X* button.

The *FBX* button allows to export LODs' cluster in FBX format in the folder previously indicated.

1.2.7 LOD Manager

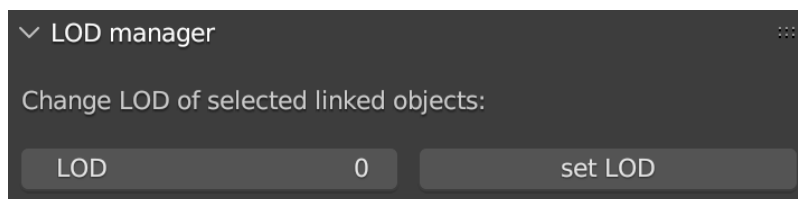


Fig. 1.7: LOD Manager panel

This panel (Fig. 1.7) permits to change the LOD for each tile of a 3D object which is displayed in the viewport of Blender. This type of tool allows to manage the visualization of large datasets which have already been segmented (using the *Segmentation* tool). Using this tool users can view different tiles of the same 3D mesh with different LODs (**NB**: this tool can be employed only if LODs have been previously generated).

To visualize a specific LOD: first, select an object that has been previously processed with the *LOD generator tool*; second, enter the desired LOD to be visualized; third, press the *set LOD* button.

1.2.8 Model Inspector

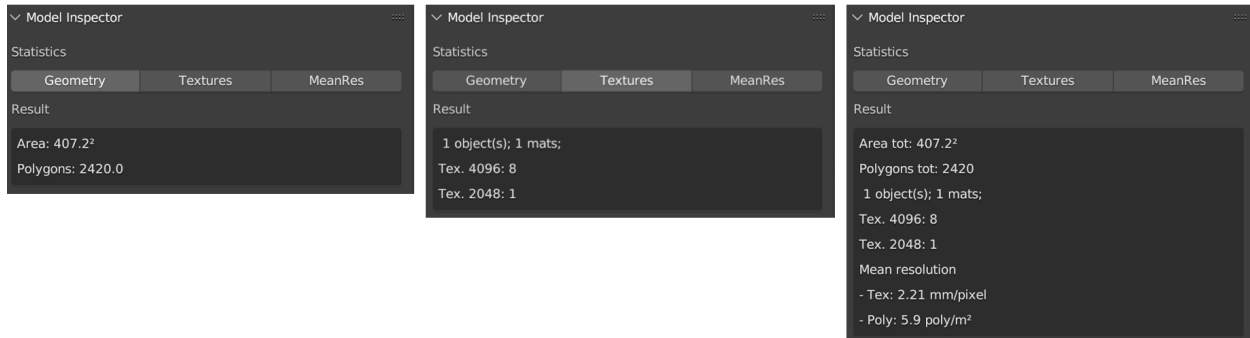


Fig. 1.8: Model Inspector panel (*Geometry* statistics on the left, *Textures* statistics in the center, *MeanRes* statistics on the right)

This panel consists of three main parts (Fig. 1.8): *Geometry*, *Texture* and *MeanRes*.

By clicking on the *Geometry* button the add-on returns some statistics on the geometry of the selected 3D object (*area* and *number of polygons*).

By clicking on the *Textures* button the add-on returns some statistics on the texture of the selected 3D object (*number of materials*, *resolution of the texture*, *number of texture per resolution*).

By clicking on the *MeanRes* button the add-on returns a summary of all the statistical values (*Geometry*, *Texture* and *MeanRes*) concerning the selected 3D object (*area* and *number of polygons*, *number of materials*, *resolution of the texture*, *number of texture per resolution*, *mean resolution per texture* - mm/pixel and *mean resolution per polygons* - poly/m²).

1.2.9 Color Correction

1.2.10 Photogrammetry paint

Photogrammetry Paint Panel

The “Photogrammetry Paint” panel in Blender is tailored for enhancing photogrammetric workflows. It provides a suite of tools for image and texture editing, enabling the user to work efficiently within the 3D environment. This panel facilitates various tasks such as managing undistorted images, merging and separating meshes for texture painting, adjusting camera settings for image projection, and integrating with external image editors for in-depth texture work.

Features

- **Setup Scene:** Initializes the scene for photogrammetric texture editing.
- **Folder with Undistorted Images:** Assign a directory containing the undistorted images to be used in texture painting.
- **Set Selected Cam(s) As:** - **Lens:** Select the type of lens used to capture your images. - **Focal Length:** Input the focal length of the camera lens. - **Apply:** Save your configured camera settings.
- **Temporary Merge/Respawn Meshes:** - **Temporary Merge:** Combine selected meshes for collective texturing. - **Respawn Meshes:** Separate previously merged meshes back to their original state.

The “Temporary Merge” function allows users to temporarily join two mesh objects in the scene. This feature is particularly useful for tasks that require meshes to be combined, such as texture painting to correct imperfections. For instance, users can utilize a clone stamp to transfer texture from one part of a mesh to another, effectively treating the meshes as a single unit. This can also be useful for creating a single UV unwrap atlas for multiple objects. After the necessary operations are completed, the “Respawn” button can be used to separate the meshes and return them to their original state.

