# SCAN2FX

Exporter for Mari

# Manual

**Version 3.7.1**
**March 2019**

# 1. Introduction

## 1.1 Background

SCAN2FX was developed out of the need to create photo-realistic assets, visualizations, structures and sets for production use in a more time efficient manner -- without the need for an extensive process, and without too many intermediate steps.

## 1.2 SCAN2FX Exporter for Mari

**SCAN2FX Exporter for Mari** focuses on quickly creating projection layers and projectors in the Foundry's Mari to photo-realistically and creatively texture models by utilizing Mari's 3D painting toolset. The toolset is focused on providing maximum control for a 3D or texture artist to achieve the best visual results - rather than automatically computing the texture. By painting masks in Mari for each scan layer, artists can precisely determine where and how which scan, or also DSLR photo (with the optional SCAN2FX Photo Projector Module) will influence the final texture and model coloring.

SCAN2FX Exporter for Mari is a module of SCAN2FX's application plug-in for FARO® SCENE. It is purchased separately or in combination with the other modules and enables a straight native export of key data to the Foundry's Mari.

SCAN2FX Exporter eliminates countless hours per scan project and takes care of difficult computations that would otherwise be required to setup the scanned projection layers or projector and transform the data from your laser scanner to be used in Mari. SCAN2FX Exporter automates that process and makes the required calculations automatically for you.

The Foundry's Mari is a popular 3D texture painting application that runs on Windows, macOS and Linux. Mari is widely used to create interactive 3D applications, including video games, animated films, TV series, product visualizations, or visual effects. SCAN2FX Exporter for Mari enables artists to directly export data to Mari from FARO® SCENE without having to spend countless hours going through various intermediate steps or through other software packages.

SCAN2FX Exporter for Mari will export the panorama scan images of the current project in FARO® SCENE to a special Mari python script. SCAN2FX Exporter for Mari computes the correct spherical panorama images and camera poses, from the panoramas and setups project layers automatically for each panorama.

If desired, SCAN2FX Exporter for Mari can also add an environment sphere as a backdrop that can then also be painted with the projections. SCAN2FX Exporter for Mari can also generate alpha mask textures for each shader at a set resolution, enabling the immediate 3D painting of a mask or painting in parts of a texture with Mari's 3D painting toolset. This alpha mask can be used to determine where which particular texture projection should be applied on a model, or

where a certain scan is occluded, and that way enable smooth transitions between different images.

Depending on the settings, SCAN2FX Exporter for Mari can also make the spherical projections paintable by default to immediately enable painting onto the color channel, e.g. to repair holes in the texture with Mari's clone brush.

SCAN2FX Exporter for Mari also provide an option to automatically set a distance falloff for each spherical projection so that a projection only has influence over the up to a certain distance.

1.3    Enhancements to other SCAN2FX Modules with SCAN2FX Exporter for Mari

SCAN2FX Exporter for Mari also provides several enhancements to other SCAN2FX modules:

o   In combination with the separately available **SCAN2FX Texture** module, SCAN2FX Exporter for Mari will enable the option to automatically texture a mesh and output the resulting data directly to Mari. This includes the ability to create different layers and images for example for the overall texture in Mari. The generated Mari script will also automatically load the mesh into the current project. SCAN2FX Texture also has the option to create masks to highlight scan bottoms, to differentiate occluded from non-occluded areas for each scan, as well as distance maps to blend textures based on distance. These masks can be imported separately into Mari if required.

    SCAN2FX Texture provides a more automated way to compute a full texture for a mesh and includes consideration for which parts of the mesh are occluded or visible by a certain scan. SCAN2FX Exporter for Mari focuses on exporting the panorama images as projections to Mari for an artist to 3D paint the texture onto a model and control exactly where which texture gets applied. Both modules can be used in conjunction with each other as well. For example, you could generate a baseline texture with SCAN2FX Texture, and then use certain additional cameras to fill in extra details or to touch up transitions between scans to better blend exposures between scans.

o   In combination with the separately available **SCAN2FX Photo Projector** module, SCAN2FX Exporter for Mari will also export the computed cameras as "Projectors" for any photo projections created with SCAN2FX Photo Projector. SCAN2FX Exporter for Mari will automatically create projectors, already configured with the correct image. This capability can be useful when you want to add extra texture detail from photos taken of your 3D scene. You will be able to quickly align specific, individual photos and then export the cameras as projectors or utilize them for texturing with SCAN2FX Texture.

    This approach can be for example a less time-consuming and more accurate alternative to photogrammetry. Rather than having to take many hundreds or even thousands of overlapping photos of a scene, you can take a few key photos of the scene where you need

additional detail to enhance your automated, "one-button" press laser scans. Instead of running through a very time-consuming photogrammetry computation where you only see the results after possibly a day or more, you can immediately see how a photo lines up with your 3D scene and you can then control the alignment by picking additional points or adjusting the existing point correspondences. Especially with larger scenes, photogrammetry may result in inaccurate meshes or may fail in aligning at least some of the photos you had taken. Unfortunately, with photogrammetry, uniform surfaces or surfaces with little texture (such as modem building walls) often result in holes that you later need to manually model, resulting in a very time-consuming process. In contrast, a laser scan will capture those surfaces with correct and accurate geometry without a problem.

When it comes to the textures, photogrammetry may also not always yield the result you want when trying to obtain a "good looking" textured mesh with crisp textures especially for man-built / non-organic structures. Typically, in photogrammetry, a "black-box" algorithm computes the textures for you by blending a large number of photos (the ones that were aligned). In practice, this often results in artifacts, for example, when there is even a minute misalignment. A small lighting change over the course of the photo capture session can also result in different coloring and artifacts. Often, you will also notice blurred lines (e.g. for door frames, etc.) where different images got blended even though there should be a clear, crisp edge. These "imaging" artifacts usually only become visible to you, after completing a full photogrammetry computation. Once done, you are then left with little or no remedy, and no simple controls to fix these artifacts. You could potentially try disabling certain photos manually, but will then have to re-compute the whole model and texture again for a day, or several hours at least, risking further delays and costs.

With SCAN2FX Exporter for Mari and SCAN2FX Photo Projector you get more control over what texture gets applied exactly where.

The SCAN2FX process can greatly reduce the amount of time your team needs to spend to capture sufficient image data for creating a photo-realistic looking mesh models.

SCAN2FX allows you to utilize the high resolution HDR images already captured by your scanner as part of your scan -- to their fullest extent -- instead of having to solely rely on the capturing and post processing of additional photos of a scene. This approach can reduce the required capture time, but also allows you to get more out of the data you already captured (e.g. in case of changing lighting conditions over time during a capture session). Of course, you can still add additional photos where needed for extra detail with the optional SCAN2FX Photo Projector module, but in a more efficient and controlled manner over traditional approaches. This way laser scanning becomes more accessible as a process for productions or visualizations.

Finally, SCAN2FX creates for the first time a straight and efficient path to the most popular visual effects and 3D software packages, from your laser scans, designed with real production use in mind.

## 2. System Requirements

### 2.1 System Requirements

- o FARO® SCENE or Scene LT 2019+
- o Foundry Mari 4.1 and above (may work with previous versions, but not tested)
- o Windows 10 (may work with previous versions, but not tested)

### 2.2 Version History

**NEW with Release 3.7**

**Release 3.7**

- **Photo Projector JPG panorama** – JPG file name support for photo projector panoramas.
- **Setting for Exporters to export panoramas only as layers or projectors and layers** – choose if to include the panoramas also as projectors or only to use Mari layers.

**Release 3.5**

- **SCENE 2018 version** – optimized for SCENE 2018
- **General setting for Exporters to control photo export** – centralized setting instead of setting per Exporter
- **Improved camera alignment with SCENE 2018** – compensation for distortion in certain scans from FARO scanners.
- **New full color resolution mode** – option to utilize image data at full, maximum resolution from FARO scans even when scan was done on a lower resolution.

**Release 3.4**

- **Improved alignment for SCAN2FX Photo Projector portrait photos** – the alignment of portrait photos from SCAN2FX Photo Projector has been improved.

**Release 3.3**

- **New "Data Include" options** – option to export scans only, export scans and cameras from SCAN2FX Photo Projector, or only cameras for SCAN2FX Photo Projector (for fast export of additional cameras).

### 3. Installation

1. Open SCENE or SCENE LT (tested with version 2019 or higher, but may support other versions).

2. If you have a previous version of SCAN2FX installed, please remove this version first with the App Manager in SCENE or SCENE LT (in the new Scene User Interface: Apps -> Apps, and then click remove right of the application in the pop-up. In the previous User Interface: Tools -> Apps, and then click remove in the pop-up).
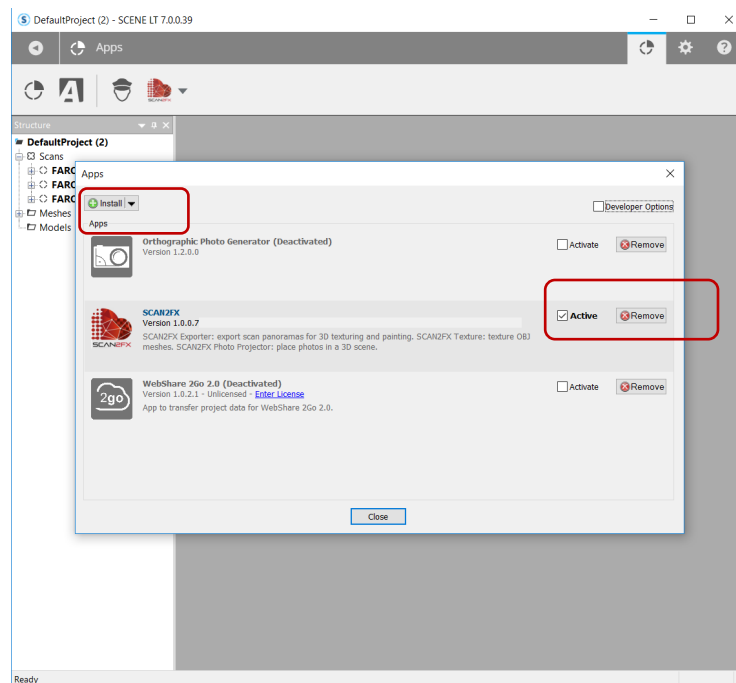


3. Install the downloaded SCAN2FX app by doing one of the following:
- Drag & Drop the SCAN2FX.fpp file into SCENE.
- Double click the SCAN2FX.fpp file in the Windows Explorer.
- Click install in the App Manager in SCENE or SCENE LT to install the SCAN2FX app, and follow the instructions.

4. Once installed, the SCAN2FX icon should appear in the apps list.
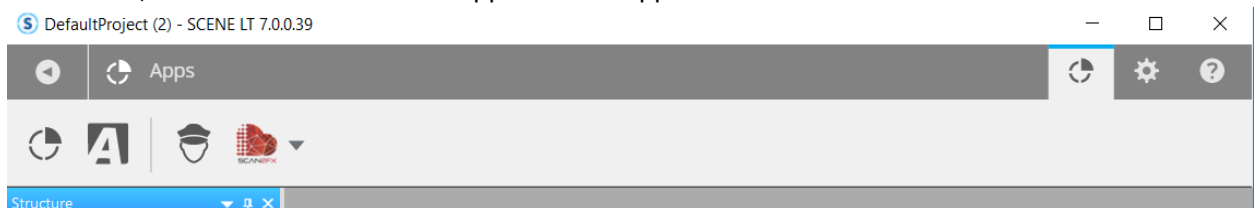
## 4. Licensing

To activate the SCANFX Exporter for Mari module, a valid license key needs to be authenticated. You can purchase the SCAN2FX Exporter for Mari module or also other modules, or all modules combined via the FARO® 3D App Center. If you are interested in a trial first, and do need a trial license, please email sales@scan2fx.com with your company information, intended use, and email address.

1. To activate your license, click on the red SCAN2FX icon as highlighted, and select Settings in the menu.
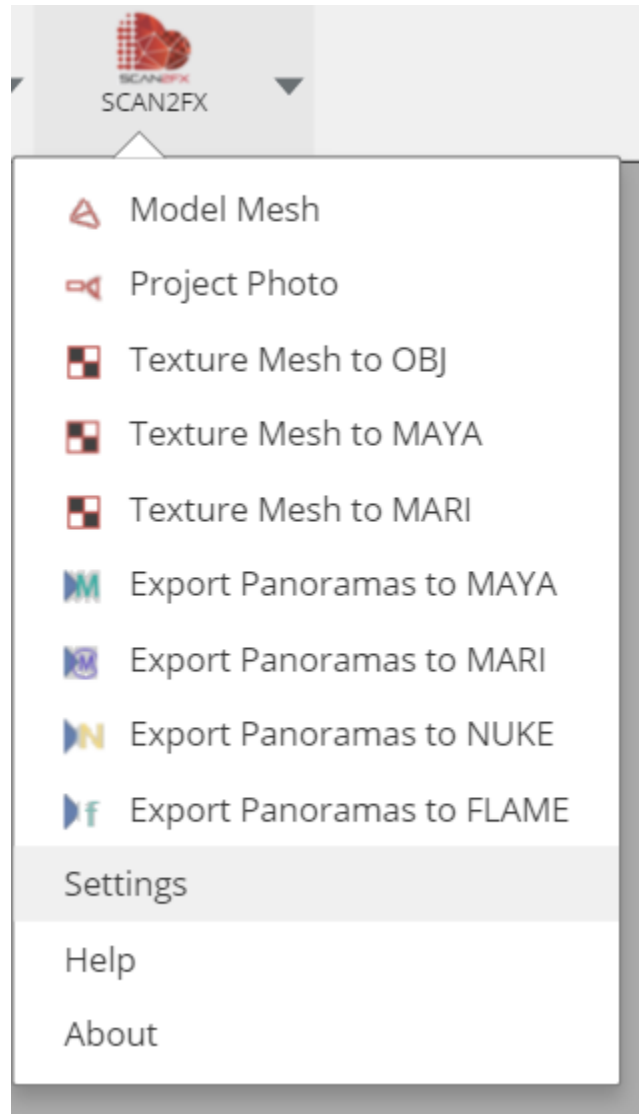


2. In the following pop-up dialogue, see the section "Licensing" at the bottom left of the dialogue box. Enter the email address that was used when purchasing the license and is associated with the license. And paste in your SCAN2FX license key.
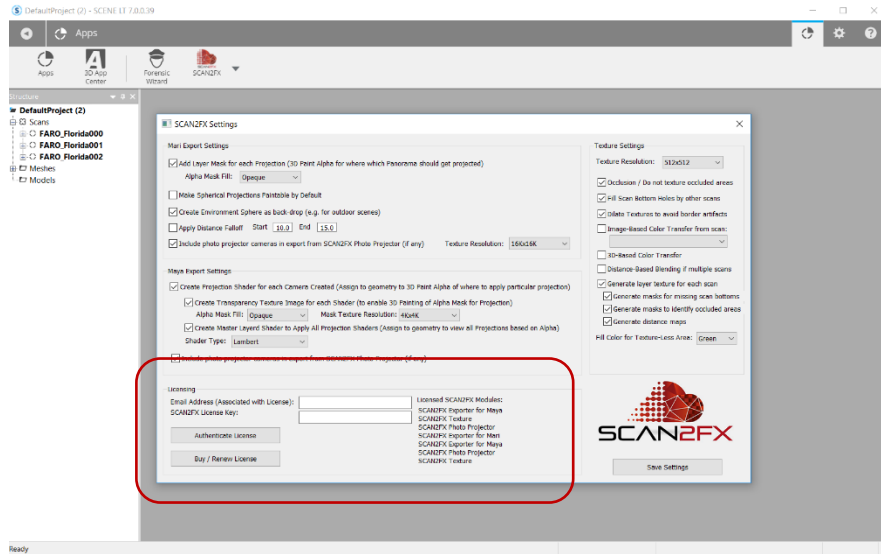
3.  Click "Authenticate License" to connect to SCAN2FX cloud licensing server for authentication.

