SCAN2FX

Exporter for Maya

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 Maya

SCAN2FX Exporter for Maya focuses on quickly creating cameras and shaders in Maya to photo-realistically and creatively texture models by utilizing Maya and its 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 Maya, 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 Maya 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 Maya.

SCAN2FX Exporter eliminates countless hours per scan project, and takes care of difficult computations that would otherwise be required to setup the scanned cameras, shaders, and projections and transform the data from your laser scanner to be used in Maya. SCAN2FX Exporter automates that process and makes the required calculations automatically for you.

Autodesk Maya, commonly shortened to Maya, is a popular 3D computer graphics software that runs on Windows, macOS and Linux. It is widely used to create interactive 3D applications, including video games, animated films, TV series, product visualizations, or visual effects. SCAN2FX Exporter for Maya enables artists to directly export data to Maya from FARO® SCENE without having to spend countless hours going through various intermediate steps or through other software packages.

SCAN2FX Exporter for Maya will export the panorama scan images of the current project in FARO® SCENE in a format suitable for Autodesk Maya. SCAN2FX Exporter for Maya computes pinhole camera positions, and poses, from the panoramas and setups back plane images automatically for each camera.

Depending on the settings, SCAN2FX Exporter for Maya can also generate a shader for each camera to project the image from the camera back onto a model in Maya. Optionally, SCAN2FX Exporter for Maya 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 Maya'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.

SCAN2FX Exporter for Maya also provide an option to automatically generate a layered shader in Maya, to combine all the individual projection shaders into one single shader and texture based on the alpha mask texture of each individual shader.

1.3   Enhancements to other SCAN2FX Modules with SCAN2FX Exporter for Maya

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

o   In combination with the separately available **SCAN2FX Texture** module, SCAN2FX Exporter for Maya will enable the option to automatically texture a mesh, and output the resulting data directly to Maya. This includes the ability to create different shaders for example for the overall texture, the contribution of certain scans to the texture, masks to highlight scan bottoms, masks to differentiate occluded from non-occluded areas for each scan, as well as distance maps to blend textures based on distance.

   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 Maya focuses on exporting cameras and panorama images to Maya for an artist to 3D paint the texture projections 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 Maya will also export the computed cameras for any photo projections created with SCAN2FX Photo Projector. SCAN2FX Exporter for Maya will automatically create 3D cameras for each photo aligned, and already configured with the correct image backplane. 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.

   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 modern 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 Maya 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 2019+
- o Autodesk Maya 2018 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

Release 3.7

NEW with Release 3.7

- **Fix for space in image filenames** – Fix for issue with SCAN2FX Photo Projector where the Photo Projector's image filename contained a space

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

- **Ai Standard Surface Shader support** – option to export as Ai Standard Surface Shader instead of Lambert for Maya 2018. However, note that Maya currently does not support 3D painting of attributes for Ai Standard Surface.
- **Improved alignment for SCAN2FX Photo Projector portrait photos** – the alignment of portrait photos from SCAN2FX Photo Projector has been improved.

Release 3.3

- **Maya cameras locked by default** – cameras are now locked by default to avoid accidental movement.
- **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).
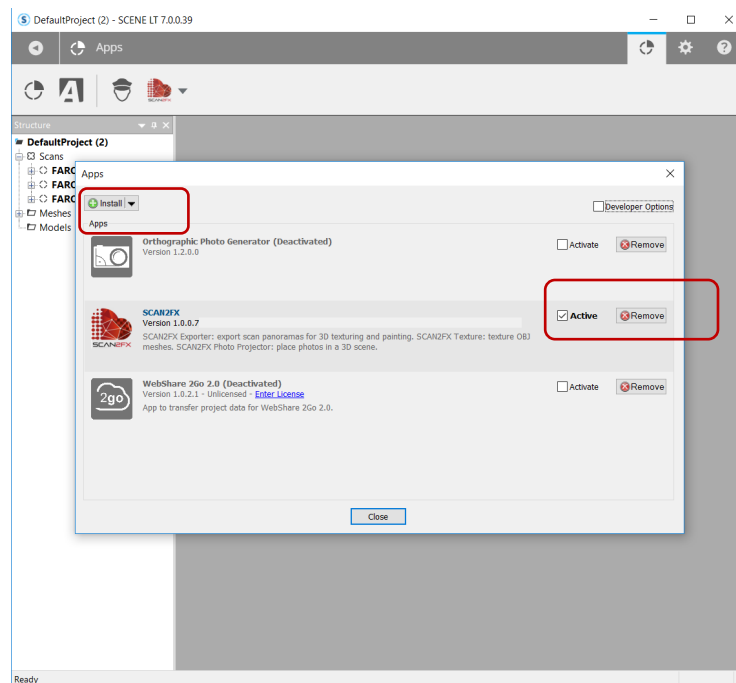

3. Install the downloaded SCAN2FX app by doing one of the following:
- Drag & Drop the SCAN2FX.fpp file into SCENE.
- Double click the SCAN2FX.fpp file in the Windows Explorer.
- Click install in the App Manager in SCENE or SCENE LT to install the SCAN2FX app, and follow the instructions.

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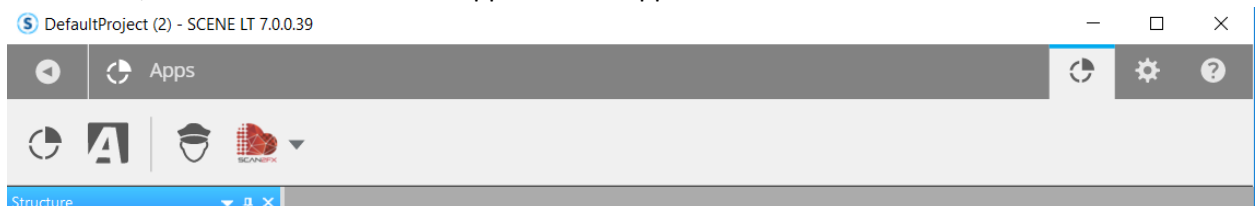
4. Licensing