- **Visual Mode:** - **Better Cams:** Enhance camera visualization for easier editing. - **Disable Better Cams:** Revert to the standard camera view.
- **Active Cam:** Display the camera that is currently being used for editing.
- **Load Undistorted Photo:** Load the undistorted image for the active camera, ready for texture painting.
- **Focal Length/Clip from-to:** Fine-tune the active camera’s focal length and clipping range for precise texture projection.
- **Camera Texture Not Present:** Notification when a camera texture is missing.
- **Canvas Object:** Select the object which will receive the projected textures.
- **Set an Image Editor Executable:** Specify the path to an external image editor for advanced texture editing.

Post-Processing in External Image Editors

After pressing the **Paint Active from Cam** button, the user engages in a post-processing phase, typically in an external image editor such as GIMP or Photoshop. Here is what generally occurs during this phase:

GIMP/Photoshop Workflow:

1. **Open Image Editor:** GIMP or Photoshop launches with two instances; one displaying the active camera’s view and the other showing the undistorted image.
2. **Copy/Paste Textures:** - Use **CTRL+A** and **CTRL+C** to select and copy the entire undistorted image. - Paste it onto the canvas that represents the 3D model.
3. **Clone Brush Tool:** Utilize the clone brush to remove unnecessary parts of the photograph and make chromatic adjustments. This ensures that the newly applied texture blends seamlessly with the existing textures.
4. **Finalizing Texture:** Once the texture editing is complete: - Disable the background layer in the image editor to isolate the new texture. - Save the new texture by overwriting the existing file or as a new file to be used as a patch.

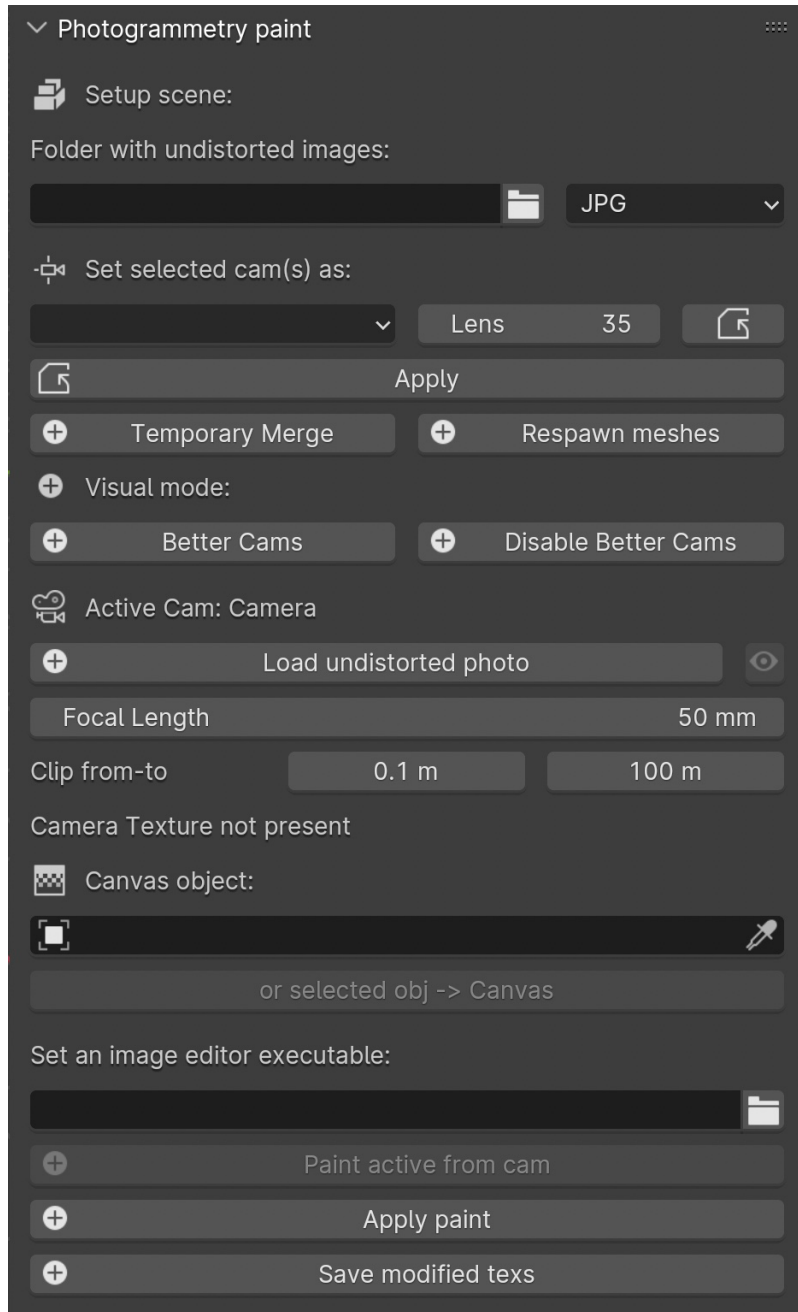


Fig. 1.9: Photogrammetry Paint panel

5. **Apply New Texture in Blender:** Back in Blender, the **Apply Paint** function transfers the edited texture onto the 3D model.
6. **Save and Update Model:** Hit **Save Modified Textures** to save your changes, solidifying the improved texture on the model.

Remember to periodically save your work in the external editor and keep track of version changes to ensure a smooth workflow.

Leverage the Photogrammetry Paint panel to ensure your textures align perfectly with the undistorted images, creating high-quality, realistic 3D models.

1.2.11 Texture mixer