    Please make sure that your computer is connected to the Internet for this step as SCAN2FX will send this information to SCAN2FX's licensing servers for license authorization.
    Each license key may enable one or more modules within SCAN2FX. The licensed SCAN2FX Modules will get listed on the right side of the email address and SCAN2FX license key box.

    Finally, please note that all licenses in SCAN2FX are subscription-based, meaning they will expire after your service term and a renewal subscription needs to be purchased in order to continue using the module. When a licensing key gets entered the first time in SCAN2FX, this particular license key will be node-locked to the particular hardware and cannot be re-used on another machine. Please note that licenses are not transferable to other machines or hardware during the subscription term once they have been activated on one hardware. A new subscription can be purchased separately and assigned to the new or modified hardware.

## 4. Using SCAN2FX Exporter for Mari

Before your first export with SCAN2FX Exporter for Mari, it is recommended to briefly review the "Mari Export Settings."

1. Click on **"Settings"** in the SCAN2FX menu.
2. Review the "Mari Export Settings" section on the left middle of the dialogue box.
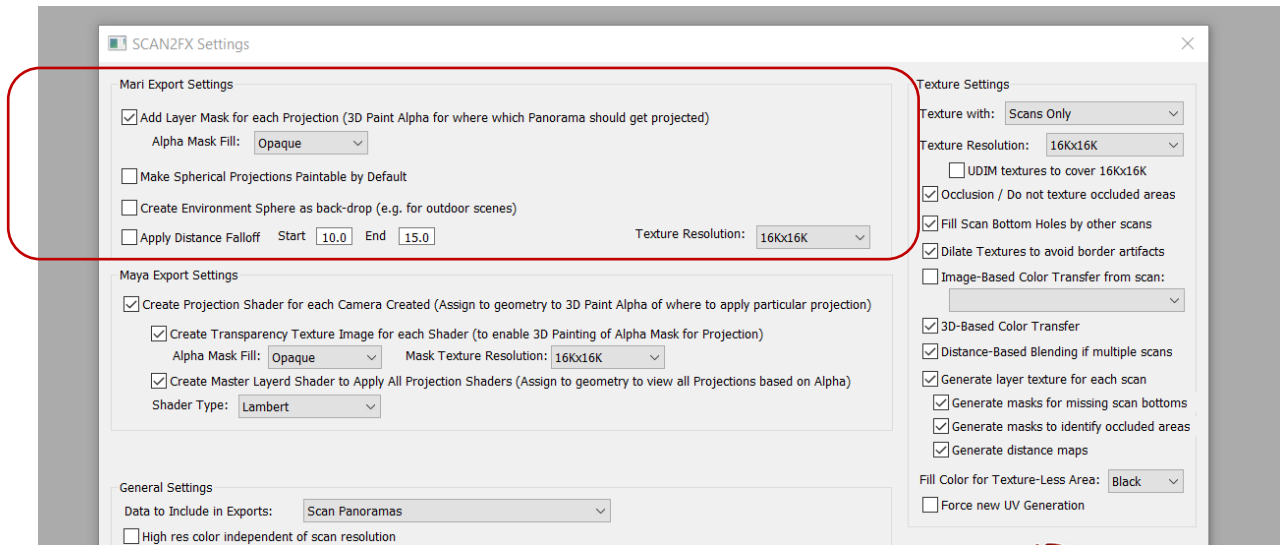


You will find several key settings here:

**- "Add Layer Mask for each Projection"**
With this option, SCAN2FX Exporter for Mari will add a mask automatically for each spherical projection so you can start masking where a scan applies right away in Mari.

**- Alpha Mask Fill**
This setting determines whether the mask should be filled to make the entire camera contribution transparent or opaque upon import. This enables different workflows when 3D painting in Mari. For example, you can decide if you want to paint in where a texture should get applied or if you want to mask out those areas where the projection should not get applied.

**- "Make Spherical Projections Paintable by Default"**
This option will automatically bake down the spherical projection to a paintable texture at the selected texture resolution. This enables you to paint directly onto the layer once Mari finished loading the imported python script generated with SCAN2FX. However, the resolution may not be as good as the original spherical projection. This option is off by default.

**- "Create Environment Sphere as back-drop"**
This option is unique to the SCAN2FX Exporter for Mari. It creates a sphere at coordinates 0,0,0 in the scene and adds all the projections to that sphere for 3D painting. Since Mari does not have any modelling tools, this feature is a quick way to create a back-drop based on the scans. The environment sphere can add realism especially in outdoor scenes where there was no 3D points captured at a distance, but still images captured.

**- "Apply Distance Falloff"**
This setting enables to automatically set a distance falloff for all the spherical projection generated in Mari by SCAN2FX Exporter. There is a start value (e.g. 10.0) and an end value (e.g. 15.0). The spherical projection gets automatically alpha blended from 100% at the start distance to 0% at the end distance from the scanner position. This feature is turned off by default, but provides a quick way to get the scans applied in roughly the correct region of your 3D scene especially when working with several scans. However, note that SCAN2FX Exporter for Mari does not consider occlusion, and masking in Mari will be required for the final touch up of where which panorama should get applied on the mesh.

**- "Include photo projector cameras in export from SCAN2FX Photo Projector"**
This option is only relevant if you also purchased the SCAN2FX Photo Projector. If checked, SCAN2FX Exporter for Mari will include the cameras computed based on your photos with SCAN2FX Photo Projector in the Mari export as "projectors."

When purchasing SCAN2FX Photo Projector, please note that you will need to purchase at least one of the SCAN2FX Exporter modules (e.g. for Mari, for Maya, for Nuke or for Flame) to actually export the computed camera data from SCENE.

**- Texture Resolution**
This setting lets you choose at what resolution masks and paintable color texture layers should be created. Please note that this setting has nothing to do with the resolution of the spherical projection images (those resolutions get determined by the panorama images in SCENE). Usually for alpha blending different scans together, you may not need as high of a resolution. However, for color painting larger models and for baking the spherical projections to UV or PTEX textures in Mari higher resolutions will be required (likely 16Kx16K). Texture resolution can be set in increments from 512x512 to 16Kx16K.
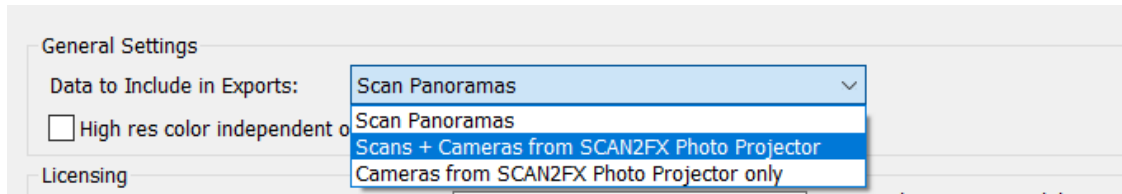
There is also two relevant Settings under General Settings.

NEW with Release 3.5
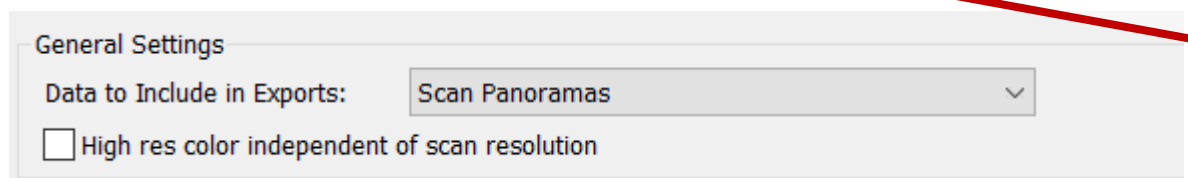


**- "Data to Include in Exports:"**
This option is only relevant if you also purchased the SCAN2FX Photo Projector.

General Settings

Data to Include in Exports: Scan Panoramas

Scan Panoramas
Scans + Cameras from SCAN2FX Photo Projector
Cameras from SCAN2FX Photo Projector only

☐ High res color independent o

Licensing

With Scans + Cameras from SCAN2FX Photo Projector, SCAN2FX Exporter for Mari will include the projectors computed based on your photos with SCAN2FX Photo Projector in the Mari export. Panorama photos will get exported as both panorama layers in Mari as well as six individual projectors. Pinhole camera photos (normal projectors) will get exported simply as a Mari projector.

With "Cameras from SCAN2FX Photo Projector only," SCAN2FX Exporter for Mari will only include the cameras computed based on the photos with SCAN2FX Photo Projector. This can greatly speed up exports from additional photo projectors.

When purchasing SCAN2FX Photo Projector, please note that you will need to purchase at least one of the SCAN2FX Exporter modules (e.g. for Maya, for Mari, for Nuke or for Flame) to export the computed camera data from SCENE.

**- "High res color"**
Under General Settings, the option "High res color" allows for SCAN2FX Exporter for Mari to utilize the maximum image resolution regardless of scan resolution. With this option, exports will take a bit longer, and result in larger, high resolution image files if scans were not scanned at 1:1 scan resolution.

*NEW with Release 3.5*

**Note:** Depending on your scanner, the image panoramas may be too large for Mari to load and you may want to manually scale down the panorama image files accordingly until Mari can load the images.

This unique mode allows to access full image resolution even when scanning at lower scan resolutions, which in turn results in much faster scan speeds.

3. Once you are satisfied with your settings, click **"Save Settings"** and the dialogue will close. Any future exports with SCAN2FX Exporter for Mari will use these settings until you change the settings again.

4. Now, start you first export by clicking **"Export Panoramas to Mari"** in the SCAN2FX menu.

5. Select a path and **enter a filename for your Mari .PY export file**.

   *Note: The python script generated by SCAN2FX contains an absolute hard-coded path, and will not work properly if the images or scripts get moved, or if the path gets moved. You can edit the path listed in the PY file if necessary with a text editor. This is due to a limitation with the Mari python interpreter.*

*It is recommended to ensure that there is sufficient disk space before this step. It is also recommended to use a separate, clear directory for each export. SCAN2FX Exporter for Mari does not just generate the Mari .PY python script, but also various other files such as texture images, masks as well as temporary, intermediate computation files. Make sure that none of these files get deleted while a computation is ongoing. Also, insufficient disk space may result in strange, unexpected or corrupted outcomes. Each scan could generate many hundreds of megabytes of data and a larger projector may contain many scans.*

*Please also note that your spherical panorama scans in your current project all will need to be 360x300 full dome scans. If you imported FLS FARO® scans, SCAN2FX will provide an error if certain scans are not 360x300. With imported scans from different formats, there may not be a warning. Also, unusual rotational offsets in such imported scans, may result in an issue of the computed projections being rotated.*

6. SCAN2FX Exporter for Mari is now computing the cameras and textures for you.

   *You will see a progress bar trying to approximate the estimated progress. This operation may take a while, and will take longer the more scans are in your project. Also, the 3D painting workflow in Mari is more trackable with fewer scans as each scan panorama will take up significant memory in Mari for real-time paint performance. However, this workflow provides the opportunity to easily create very realistic textures on your meshes and models in Mari and to precisely control how which part of the images gets applied.*
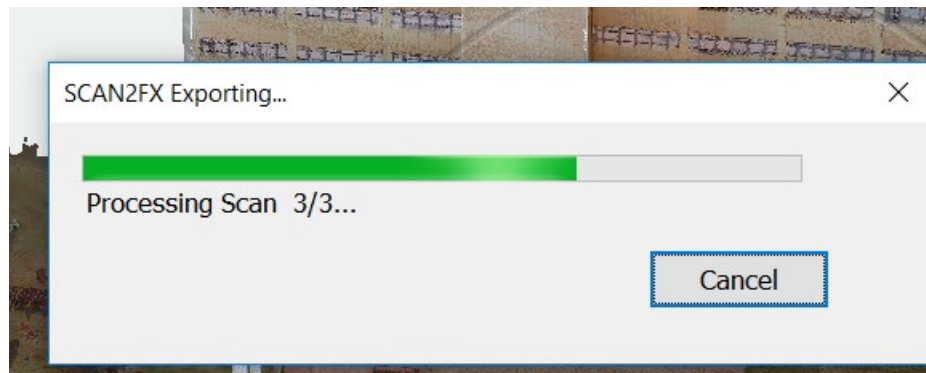


7. Once finished, SCAN2FX will message you how many scans or photo projectors were exported.

You are now **ready to import the Mari .PY file into Mari**.

## 6. Creating your Mesh

### 6.1 Creating Meshes with SCAN2FX Mesh Modeler

NEW with Release 3.3

SCAN2FX Mesh Modeler is an **option module**, not included in SCAN2FX Texture, to create high quality meshes as well as fill or simplified geometry. To get started, activate the SCAN2FX Mesh Modeler dialogue / tool box by clicking Model Mesh in the SCAN2FX menu.

Please see the SCAN2FX Mesh Modeler handbook for full instructions.
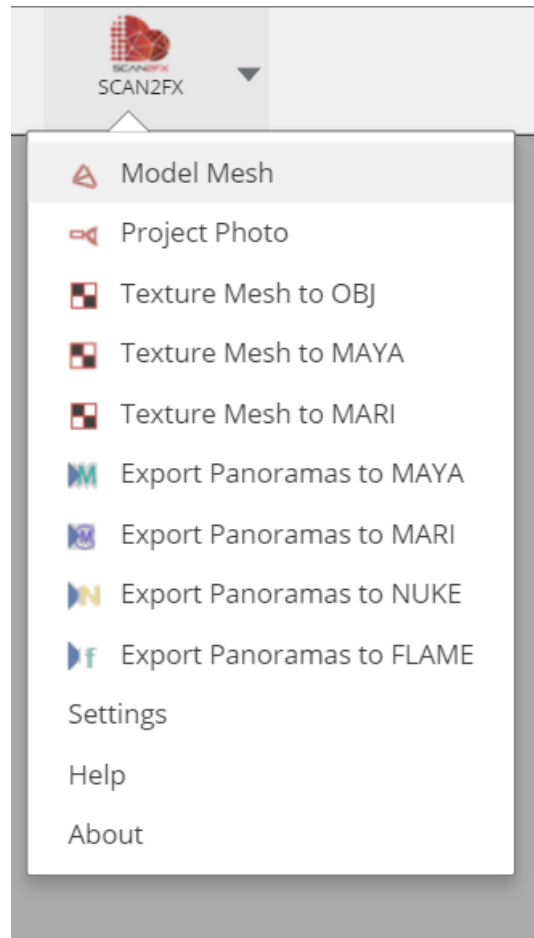


Create a "New Mesh" in SCAN2FX Mesh Modeler, then:

 Click the **"Extract Mesh"** icon to activate the tool. The icon will appear slightly red when active. The "Extract Mesh" tool is a crucial tool and enables access to all of SCAN2FX Mesh Modeler's automatic meshing capabilities.