To activate the SCANFX Exporter for Maya module, a valid license key needs to be authenticated. You can purchase the SCAN2FX Exporter for Maya 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.
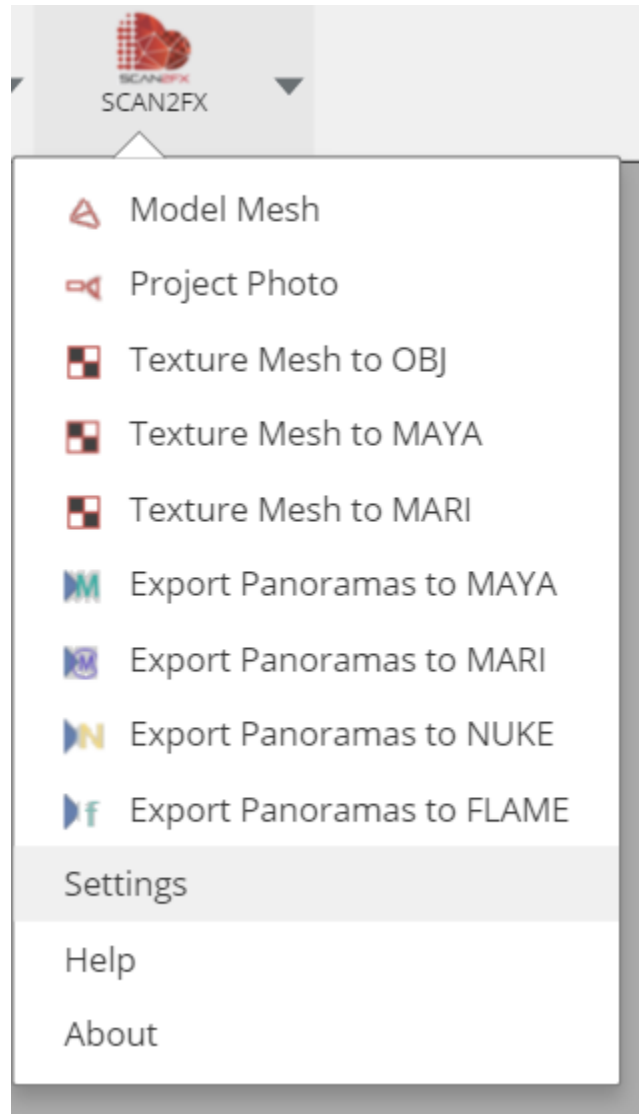
2. In the following pop-up dialogue, see the section "Licensing" at the bottom left of the dialogue box. Enter the email address that was used when purchasing the license and is associated with the license. And paste in your SCAN2FX license key.
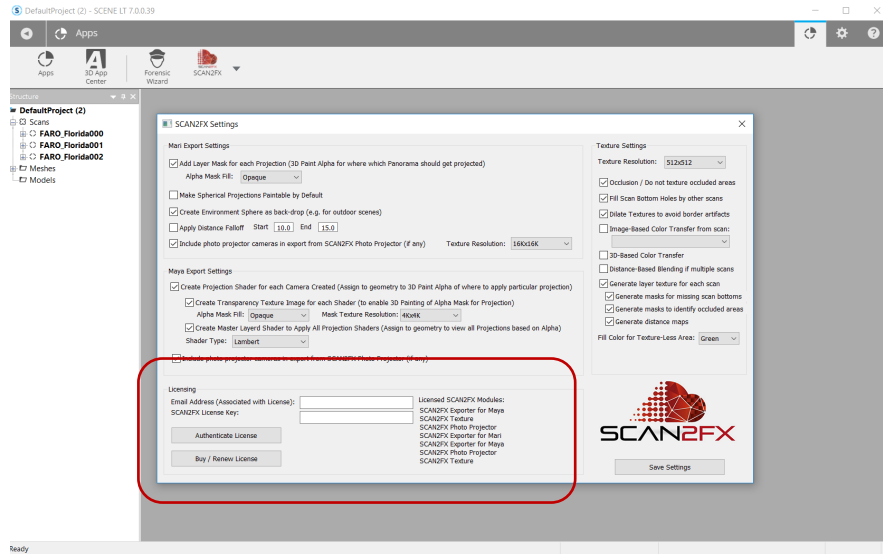
3. Click "Authenticate License" to connect to SCAN2FX cloud licensing server for authentication.

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.

5. Using SCAN2FX Exporter for Maya

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

1. Click on **"Settings"** in the SCAN2FX menu.
2. Review the "Maya Export Settings" section on the left middle of the dialogue box.
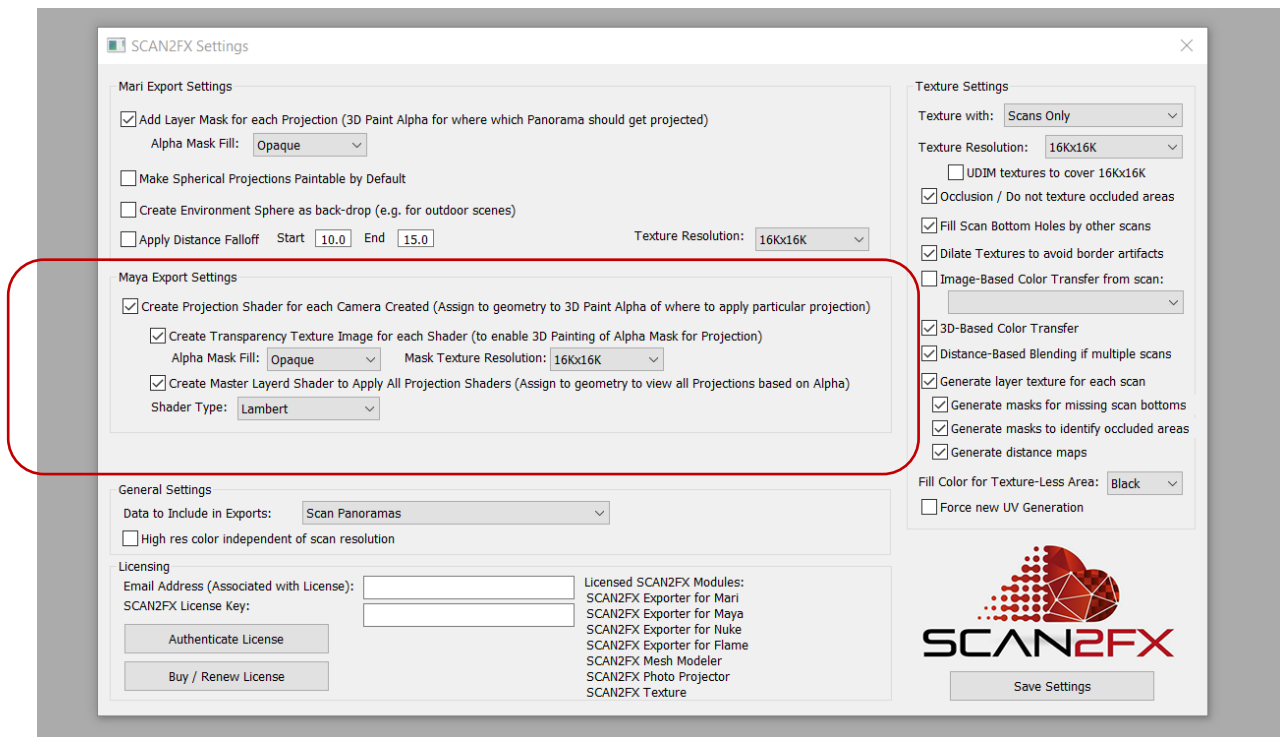
You will find several key settings here:

- "Create Projection Shader for each Camera Created"
With this option, SCAN2FX Exporter for Maya will export several pinhole cameras with image backplanes for each scan, and also automatically set up a projection shader for each camera and the correct image configured. This projection can be used to texture your models.

- "Create Transparency Texture Image for each Shader"
If a shader gets created for each camera, this option will also automatically create one image file per shader, and set it up as a transparency texture for each shader generated.

- Alpha Mask Fill
This setting determines whether the transparency texture should be filled to make the entire camera contribution transparent or opaque upon import. This enables different workflows when e.g. 3D painting in Maya. 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.

- Mask Texture Resolution
This setting lets you choose at what resolution the transparency texture should be created. Please note that this setting has nothing to do with the resolution of the image backplanes or projection images (those resolutions get determined by the panorama images in SCENE and how they get divided rather than this setting). Usually for alpha blending different scans together, you may not need as high of a resolution, saving you valuable disk space and/or memory in rendering. Mask texture resolution can be set in increments from 512x512 to 16Kx16K.

- "Create Master Layered Shader to Apply All Projection Shaders"
This setting determines if another "Master" shader should get generated in Maya. This shader will "link up" and layer all the other shaders generated for the cameras and their alpha masks. The shader will blend the textures in the order shown in the Layer shader dialogue in Maya. The order can be altered any time by dragging and dropping the contributing shaders in the Layer shader attributes. This shader enables you to preview how the different shaders blend together in Maya.

Maya currently does not allow 3D painting onto multiple shaders at the same time, so you need to assign one of the camera-based shaders onto your model, 3D paint your alpha, and then assign the overall Master Layered Shader to see how the shader now blends with the other projection shaders, based on the alpha you just painted. You can change the camera perspective and also have the capability to look through the applicable camera when painting.

ENHANCED with Release 3.4

- "Shader Type"
As a default, all shaders get generated with the shader type "Lambert" in Maya. The shader type can easily be changed within Maya through a drop-down. Alternatively, SCAN2FX can also create "Ai Standard Surface" shaders for Maya 2018 / Arnold 5 or higher. However, note that Maya's 3D paint functionality does not allow painting attributes of "Ai Standard Surface" standard shaders. Hence, it is recommended to export with "Lambert," paint any masks and then rewire the transparency as opacity and color as base color for the new shader.

If other shader types are required or desired, please email sales@scan2fx.com with your requirements.
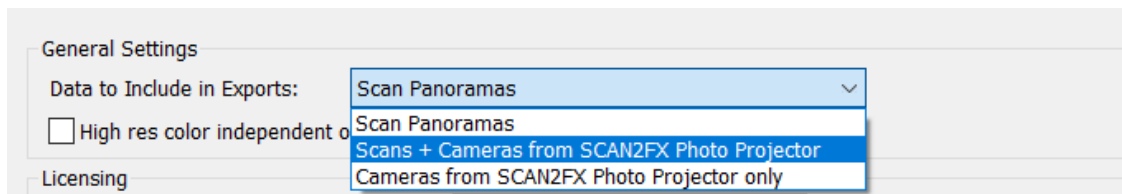
There is also two relevant Settings under General Settings.
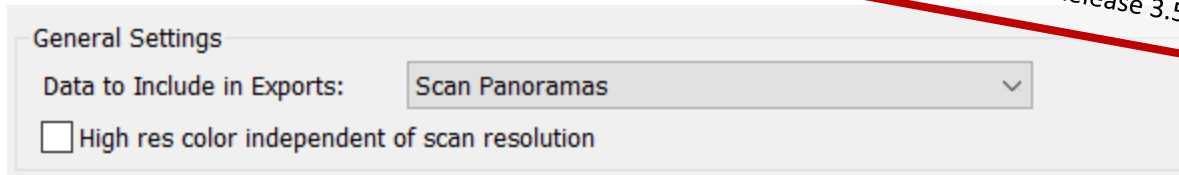
- "Data to Include in Exports:"
This option is only relevant if you also purchased the SCAN2FX Photo Projector.

With Scans + Cameras from SCAN2FX Photo Projector, SCAN2FX Exporter for Maya will include the cameras computed based on your photos with SCAN2FX Photo Projector in the Maya export.

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

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 actually export the computed camera data from SCENE.

- "High res color"
Under General Settings, the option "High res color" allows SCAN2FX Exporter for Maya 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.

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 Maya will use these settings until you change the settings again.

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

5. Select a path and **enter a filename for your Maya .MA export file**.

Note: 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 Maya does not just generate the Maya .MA file, 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 Maya 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 Maya is more trackable with fewer scans as each scan panorama will generate 6 different cameras to work with and masks need to be painted for each camera to determine where which projection should get applied or occluded. However, this workflow provides the opportunity to easily create very realistic textures on your meshes and models in Maya and to precisely control how which part of the images gets applied.
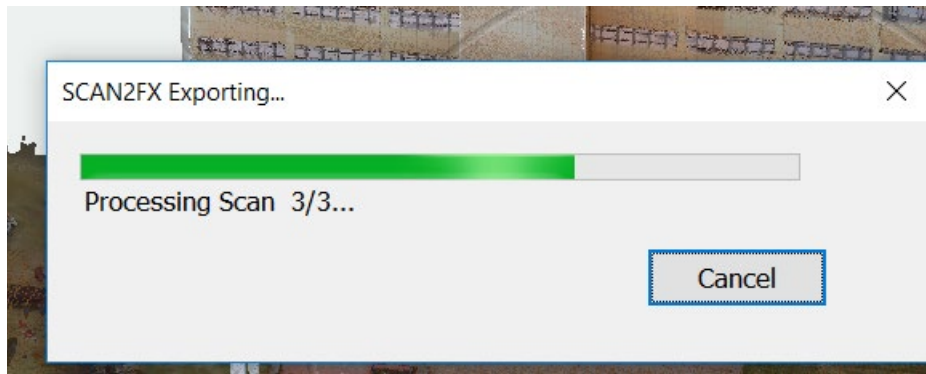
7. Once finished, SCAN2FX will message you how many scans or photo projectors were exported.