The tool will automatically convert a section or all of the project point cloud to a mesh upon export (Make sure to select triangulation during export).

SCAN2FX Mesh Modeler provides unique meshing algorithms designed in particular for sharp-edged man-made structures. SCAN2FX Mesh Modeler's "Extract Mesh" tools also provide several other unique models that can be handy if trying to create special effects.

All of meshing happens on the local machine and does not require a cloud service or uploading of point cloud data to a 3$^{rd}$ party service. Also, there is no restrictions on the size of the meshing region as long as a decent spec machine is utilized.

CTRL + click on the point cloud at opposite ends of the volume. Starting with the second point, a volume box gets created to identify a rough area to mesh. Expand the volume until it completely encloses the part of the point cloud to mesh. Clicking points always increases the volume or keeps the volume the same if the new point is already enclosed by the volume.
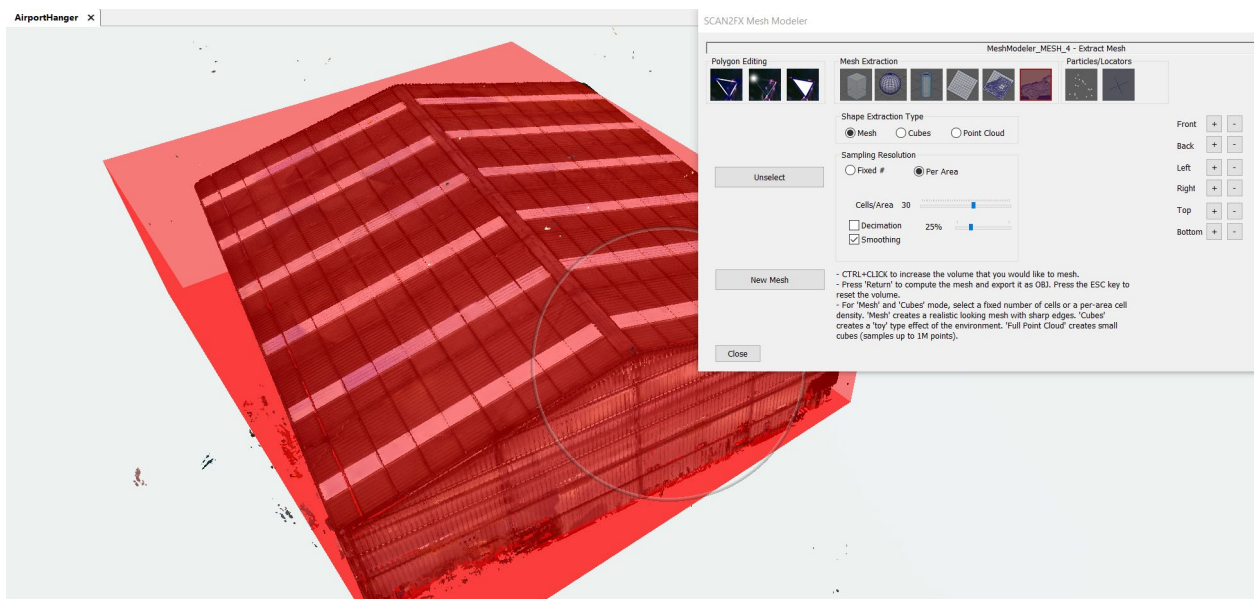


Choose and double check the meshing **settings** (see 14.3 – 14.5 in the SCAN2FX Mesh Modeler handbook for details on the settings) and press the "return" key to save the mesh component to the Components list, so it can be later exported. Meshing of all identified meshing volumes will take place during export in a single, "batch" pass instead of having to wait for each individual mesh to complete.

Export your mesh as MA file once done. SCAN2FX Mesh Modeler also allows the creation of fill polygons and primitives e.g. to fill in holes, windows, or other areas missing from the scans. These components can be exported together or separately from your main mesh and then combined into a single mesh.

If you want to utilize UV mapping, add a UV layout to the mesh before 3D painting in Mari. Mari alternatively provides built-in PTex support. Also you may want to utilize the decimation option in Mesh Modeler to increase Mari 3D painting performance on your mesh. Make sure to import the decimated mesh.

6.2 **Basic Meshing - Creating a Basic Mesh just with SCENE**

Alternatively, if you are on a budget, you could also use the standard meshing functionality in SCENE. Standard SCENE meshing will work better with organic or blobby shapes vs. man-made structures.

In SCENE, you may also want to create a mesh from your point cloud that you could then load into Mari for 3D Painting. However, note that it is advisable to re-topologize your mesh prior for reasonable performance in Mari. You will need to utilize a modeling package for this step.

1. To create a mesh with SCENE, first, ensure you have a project cloud created in SCENE for your scans. If not, create a project cloud per the usual process in SCENE.
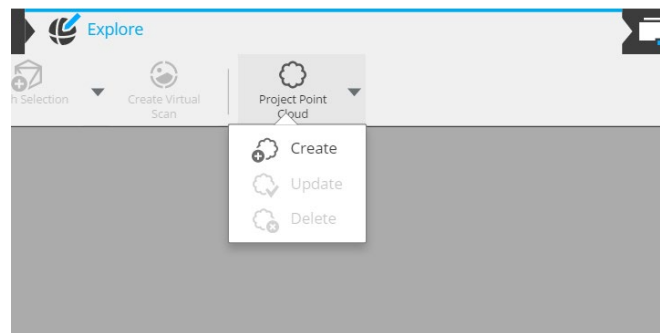


Depending on the number of scans and settings, the project point cloud computation may take a while to process.
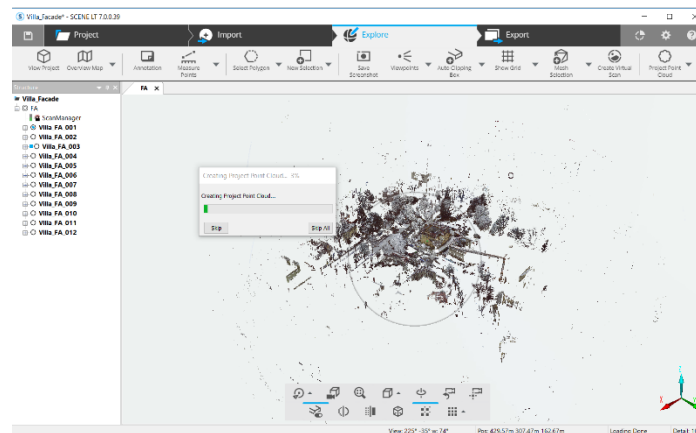


2. Once done, view the project point cloud in 3D, and make a selection or create a clipping box in SCENE.

3. Now click "Mesh Selection" or "Mesh Clipping Box." A dialogue with appear enable you to set the triangle count and other parameters.
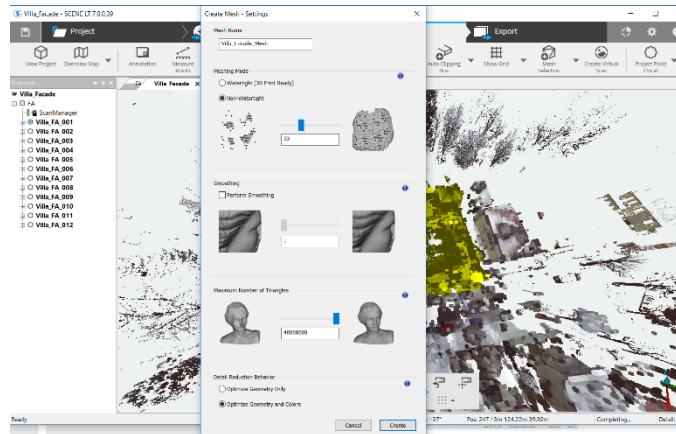


4. Once your parameters are set, click "Create" to start meshing the project point cloud selection or clipping box. The mesh generation may require substantial time depending on the size of the point cloud.
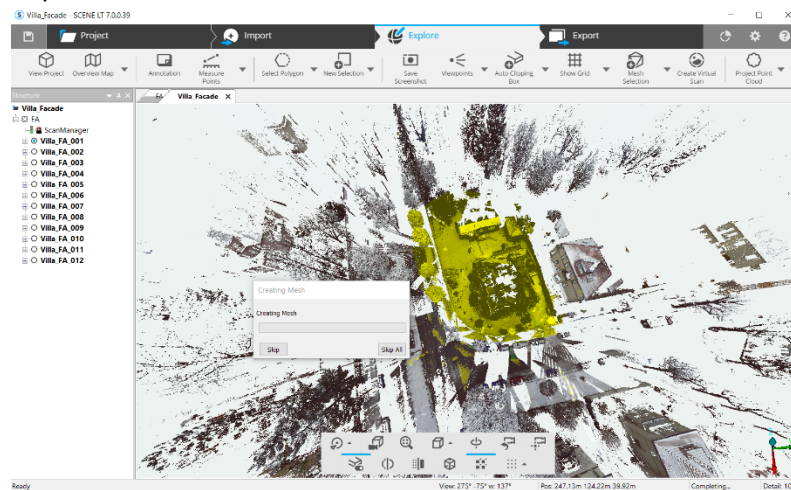


5. Once processing is done, export the mesh by right clicking on the mesh, and select "Export."
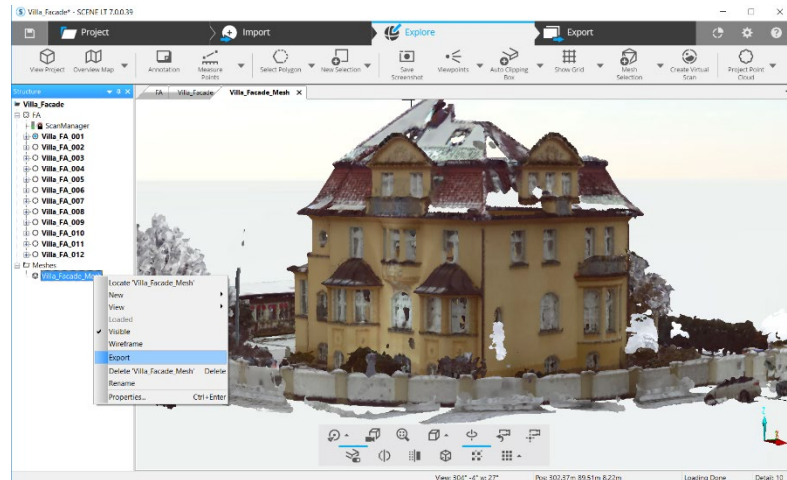
*Note: You notice in this example that there are certain gaps in the mesh where no scan data was captured (e.g. the roof). Also, windows and other reflective or translucent surfaces may have not returned 3D scan points even when visible from the scanner position, and hence show gaps. We can later fill in those gaps with a 3D modelling software such as Modo or Maya.*

*Some basic coloring has been applied by SCENE based on the triangle vertices (vertex coloring). As you reduce the number of triangles for optimal performance, the colors will become blurrier and blurrier. The texture we will later create will provide much higher color and texture detail, regardless of triangle count.*

6. Select *.obj as the file format (the format that Mari reads for meshes) and enter the filename and path into the "Save As" dialogue. Click "Save" to save your Wavefront OBJ file.

As mentioned, it is recommended to re-topologize your mesh prior to import for reasonable performance in Mari. For example, you may want to simplify the topology and/or reduce the number of triangles.

You can later import your OBJ file into Mari either when creating a new project or by clicking "Add Object" in the "Objects Palette" in Mari.
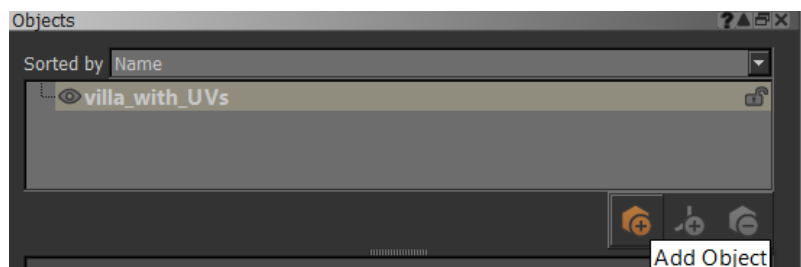
Select the OBJ mesh to add the mesh to your Mari project.

Here's how the mesh looks in Mari:
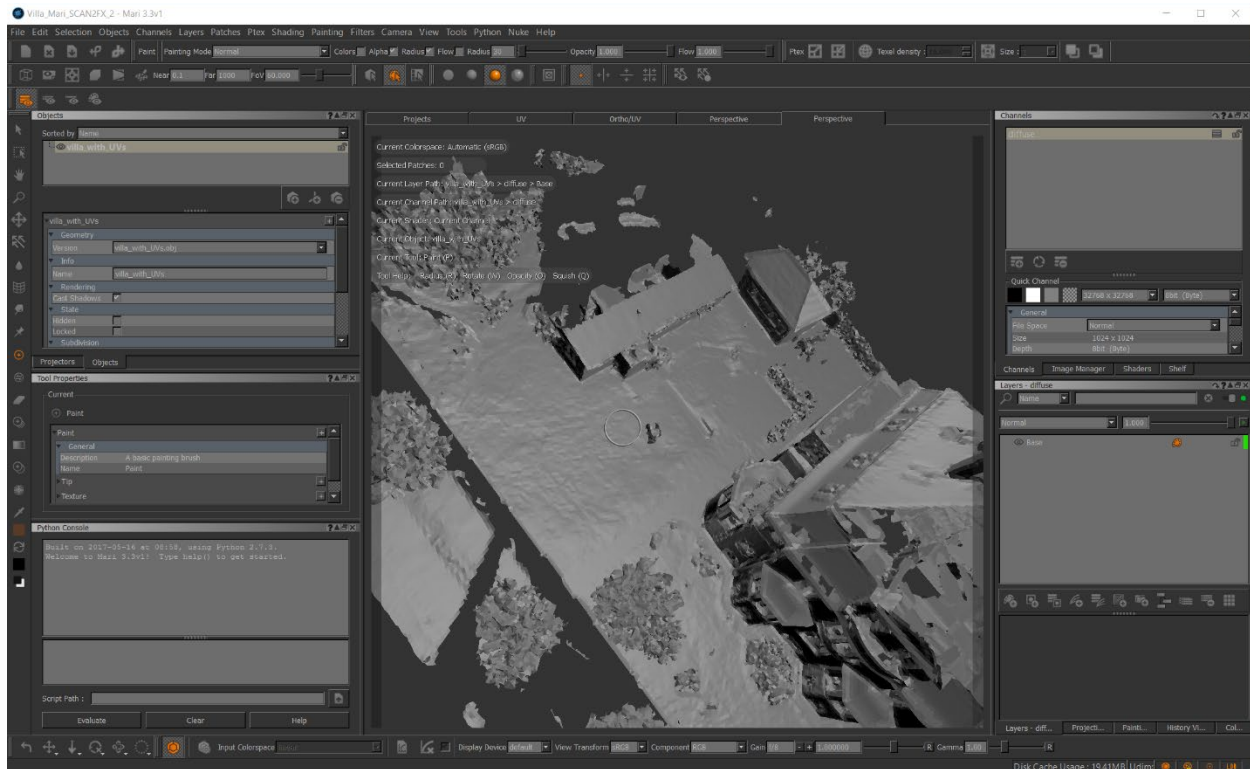


## 5.2 **Alternative Ways to Create the Mesh**

You could also use other point cloud meshing software to process the point cloud. Another alternative is to manually construct your model in a 3D modelling application such as Modo, Maya, 3D Studio or Houdini.