You are now **ready to import the Maya .MA file into Maya**.

6. Creating your Mesh

6.1 Creating Meshes with SCAN2FX Mesh Modeler

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.
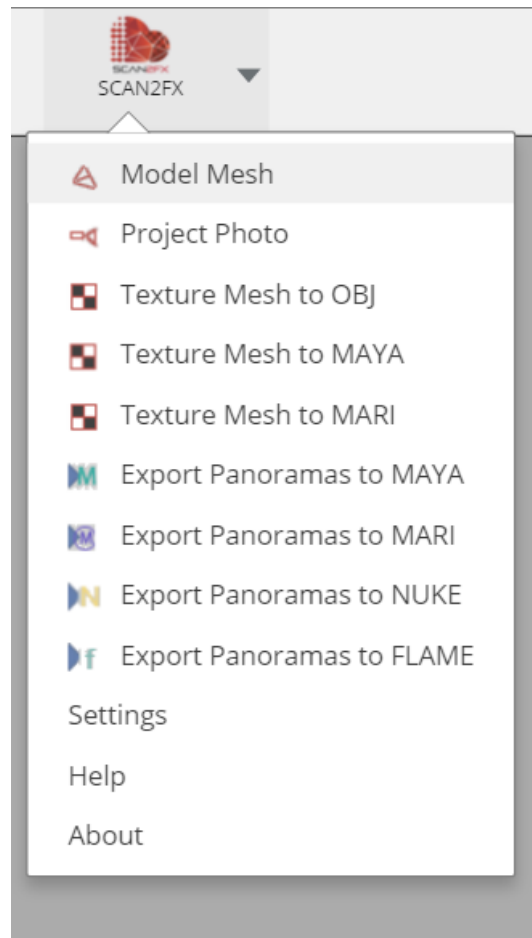

Create a "New Mesh" in SCAN2FX Mesh Modeler, then:

 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 3rd 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.
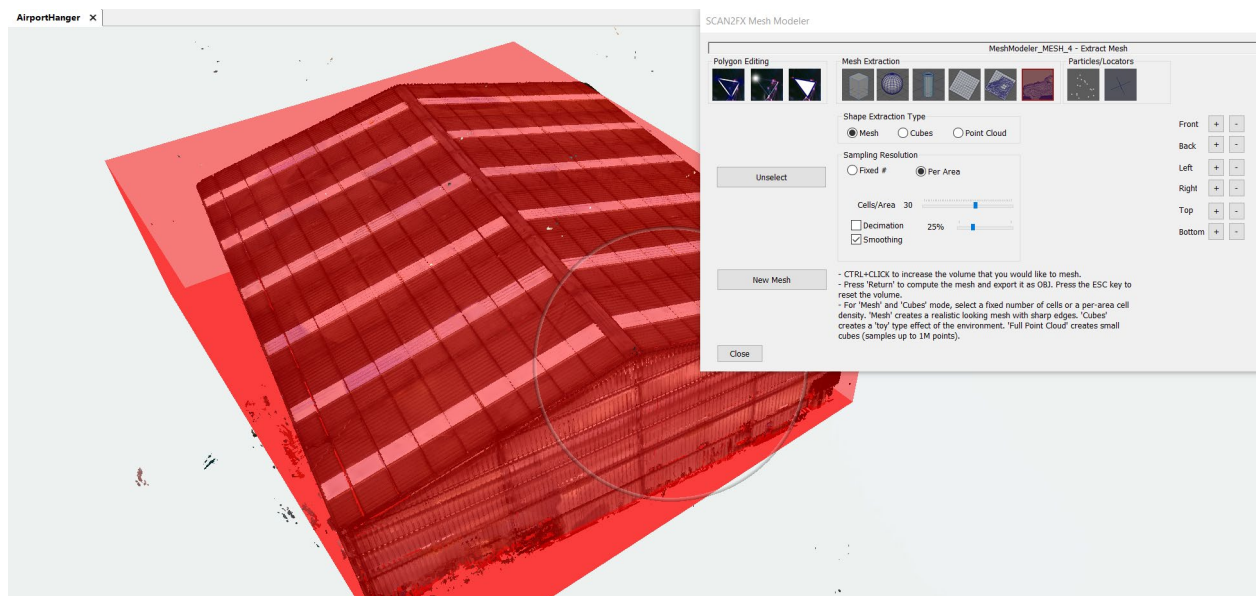
Choose and double check the meshing **settings** (see 14.3 – 14.5 in the SCAN2FX Mesh Modeler handbook for details on the settings) and press the "return" key to save the mesh component to the Components list, so it can be later exported. Meshing of all identified meshing volumes will take place during 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.

It is critical to add a UV layout to the mesh before 3D painting in Maya.

Important Note: To 3D paint onto a mesh in Maya, the mesh requires a UV layout.

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 Maya to apply the projection shaders from SCAN2FX Exporter to texture the mesh.

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.
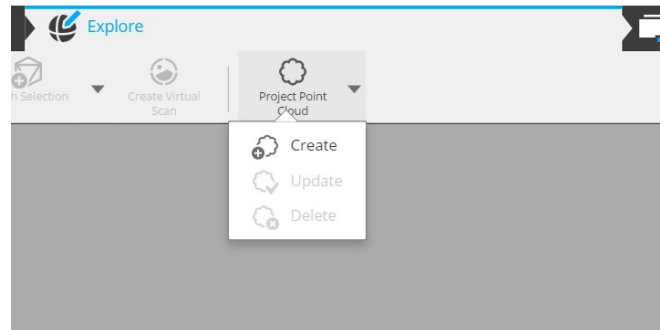
Depending on the number of scans and settings, the project point cloud computation may take a while to process.
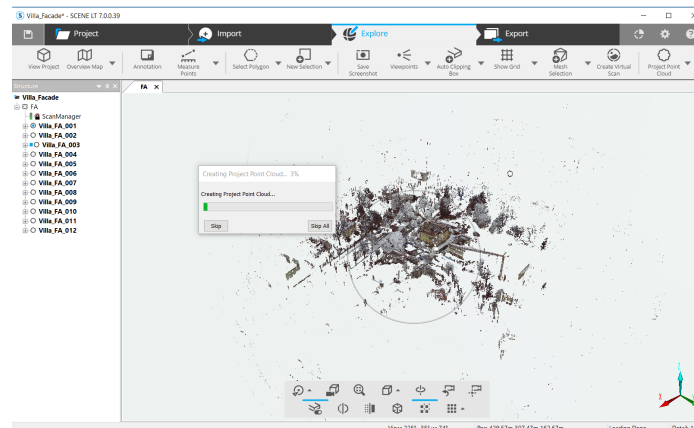
3. Once done, view the project point cloud in 3D, and make a selection or create a clipping box in SCENE.

4. Now click "Mesh Selection" or "Mesh Clipping Box." A dialogue with appear enable you to set the triangle count and other parameters.
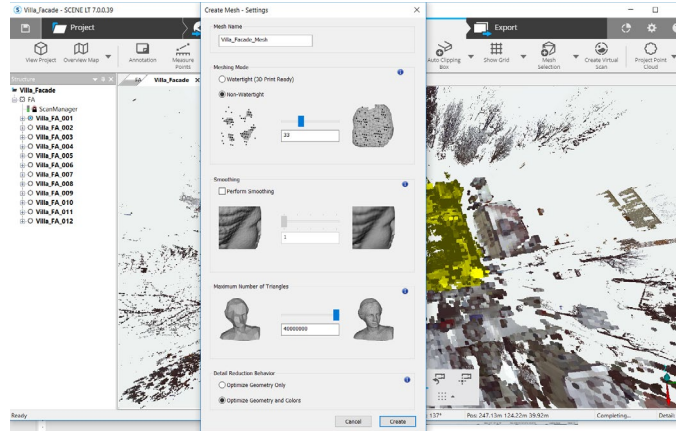
5. Once your parameters are set, click "Create" to start meshing the project point cloud selection or clipping box. The mesh generation may require substantial time depending on the size of the point cloud.
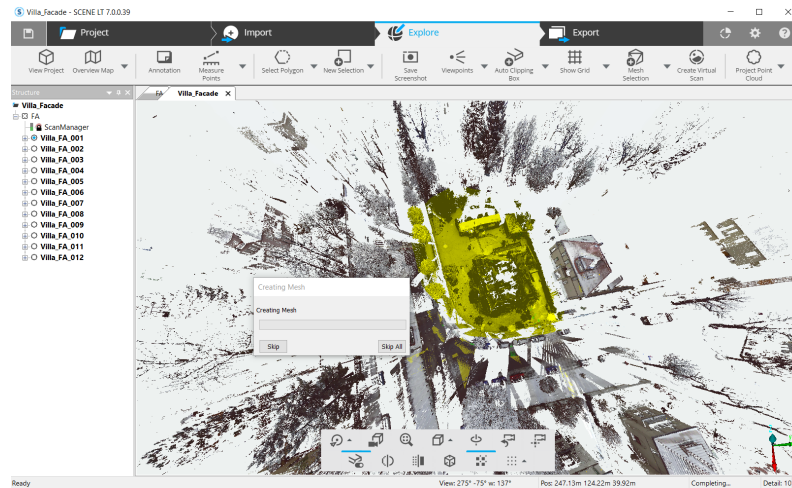
6. Once processing is done, export the mesh by right clicking on the mesh, and select "Export."
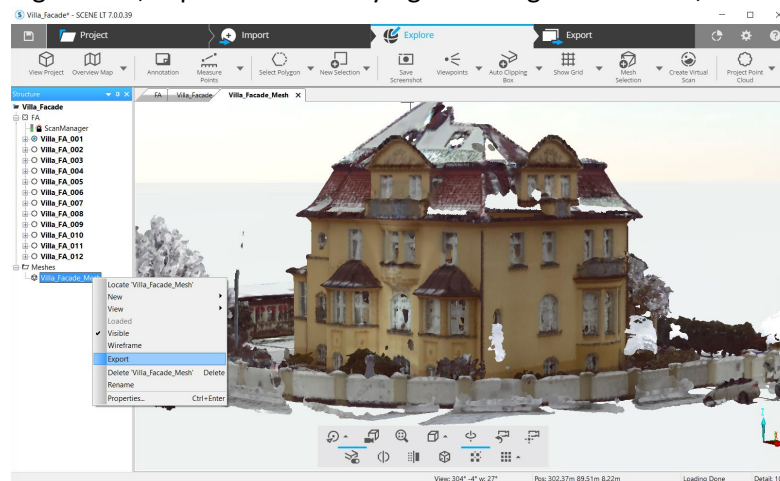
Note: You notice in this example that there are certain gaps in the mesh where no scan data was captured (e.g. the roof). Also, windows and other reflective or translucent

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 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.