With the separate SCAN2FX Exporter for Maya module and Maya, you could for example use the projected cameras from SCAN2FX Exporter as a guide, and align polygons or primitives within Maya by looking through the various aligned cameras.

## 6. Importing your SCAN2FX Export into Mari

To import your SCAN2FX data, first, ensure that the mesh you want to texture is selected in the "Object Palettes" in Mari.

Now make sure the Python console is visible in Mari. If the Python console is not visible, click "Show Console" under the Python top menu or hit the hotkey (Ctrl+Alt+P on Windows). The Python console is highlighted in below screenshot.
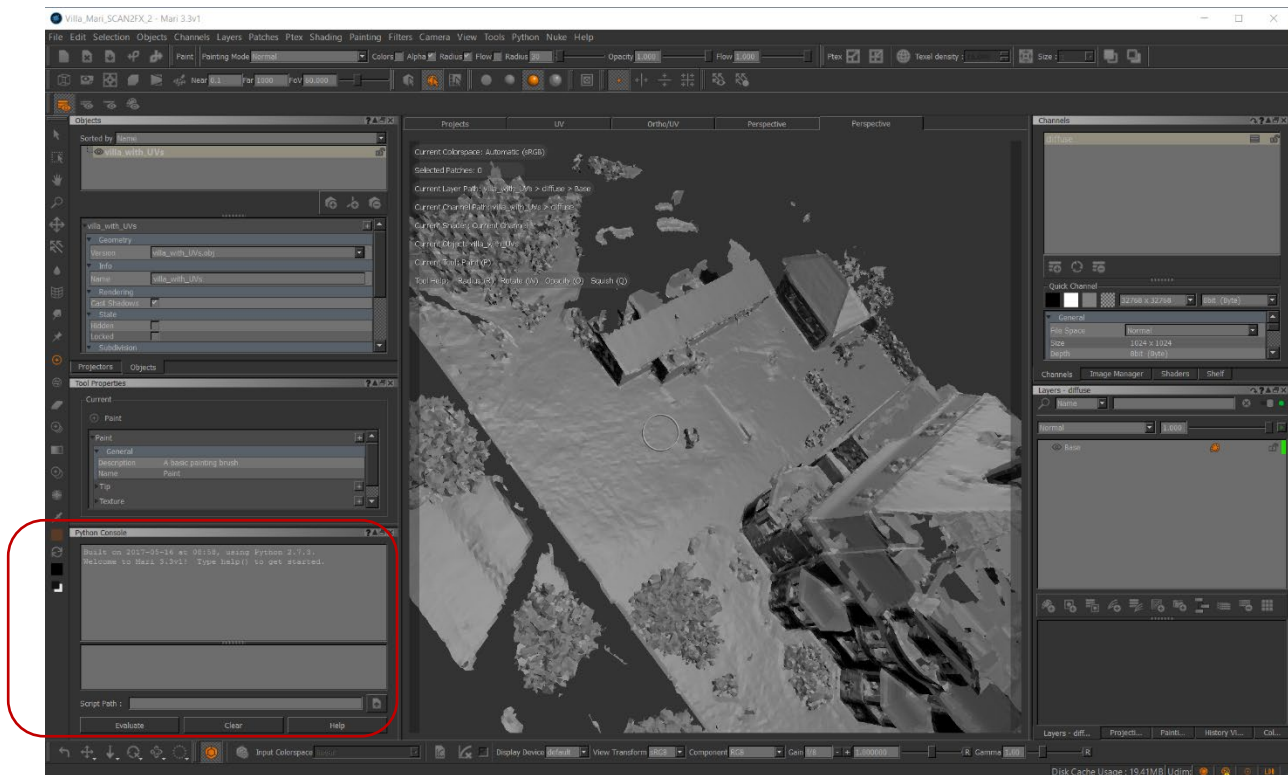


1. Click the **Document Symbol with the up arrow** where it says script path and select the Mari .PY script that was generated by SCAN2FX Exporter for Mari.
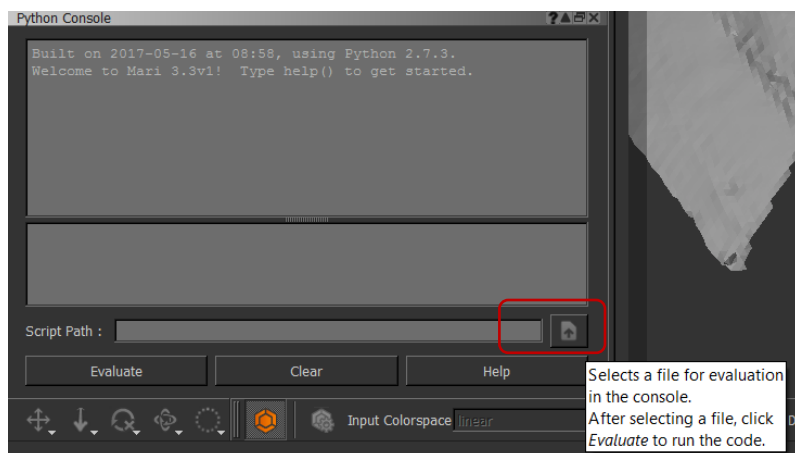
2. The path of the Mari script will get displayed. Now click **"Evaluate"** to run the SCAN2FX import script.
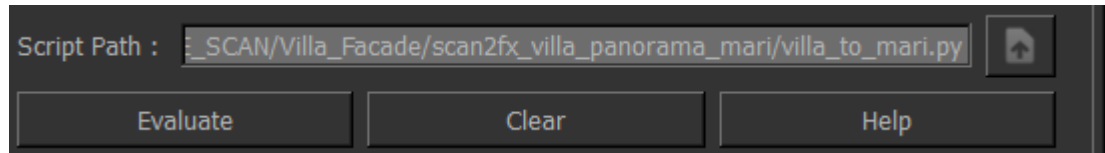


Mari will now load the projection layers, masks, and/or projectors (depending on the settings) that were exported with SCAN2FX Exporter. Once Mari finishes loading the data, you are ready to work with the newly imported SCAN2FX data in Mari.

This export from SCAN2FX generated an environment sphere (see the additional object at the top left that was generated in addition to the previously loaded mesh). Also, in the middle on the right side you see the layers generated.
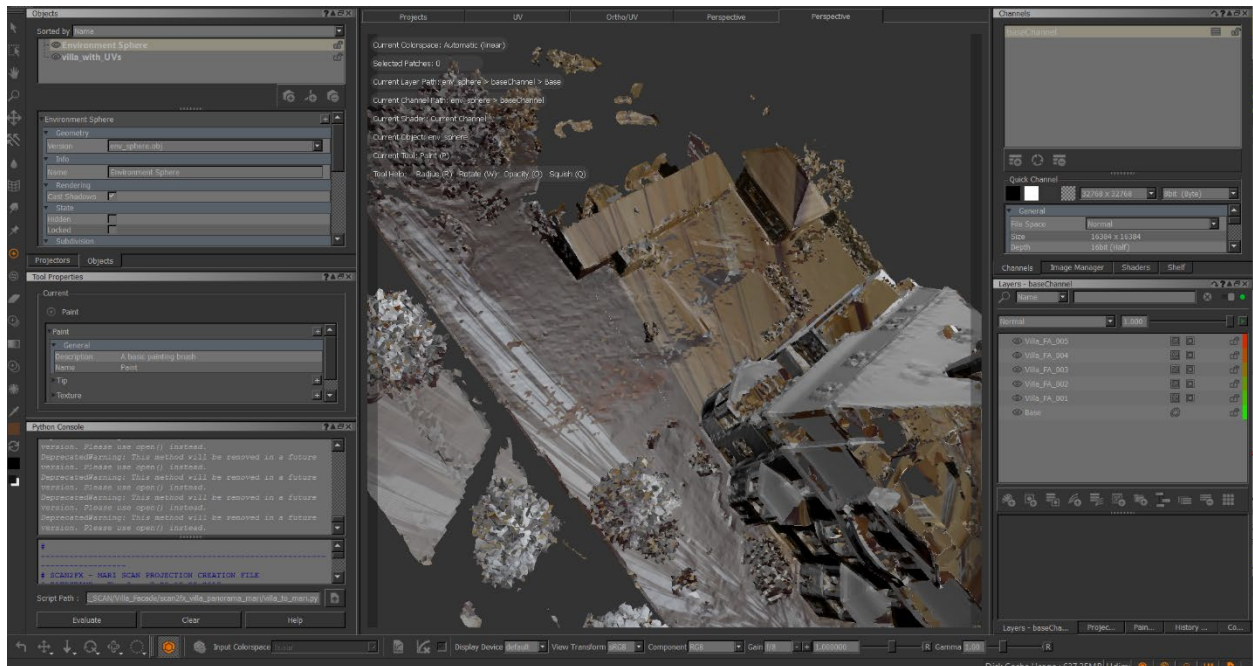
Note: Mari has some limitations on the resolution of panorama images that may apply depending on version and system specifications. If an error occurs indicating such limitations during import, simply open the relevant PNG panorama image and scale down the image with a locked aspect ratio (e.g. with Adobe Photoshop or other paint application).

Depending on your system, Mari may also run out of GPU memory and have trouble loading too many layers. In that case, it is recommended to reduce the number of scans in your export by deleting them from your SCENE project before running a new export. You can later combine textures by baking the layers down into a single layer once painted and masked, and then import the remaining scans for painting.

## 7. Data generated by SCAN2FX Exporter for Mari

To better illustrate how to best work with data generated from SCAN2FX Exporter in Mari, we will run through an example.
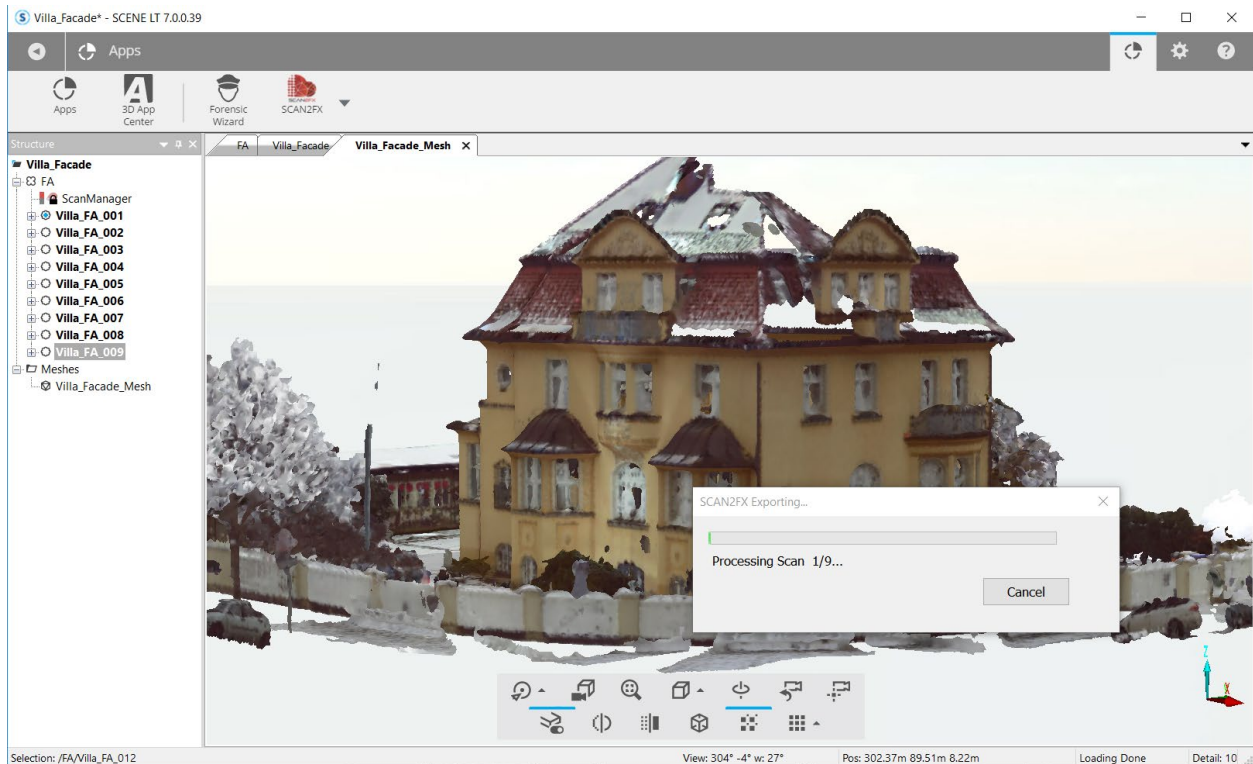


The following example export from SCAN2FX generated 9 layers within Mari (one for each of the 360x300 panorama scans), as well as configured the according masks for immediate alpha masking.

The data generated and automatically configured in Mari by SCAN2FX Exporter for Mari includes the following:

6.1 **Layers**

Here you see some of the newly created layers (for best performance in Mari some layers were removed):
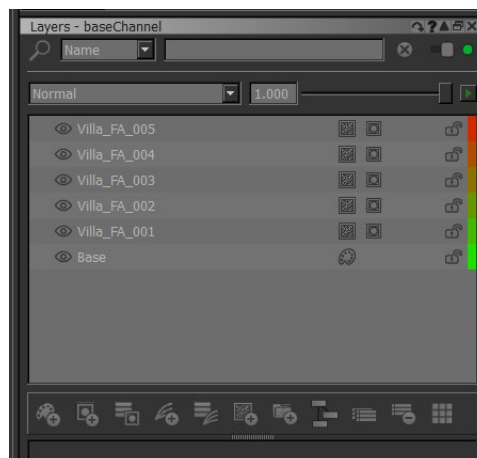
Next to each layer, the symbols provide additional key details:

 implies that the layer as a procedural projection, which is the default. This type of layer does not allow painting the color, but allows you to modify the camera position and rotation of a projection. It provides the full resolution of your panorama scan and hence the highest visual quality. You can bake down the projection to a normal, paintable layer later (right click on the layer, then left click on "Convert to Paintable.")

 implies that the layer is a paintable layer. If "Make Spherical Projections Paintable by Default" was selected in the SCAN2FX Exporter for Mari options, SCAN2FX will automatically convert each projection layer to a "paintable" layer at the set texture resolution. This setting allows you to immediately paint onto the color portion of this layer after import. However, you will lose some visual quality and the ability to adjust the projection camera pose.

The layers are automatically named based on your scan names in SCENE.

## 6.2 Masks

For each layer, SCAN2FX may also generate a mask. You can identify a mask through its icon for each layer:

 implies that the layer has a mask. Click this icon to paint onto the mask. A black brush will make the layer transparent in the painted region of the mesh, while a white brush will make the layer opaque in the painted region of the mesh. If the option "Add Layer Mask for each Projection" was selected in the SCAN2FX Exporter for Mari settings, a mask will automatically get added during import. The mask can be filled either fully opaque or fully transparent depending on the "Alpha Mask Fill" setting. If fully opaque, you can now paint where a scan should not apply (scan occluded). If fully transparent, you can now fill in where the scan should apply.

### 6.3 **Spherical Projection Image**

SCAN2FX also automatically computes a full spherical panorama image stored on disk that gets used by the projection layers, together with the computed camera pose.
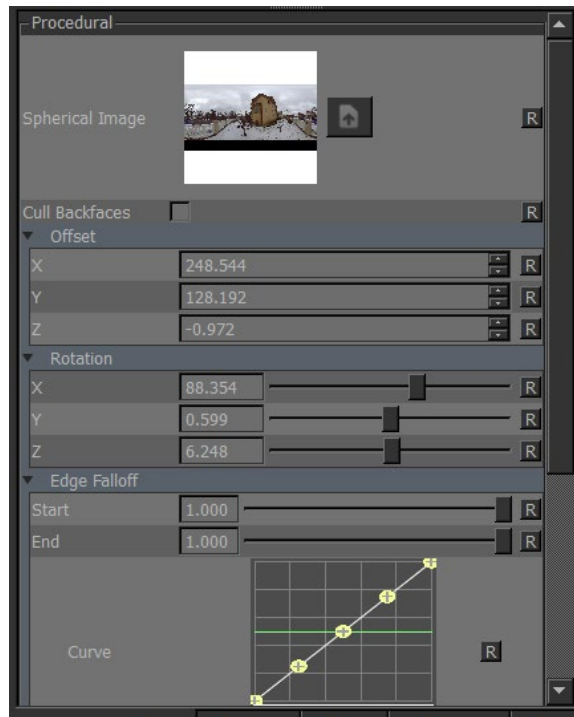


### 6.4 **Environment Sphere** (Optional)

If the option "Create Environment Sphere as back-drop" was enabled, SCAN2FX Exporter will have also add an additional mesh object. This mesh object will also get all the projection layers generated so that a backdrop can be painted based on the panorama images from SCENE. Note that the sphere gets automatically placed at position 0,0,0 so it is important that your exported scans are centered around the 0,0,0 origin position in SCENE.
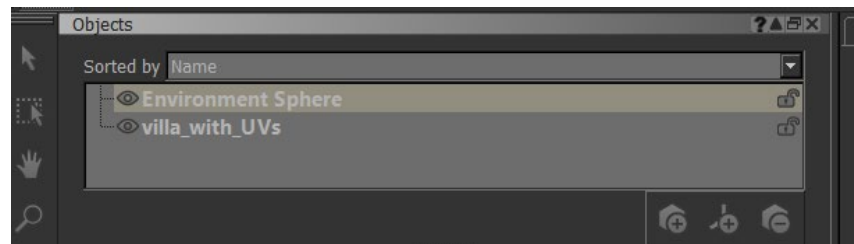
6.5 **Projectors** (Optional – only with SCAN2FX Photo Projector)
If you purchased the optional module SCAN2FX Photo Projector, and Photo Projectors are included in the General Export Settings is turned on, SCAN2FX will also export any computed 3D photo projectors or panoramas from photo projectors created with SCAN2FX Photo Projector to Mari.

These 3D cameras get created as projectors completely configured with the relevant image and the computed camera pose. For panorama photos, SCAN2FX Exporter for Mari creates a panorama projection layer as well as six projectors per panorama.

By projecting the photo from the perspective of the camera onto a paintable layer, additional texture detail can be added to your model in Mari.

## 8. Texturing your Mesh with the data from SCAN2FX Exporter in Mari

### 8.1  Use PTEX or Create UV Layout prior to Import into Mari

Mari does not require UVs and will use PTEX if your OBJ mesh does not contain any UVs. SCENE does not generate UVs when exporting a mesh. So if you import a mesh from SCENE straight, MARI will default to PTEX.

If a UV layout is required, you will need to add UVs to your OBJ mesh prior to import to Mari. There is many software packages that allow you edit or even auto-generate UV layouts (for example: Modo, Maya, Blender, 3D Studio, etc.)

### 8.2  Retopologization prior to Import into Mari

For optimal paint performance, it is highly recommended to re-topologize or even re-model the mesh. This step cleans up the topology and reduces the triangle count. There is also some automated retopologization tools.

If you would like to learn more about retopologization and potential tools, contact sales@scan2fx.com.

### 8.3  Select Layer and Associated Mask

It is recommended to start with one layer at a time and make sure it gets applied in the right areas of your model. Toggle the top layers invisible by clicking the 👁 symbol next to each layer, so only one of the projection layers is visible. The symbol will turn to 👁 when a layer is invisible / hidden in Mari.

If the layer is not paintable and a procedural projection, you should also see the option "Cull Backfaces" in the procedural settings when selecting the layer.
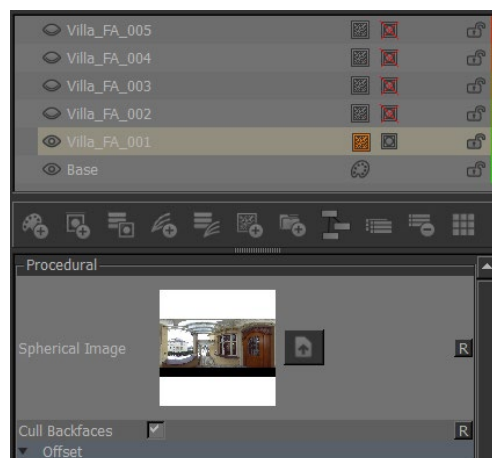


"Cull backfaces" will make sure to not project the panorama onto certain backfaces, making it easier to identify the area where the scanner was based during the capture within the 3D scene.

Now select the mask symbol to tell Mari that you would like to paint on the alpha channel / mask by clicking on the mask symbol  for the selected layer. The mask symbol gets highlighted when the mask is selected.
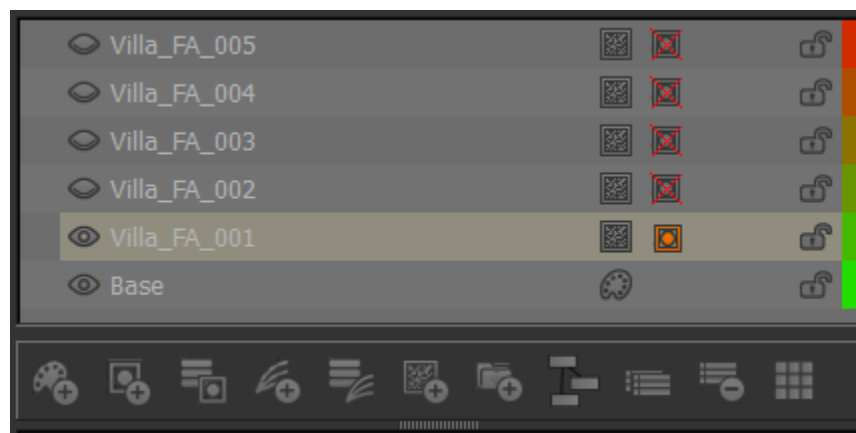


### 8.4  3D Paint Mask

The first projection looks as follows with the other layers hidden. It is a scan of the entrance hallway.
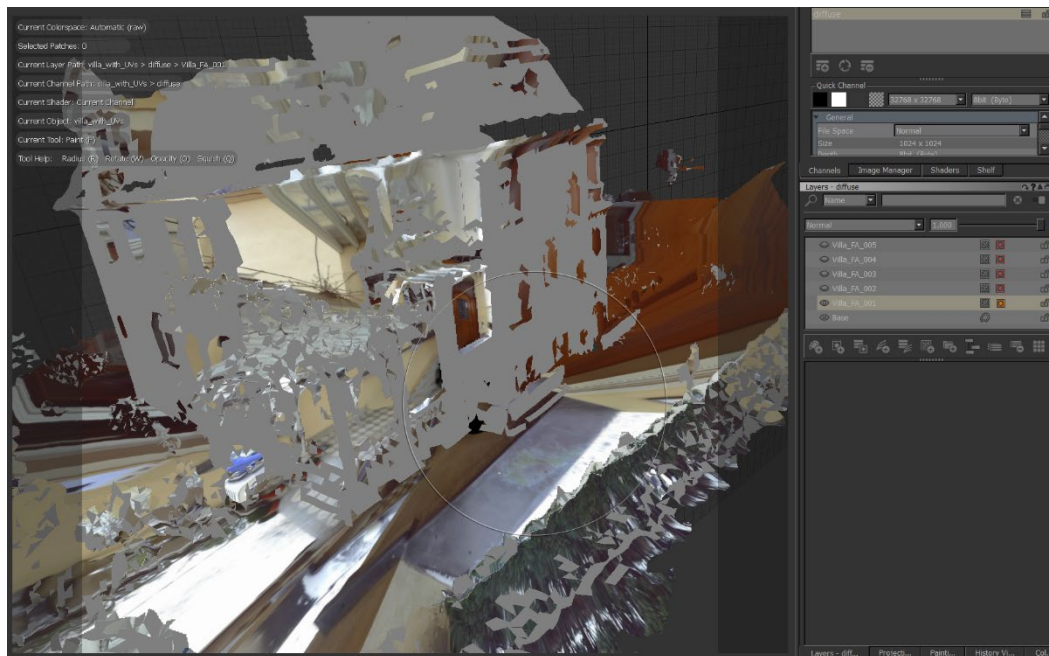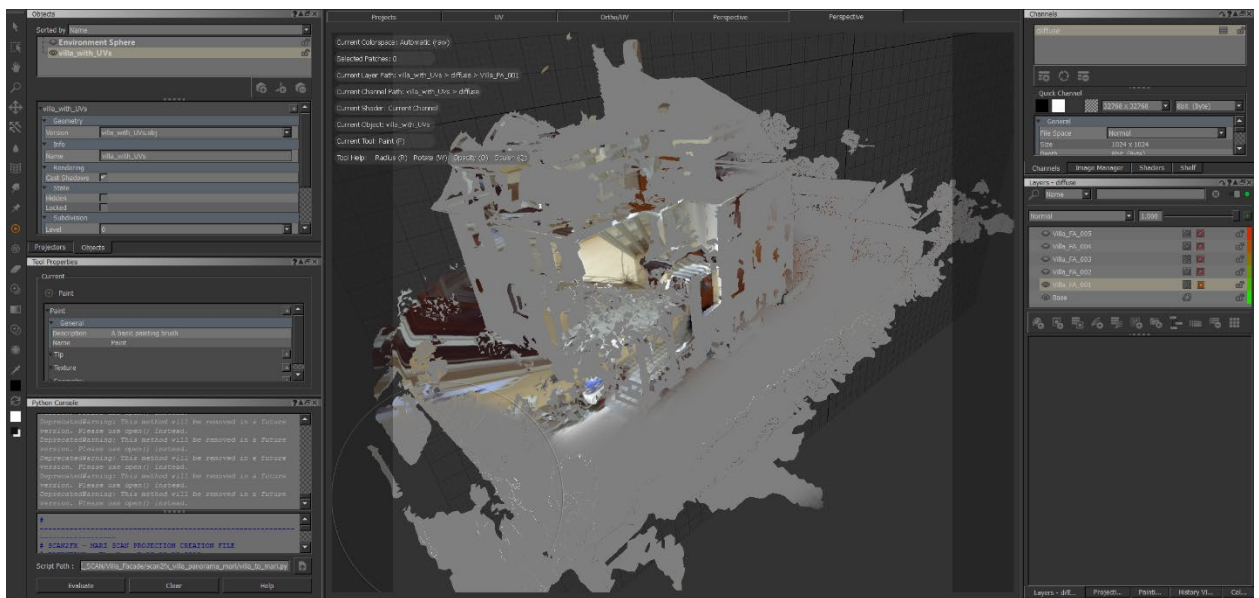
We will now paint the mask black where we want to hide this scan (i.e. where it should not get applied to the mesh).

We select the brush tool (see orange icon on the right), and select black
as the top color (see the large black box on the right).

We start painting on the mesh and immediately see the masked areas to turn
gray in the 3D perspective view.



You can move the camera around as you paint. And by pressing 'R' you can adjust the brush
radius/size.

You can see how the nearby area gets masked out.