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

You can later import your OBJ file into Maya through "Import…" in the File menu. You will notice that Maya will not import the coloring by default. Once the mesh is imported, press the "F" key to focus the current camera onto the mesh. The mesh may not be at the 0,0,0 position of your Maya grid and use a different orientation. The mesh from SCENE in Maya:
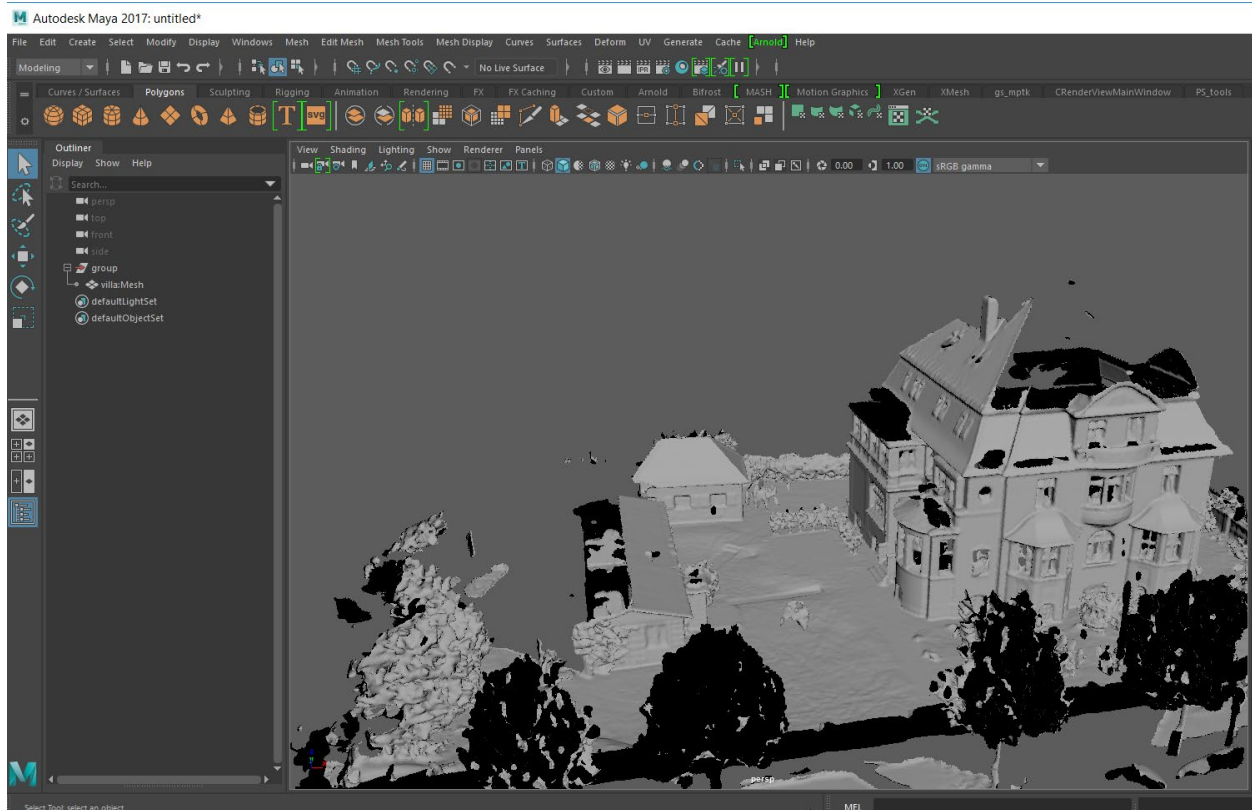
NEW with Release 3.3

All cameras are locked by default, but you can unlock a camera to make adjustments if needed e.g. to adjust cameras from SCAN2FX Photo Projector further.

Important Note: Make sure to **<u>not</u>** move the mesh by itself since otherwise any imported cameras will no longer line up with your mesh!

6.2 **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 Maya, or another 3D modeling application.

Within Maya, you could use the projected cameras from SCAN2FX Exporter as a guide, and align polygons or primitives within Maya by looking through the various aligned cameras. Move the vertices against the image backplanes until they line up with the images in all cameras that were automatically generated by SCAN2FX Exporter for Maya (See Section 10 for more details, and an introduction to modeling based on SCAN2FX image backplanes.)

7. Importing your SCAN2FX Export into Maya

Launch Maya, or load your existing project in Maya for which you want to load the SCAN2FX Export.

1. Click on "Import…" in the "File" menu.
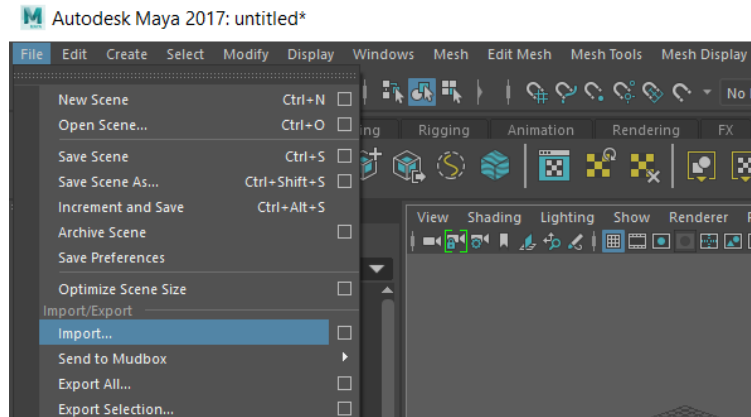
2. In the Import dialogue, select Maya ASCII as Files of type to see the relevant Maya files. Select the .MA file exported from SCAN2FX Exporter. Click **"Import."**
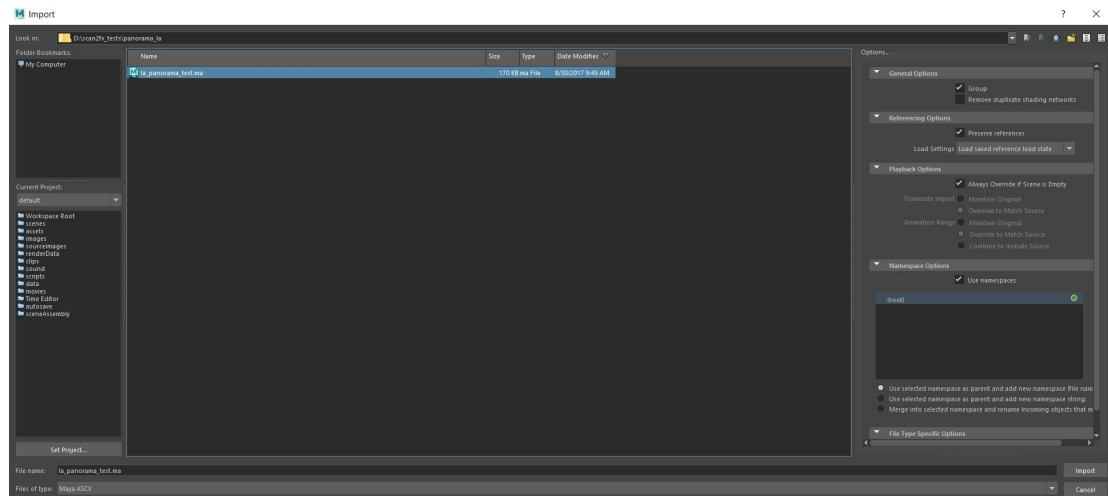
Maya will now load the cameras, and/or shaders (depending on the settings) that were exported with SCAN2FX Exporter. Once Maya finishes loading the data, you are ready to work with the newly imported SCAN2FX data in Maya.

8. Data generated by SCAN2FX Exporter for Maya

To better illustrate how to best work with data generated from SCAN2FX Exporter in Maya, we will run through an example.
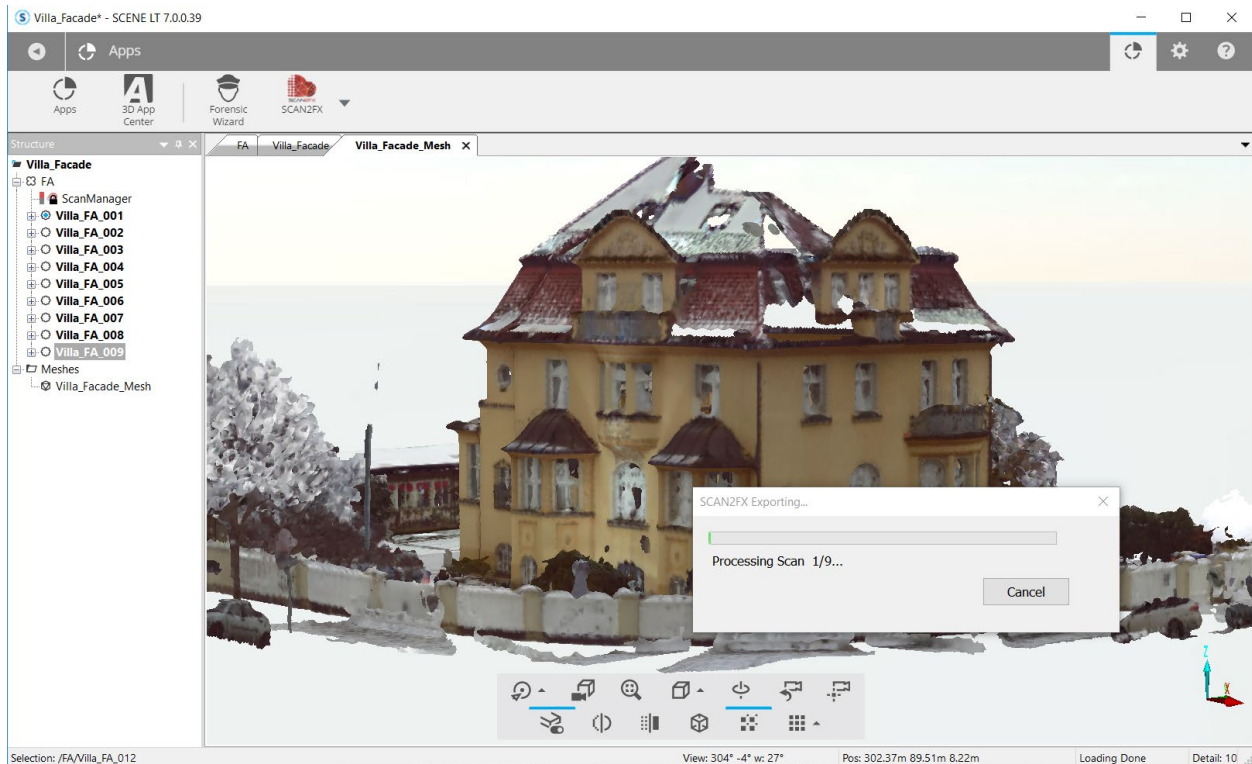
The following example export from SCAN2FX generated 54 cameras from 9 360x300 panorama scans, as well as the according image backplanes, material shaders, a "Master" shader, and transparency textures.

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

8.1 Cameras

Here you see the newly created cameras. Each camera was automatically labeled based on the scan name in SCENE. The different numbers indicate the direction of the camera, as each 360x300 panorama in SCENE, gets broken up into 6 different pinhole cameras so Maya can represent them. Each camera contains the name of the scan followed by c and a number from 1 to 6, based on the camera. The top facing camera has _top in the name, while the bottom facing camera has _bottom in the name.

The naming convention is in place you can easily identify each camera at a given time and also easily look up the associated shader material.

A top down view onto the scene shows the different camera positions:

8.2 **Image Backplanes for Cameras**

Each camera is automatically set to the correct scan location and camera pose. SCAN2FX Exporter also automatically configured and computed the correct image backplane for each camera.
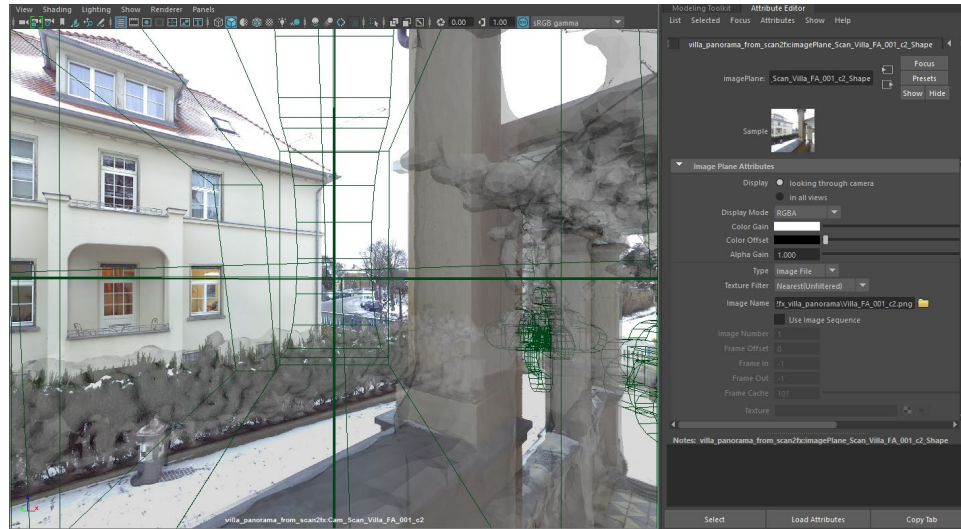

8.3 **Shaders** (Optional)