We continue painting until only the relevant hallway is still visible:
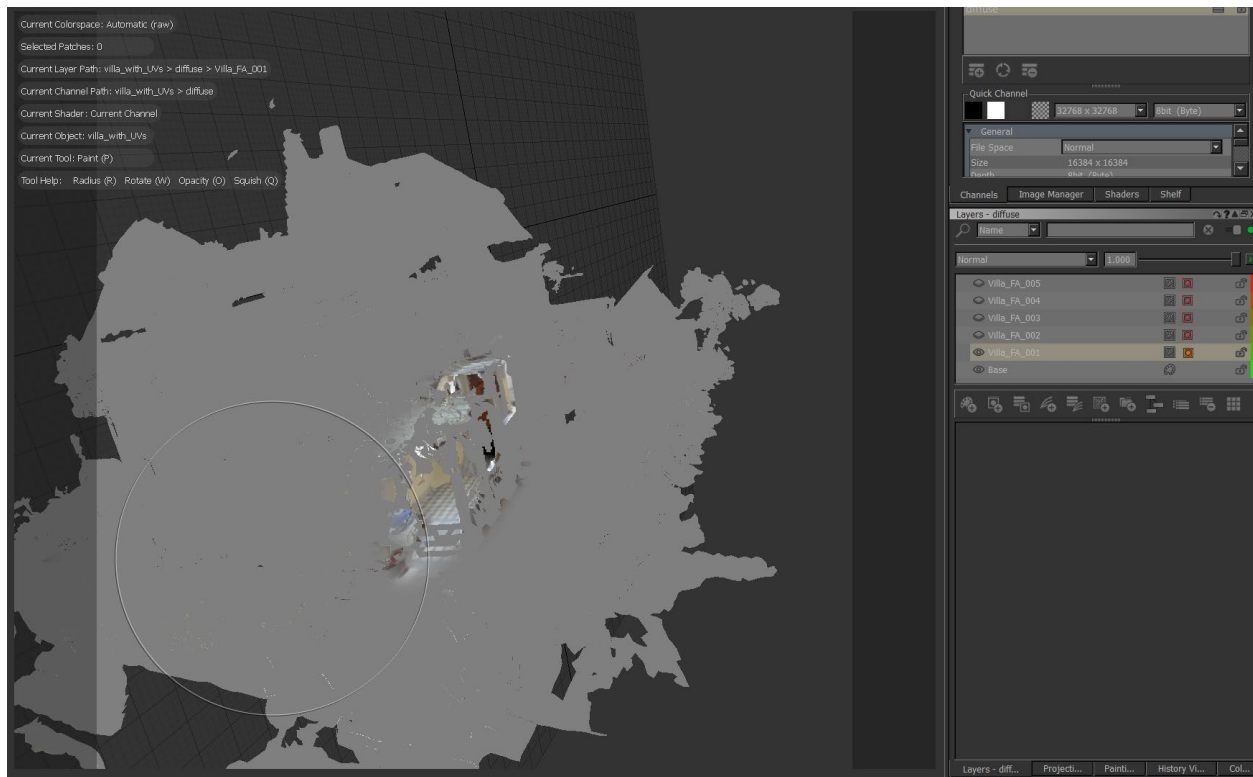


> **Note:** You may notice artifacts once you move your camera or the texture bakes if your channel has a low resolution (e.g. 1024x1024). You can "upgrade" your channel to a higher resolution by right clicking the channel and select clicking "**Resize**" with the desired resolution. High resolutions require longer to bake though.

Once done, we will make the second layer visible and paint on the mask of the second layer. Select "Cull Backfaces" if you want to hide some of the more obvious areas that should not get textured by this scan.

> **Note:** Make sure that your previous **paint work is baked** (e.g. by moving the camera or pressing 'B' to bake) prior to switching the mask as otherwise the previous paint work gets applied to the newly selected later.

Here's how the scene looks like now with the 2nd layer visible.
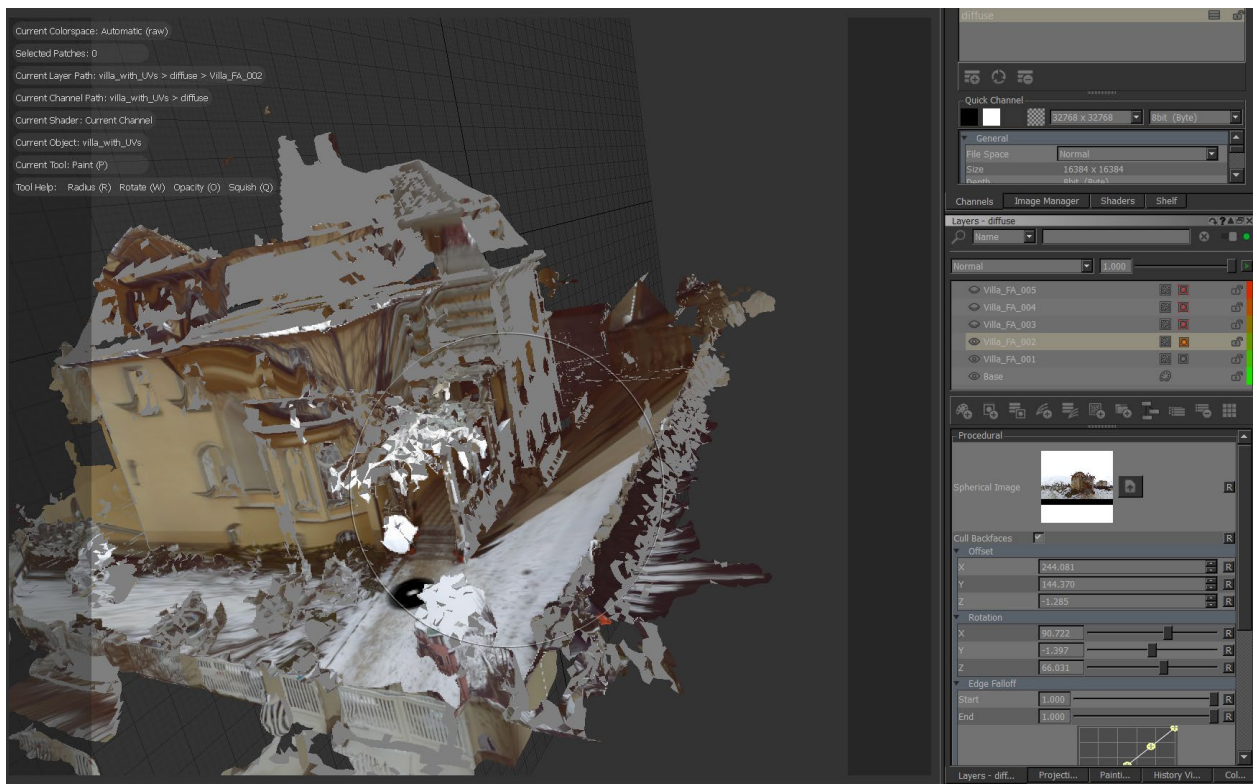


We will start painting the areas again that should become invisible / masked. We can also hide the scan bottom to try to texture it with another layer and mask out some of the areas further away where the texture might be too blurry or stretched.
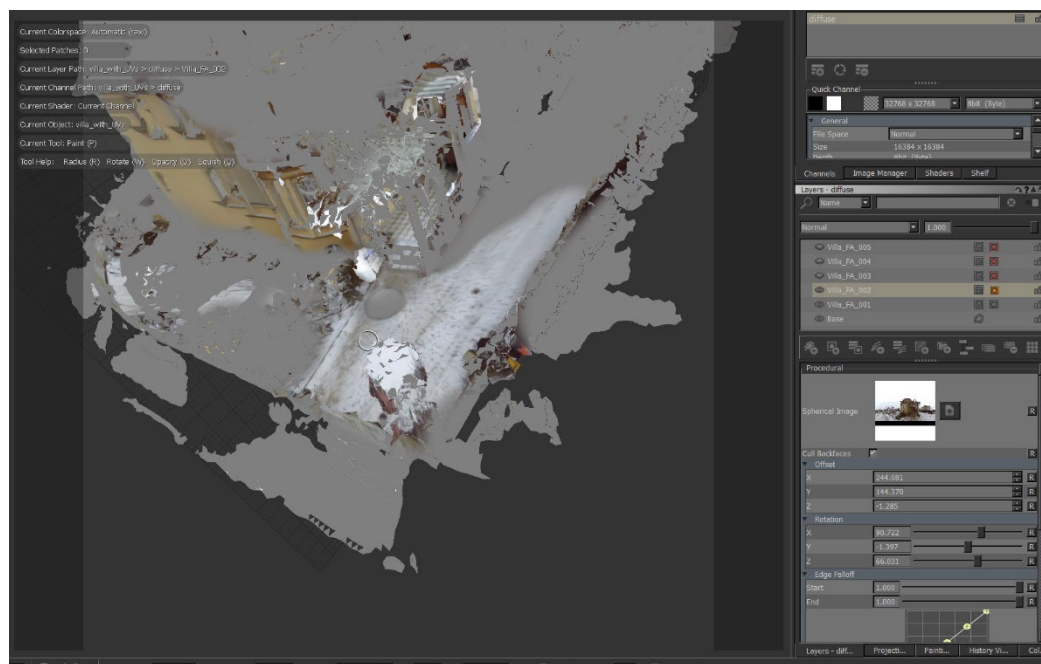
We will continue this paint process layer by layer until we have fully covered the model and all layers to our liking.
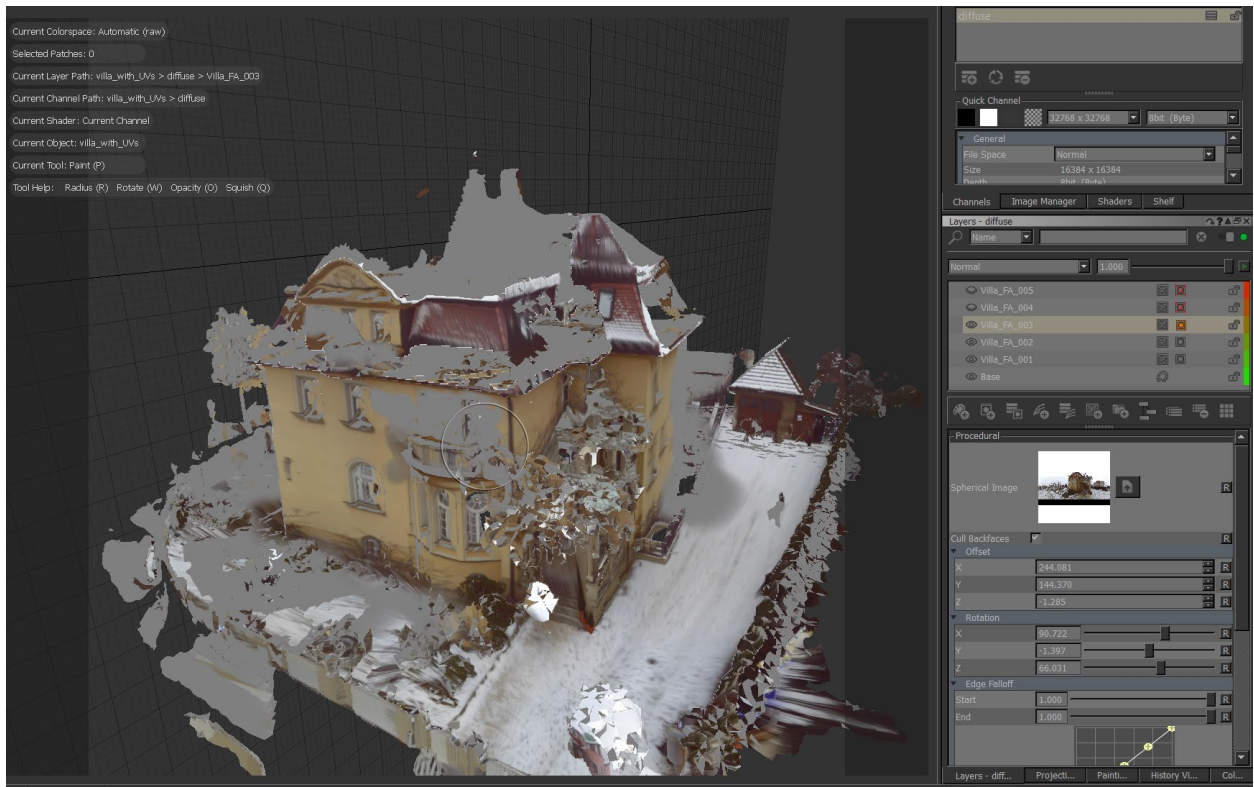


Note: The **order of the layers** determines in which order the scans get projected. The top layer gets projected first, while the bottom layers gets projected last. By dragging and dropping layers, one can adjust the projection order. Sometimes changing the order of scans can get you to the desired result faster without having to paint as much.

Note:  For those interested in SCAN2FX Exporter for Maya. In contrast to Maya, Mari automatically displays the combined output of all layers on your mesh. However, Maya provides modelling tools and SCAN2FX Exporter for Mari will create cameras with image backplanes that can assist in modelling in Maya. So, as you can see there is advantages and disadvantages to both depending on your needs.

## 9. Tips and best practices for working with the SCAN2FX data within Mari

9.1   Cull Back Faces

If a layer is not paintable and a procedural projection, you should also see the option "Cull Backfaces" in the procedural settings when selecting the layer.
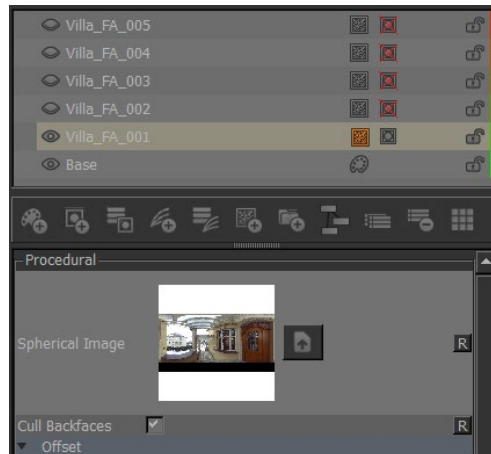


"Cull backfaces" will make sure to not project the panorama onto certain backfaces, making it easier to identify the area where the scanner was based during the capture within the 3D scene.

Paintable layers will no longer have this option, so there is advantages to keeping the layers as projection layers rather than converting them to paintable layers by default.

9.2   Fill Mask for Reveal Paint or Masking Out

Besides the option in SCAN2FX to make all masks opaque or transparent by default, there is also a technique to change the behavior of a mask for a given layer.

First remove any existing mask from the layer by right clicking on the layer, and selecting Layer Mask -> Remove Mask.

Next right click again and mouse over the "Add Mask" menu under Layer Mask.
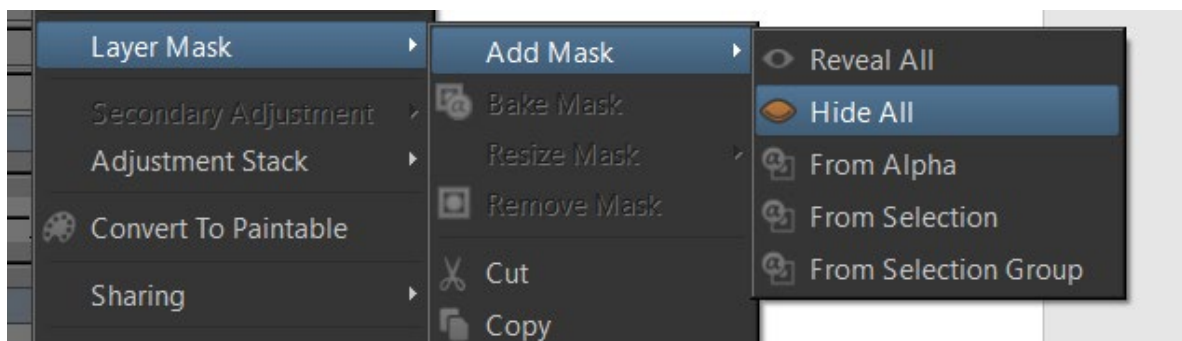
Here you have the option to add a new mask that reveals all or hides all as a starting point. If you click "Hide All," you can virtually reverse the painting process by painting in / revealing a scan rather than hiding / masking out a scan.

By painting with a white brush you now fill in exactly those areas where you want the scan of the current layer revealed / visible.
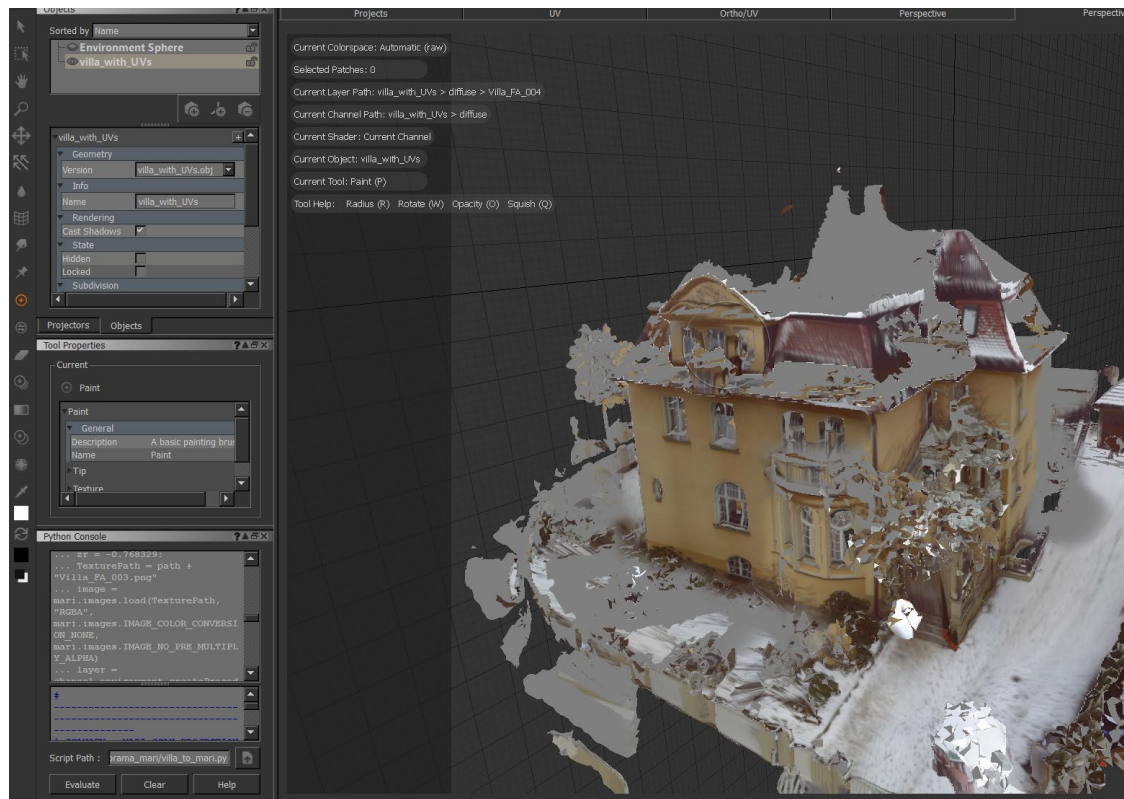
### 9.3 Making Projections Paintable to Paint in Texture Holes

In order to paint new colors onto a layer, we need to make sure the layer is "paintable." A procedural projection layer is not paintable, so you need to convert it to a paintable layer first.

You may want to make a copy (Copy / Paste layer and make copy invisible) first to preserve the full projection. Now right click on the layer and click "Convert to Paintable."
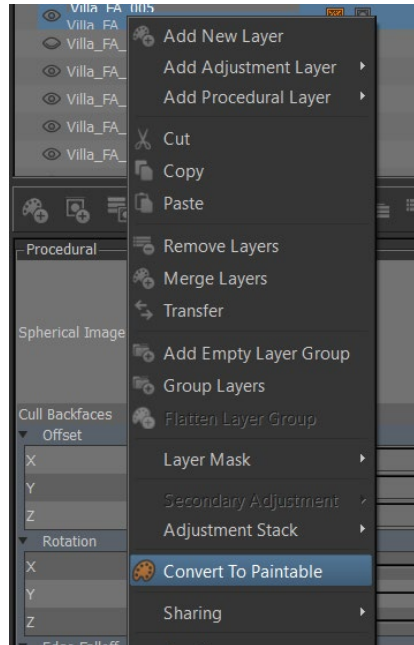


You may experience some loss of visual "fidelity" after converting (especially with lower channel resolutions). You can now paint onto the mask as usual, but also have the option to paint "colors" onto the layer. Here's the current texture project where you can see some trees get projected on the snow.

We can now over paint the trees with white or also utilize the "clone" brush in Mari to replicate the snow texture.

Here you can see the area with the tree in the front and back replaced by snow.
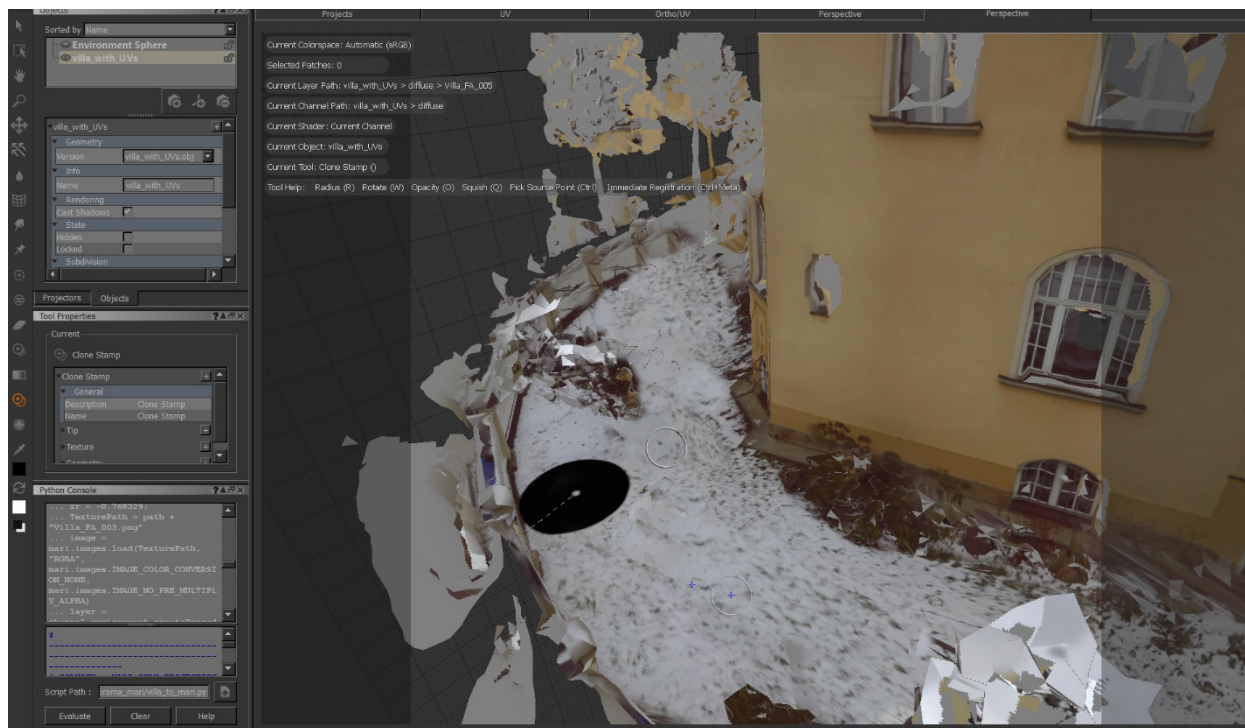


## 9.3  Clone Brush to Paint in Scan Bottoms

You can also utilize the "clone" brush to paint in the scan bottoms (especially when other scans you could use create a "blurry" result or maybe you do not have a second scan to cover this area).

Select the "clone" brush tool by clicking the following icon:



Select the to-be-cloned area by clicking with the brush onto the mesh while pressing "CTRL."

Here is the result with the scan bottom replaced without the use of any additional scans:
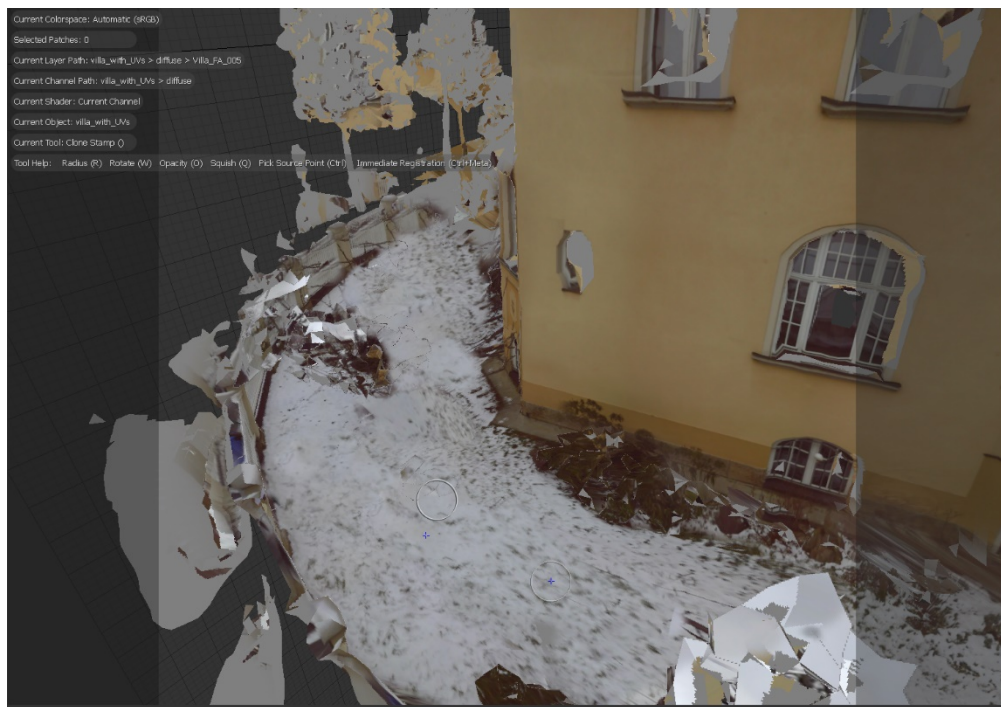


## 9.4   Checking Scan Bottoms and Direction of Streaks to Identify Origin of Scan in Scene

Sometimes it can become a challenge to identify where an actual scan is supposed to apply. See if you can identify the scan bottom or follow the direction of streaks to a center point.

## 9.5   Distance Falloffs to Quickly Create Baseline Texture and Identify Area of Scan

Setting up distance falloffs can also help identify the position of a scan. Falloffs can be defined in the SCAN2FX Settings for Mari Export to apply a standard default for scan.
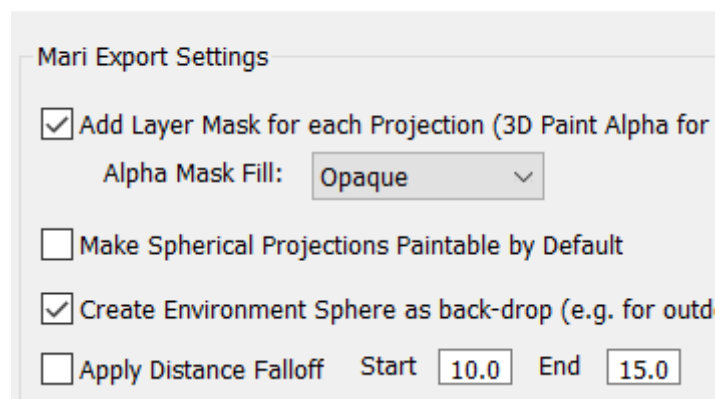
Alternatively, you can define a particular falloff start and end in each spherical projection layer. Here you also can adjust a curve to define how quickly or slow the blending should take place.
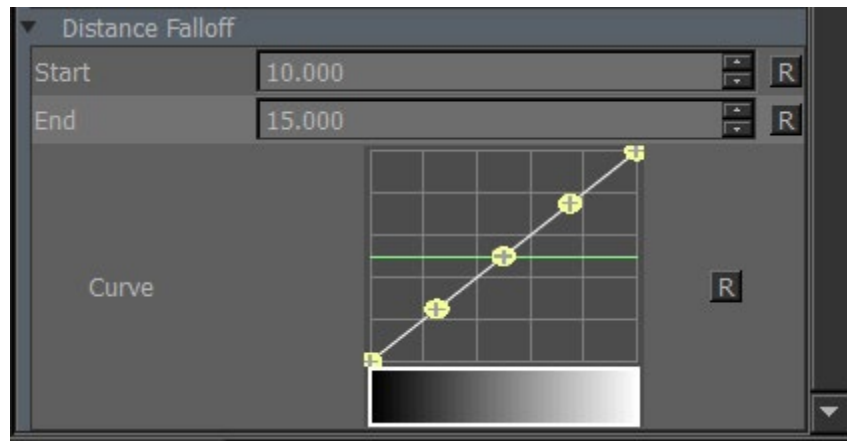


Note that even if a mask is opaque in an area further away than the distance falloff end, that area will not become visible and remain hidden.

Here is an example of how the scene looks like with a distance fall off on one of the scans.

9.6  Filters and Color Correction on Layers to Adjust Look and Overcome Exposures

In some situations, you may run into issues with different scans showing different coloring for the same area (e.g. due to changes in lighting during scanning or varying camera exposures). Mari has a handy feature that deserves highlighting: "Adjustment Layers."

Right click on layer that you want to adjust, mouse the mover "Add Adjustment Layer" to see a list of possible adjustments. Adjustments can include "Brightness" or "Contract," or even more involved adjustments such as "Color Balance" or "Levels."

9.7  Ensure High Resolution before Converting to Paintable or Baking a Mask

It is important to consider the channel resolution before converting a layer to paintable or before baking a mask. Otherwise, you may run into texture artifacts or for example a mask never fully hiding border of polygons after baking. You can "upgrade" your channel to a higher resolution by right clicking the channel and select clicking "Resize" with the desired resolution. High resolutions require longer to bake though.

### 9.8 Making micro adjustments if projection seems to be slightly off

If a spherical projection seems to be slightly off, one can make "micro adjustments" by clicking the up and down arrow right of each data entry in the procedural details for the layer. The offset (X,Y,Z) and rotation (X,Y,Z) values are listed and can be adjusted if ever needed.
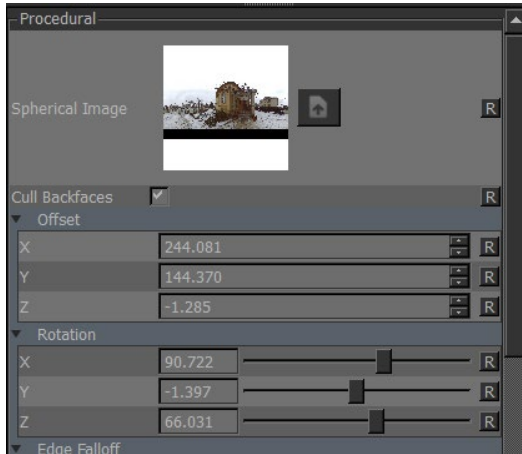
## 9.9    Set lighting to flat for more realistic preview

We recommend putting the lighting to flat when working with scanned meshes and textures in Mari. The different shader balls (see orange ball) indicate the lighting status.

Full lighting in Mari may highlight shading artifacts.
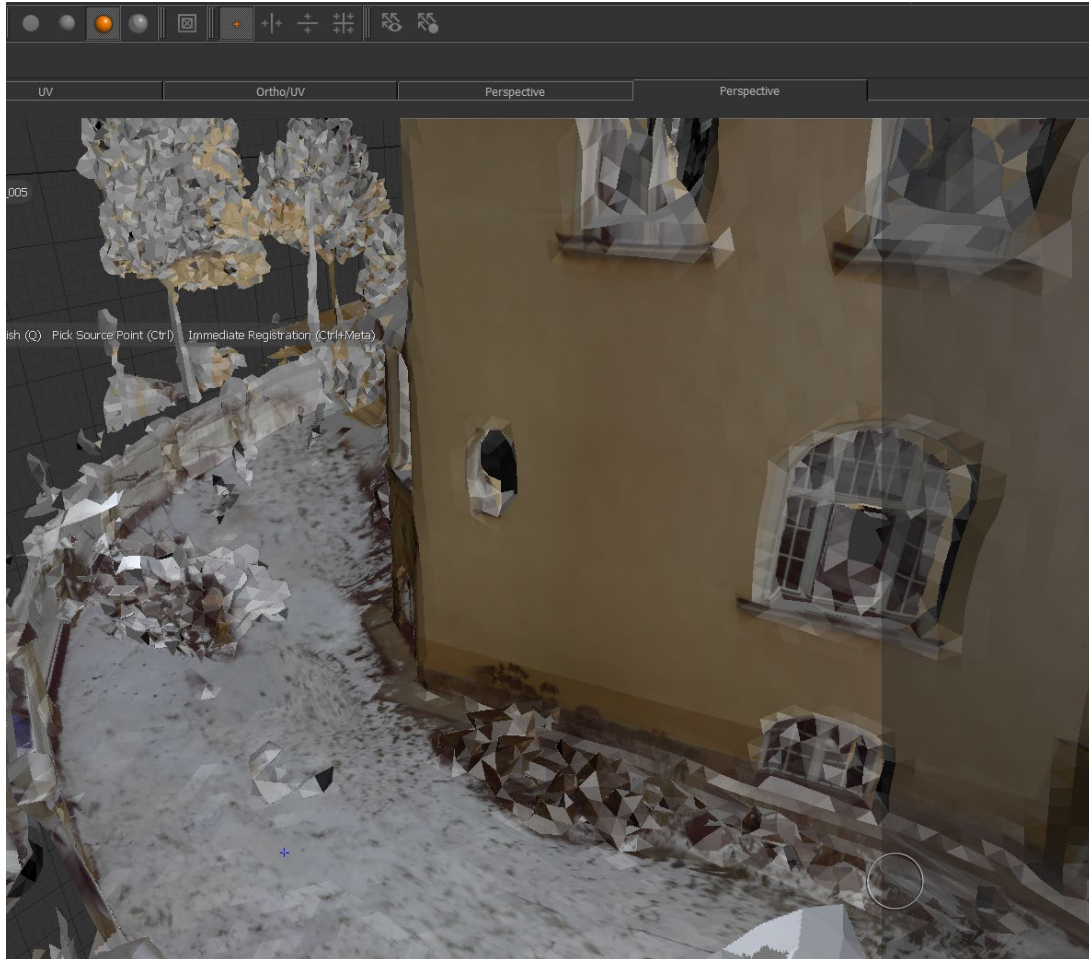
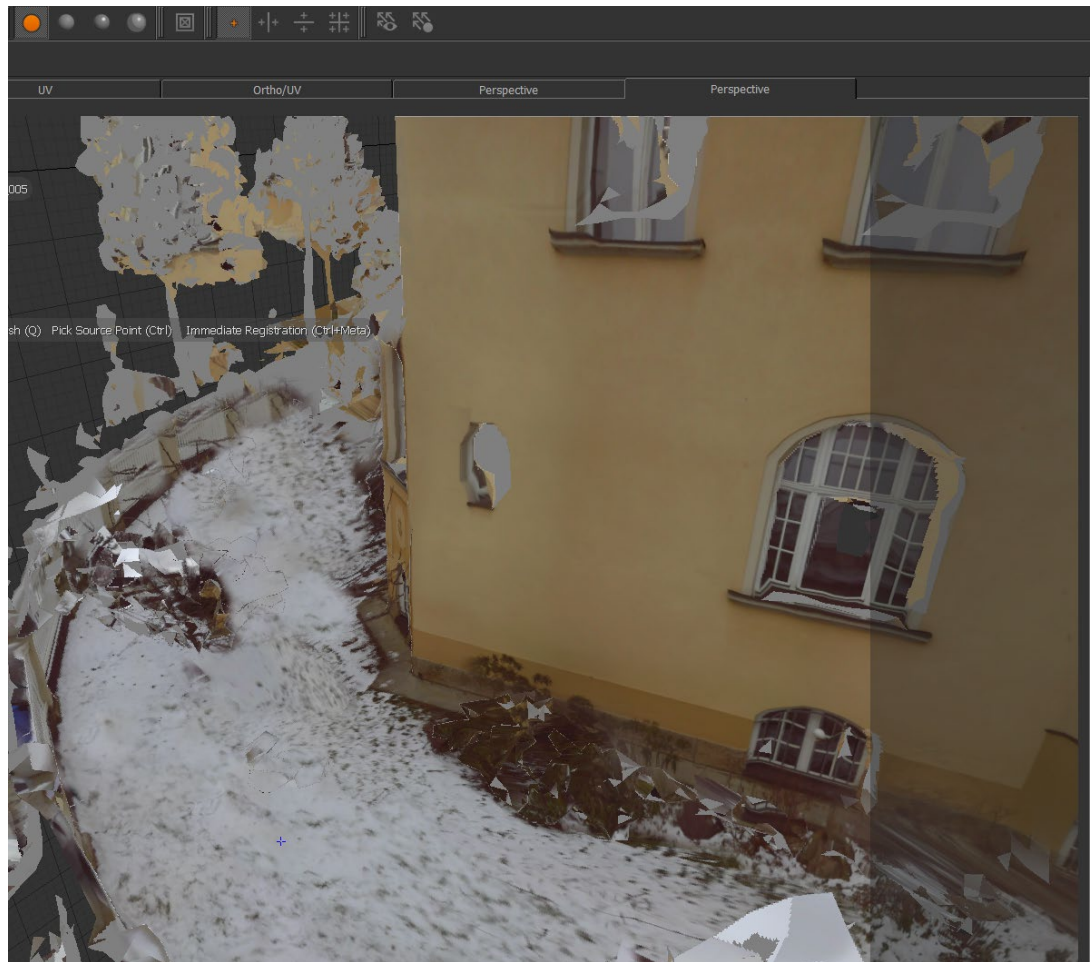Flat lighting in Mari better represents the actual colors of texture and scan.

## 10. Quality Achievable with SCAN2FX

When you import a mesh from SCENE, Mari will not show any colors normally. SCENE only colors the vertices and does not generate textures when creating a mesh. However, Mari requires textures to display color on meshes. With SCAN2FX Exporter, you can obtain the full high-resolution images and cameras captured, and can with projection painting obtain photorealistic visualizations of your models with the highest resolution textures possible.

As a comparison, you see here the same mesh with vertex coloring in SCENE:
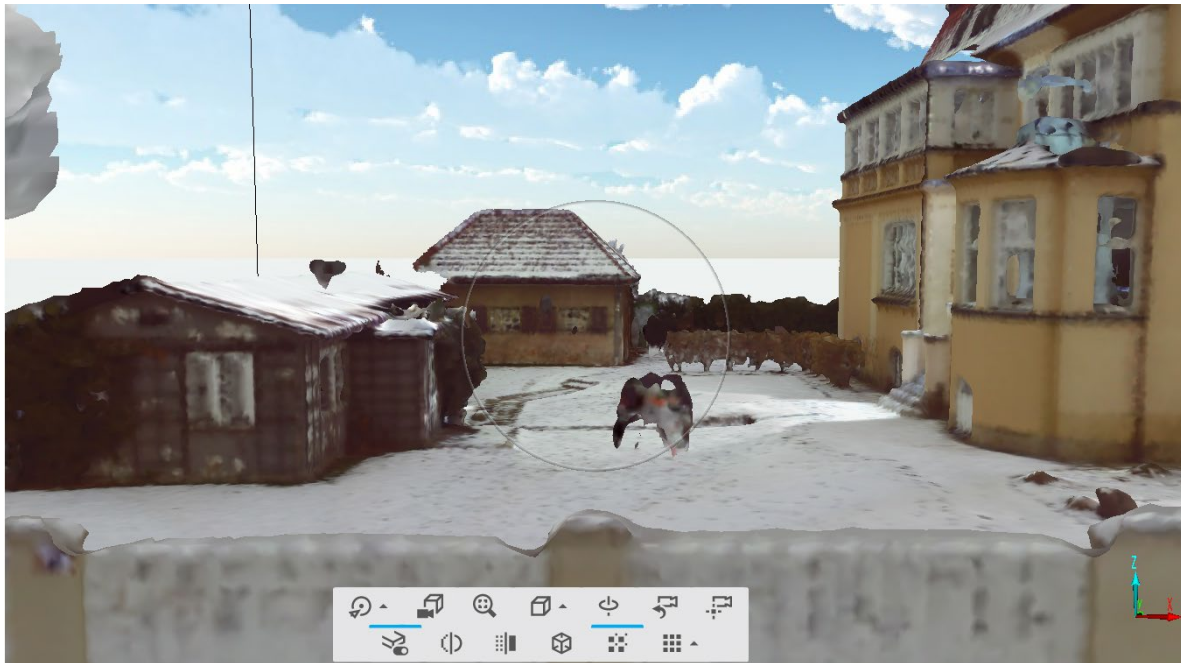


And then here the same mesh with SCAN2FX textures and then rendered with Maya:

Mari is a dedicated 3D paint application and does not include a renderer. Many rendering application are available that can also apply additional effects such as depth of field, and full lighting simulations.

Examples for rendering engines include Arnold, MentalRay, Octane, Renderman, V-Ray, or, for real-time visualizations, Unreal Engine.

The aim with SCAN2FX Exporter for Mari is to enable a high degree of control for 3D texture artists.

For a more automated texturing process, SCAN2FX also offers a separate module "SCAN2FX Texture" that can be used in conjunction with SCAN2FX Exporter for Mari or separately.

## 11. Known Limitations or Considerations

11.1 FARO® SCENE and Mari Version

SCAN2FX Exporter for Mari has only been tested and qualified with FARO® SCENE 2019 or SCENE LT 2019. Given the API documentation, SCAN2FX Exporter for Mari may function on previous versions of FARO® SCENE, but SCAN2FX cannot guarantee the functionality.

SCAN2FX Exporter for Mari has been tested with Autodesk Mari 3.3. It will likely work with other versions, but SCAN2FX cannot guarantee the functionality. Please email support@scan2fx.com if you think you may have identified an issue as we would love to hear.

11.2 Disk Storage Usage

SCAN2FX may not display a warning or error if disk space is full, and a full disk may result into unpredictable behavior including crashes, wrong textures or other issues. Please make sure to have sufficient disk space available or if you run into an issue, please check that there is write permission in the folder you selected and sufficient disk space. Insufficient disk space is a likely reason for issues.

11.2 Always Scan full 360x300 panoramas

When scanning for a project that you want to use SCAN2FX on, make sure to always scan full 360x300 panoramas. Partial panoramas are not supported, and will need to be deleted before exporting the scans with SCAN2FX Exporter.

11.3 Mari Performance

Mari may not handle the meshes generated from SCENE that well. It is recommended to re-topologize each mesh for optimal performance prior to import into Mari. Contact support@scan2fx.com if you have additional questions or are looking for tips.

Certain panorama images with extremely high resolution may not load into Mari. You may need to down scale the images (with locked aspect ratio) prior to import if an error indicating too high a resolution for a certain panorama.

Loading too many panorama projections into Mari may freeze Mari. In those, it is recommended to start with less layers and delete some scans before exporting. After painting and merging the first set of scans, additional scans can be imported into the same Mari project.

SCAN2FX also has no control over Mari or any changes to Mari functionality described within this document.

### 11.4 Manual Process vs. Automatic Texturing

SCAN2FX Exporter for Mari focuses on providing control to texture artists vs. maximum automation for texturing. If you want a more automated process to generate a texture for your mesh, you may want to check out the optional SCAN2FX Texture module, which you can also use in combination with one or more of the SCAN2FX Exporter modules. SCAN2FX Texture also provides the unique ability to create texture layers for advanced texturing.

### 11.5 Older Versions of Windows

During our testing, the SCAN2FX suite has been mainly used on Windows 10. There may be certain issues or layout problems under previous versions of Windows we may be unaware of. We have decided to focus our development on the most current versions of software and operating systems instead, so we can get more functionality implemented faster rather than trying to test with too many versions or older operating systems.

### 11.6 Internet Connection Requirement for Licensing

If you intend to use SCAN2FX without Internet connection, please authorize SCAN2FX when connected to the Internet and keep FARO® SCENE open. Please note that SCAN2FX will authorize all previously entered licenses on each application start. If SCAN2FX licensing servers are not reachable at the time of authorization, SCAN2FX will disable the according SCAN2FX menus.

### 11.7 Subscription-based Licenses

Please note that all licenses in SCAN2FX are subscription-based, i.e. they will expire after your service term and a renewal subscription needs to be purchased to continue using SCAN2FX. When a licensing key gets entered the first time in SCAN2FX, this particular license key will be node-locked to the particular hardware and cannot be reused on another machine.

### 11.8 Significant Changes in Hardware / No Transferability of License

Licenses are not transferable and once associated with a particular computer hardware are not transferable. Unfortunately, in some case where you purchase a new computer or change computers you may have to purchase a new subscription early while not getting a discount for the existing subscription. We hope you appreciate this policy and limitation in order to protect our work and intellectual property, and at the same time by purchasing your subscription you enable us to better support you and also to continue development of the SCAN2FX plug-in applications and modules for FARO® SCENE. Laser scanning add-on software is a small, highly specialized market as of now, and we need sufficient revenue to

keep innovating and provide additional solutions.

11.9  Other Issues or Needs

If you have ideas for, or need particular solutions or enhancements, feel free to email us at [sales@scan2fx.com](mailto:sales@scan2fx.com) to discuss options on how to support your business. We would love to hear from you.

## 12. Support & Training

If you have **questions or feedback**, please email us at support@scan2fx.com. Or contact us via our website at http://scan2fx.com/?id=contact. Additional premium support may be available at an extra cost.

If you have **additional requirements or special projects** you would like us to support, please contact us at sales@scan2fx.com with your requirements to discuss a possible collaboration and pricing.

To request a quote for **training**, please contact us at sales@scan2fx.com with your requirements and/or training needs for yourself or your team.

support@scan2fx.com