If the option "Create Projection Shader for each Camera Created" was enabled, SCAN2FX Exporter also created a shader for each camera. Each shader is automatically linked with a projection node and the camera as you can see in the Maya Hypershade editor. All shaders are of type Lambert by default, but can be easily changed in the Attribute sections of each shader to a different shader type. *(Note: The shader preview ball shows orange in this example probably due to limited GPU memory and/or a limitation of Maya 2017.)*
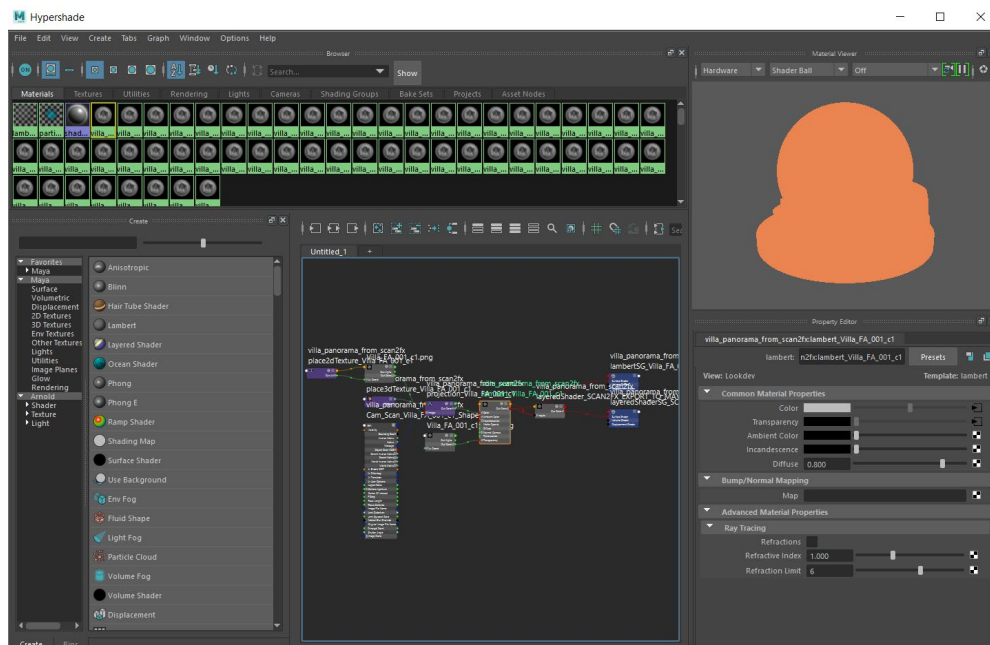
8.4 **Master Shader** (Optional)

If, in addition, the option "Create Master Layered Shader to Apply All Projection Shaders" was enabled, SCAN2FX Exporter will have also created a "Master" shader that layers all the camera-based shaders via their alpha masks.
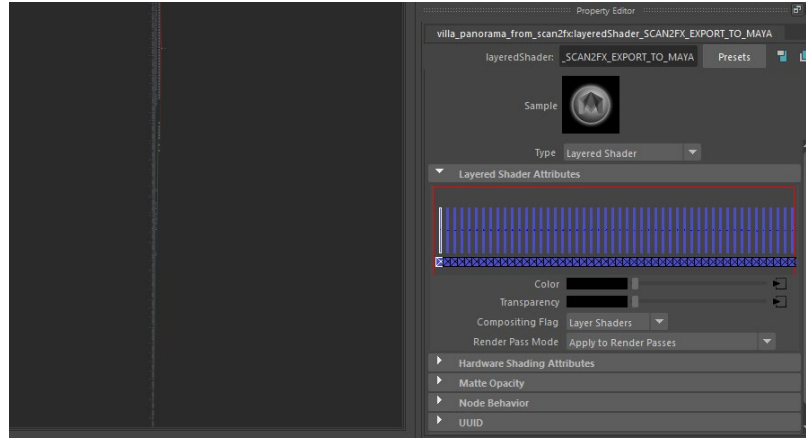
The blue rectangles represent each individual projection texture that gets blended. It is highly recommended that users reduce the number of layers for optimal performance in Maya's Viewport and to not max out your GPU's memory.

8.5 **Transparency Texture / Mask** (Optional)

If the option "Create Transparency Texture Image for each Shader" was enabled, SCAN2FX Exporter will have automatically created an image texture file based on the selected "Mask Texture Resolution" and "Alpha Mask Fill Setting" (Opaque or Transparent as default). This mask can be useful for 3D painting an alpha mask for each projection shader material to determine where a scan is occluded (transparent) or where a scan should be visible (opaque). Flood fill in the 3D paint tool kit can be used to quickly make an entire projection opaque or transparent by picking black or white as color to paint the transparency channel.
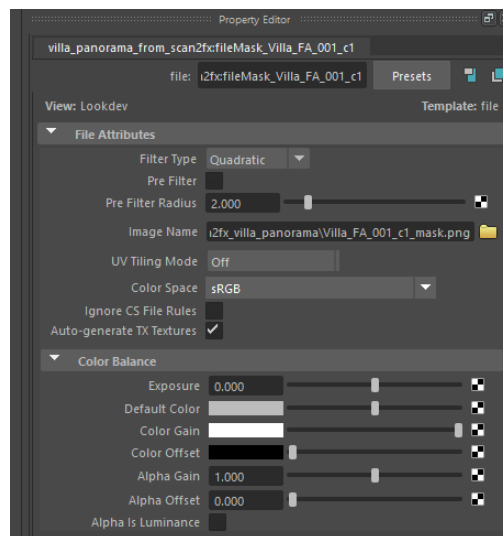
9. Texturing your Mesh with the data from SCAN2FX Exporter in Maya

9.1 Importing a Mesh

To apply the imported data, we now import a mesh into Maya. We previously generated this mesh in SCENE and exported it as OBJ. We could also have created a mesh through another meshing software, or by modeling (e.g. in Maya, based on the imported image backplanes, or maybe another 3D modeling package).
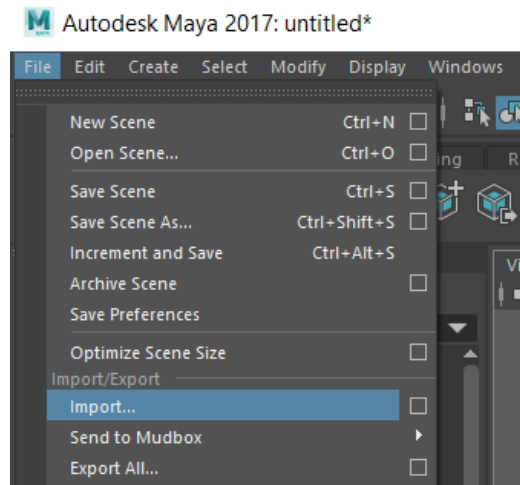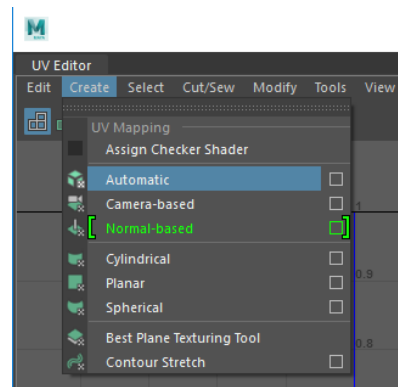

9.2 Generating a UV Layout

As a first step, we will now want to create a UV layout in Maya as SCENE did not generate any UVs for the mesh. The UV coordinates are needed so that Maya knows which part of a texture is supposed to color which triangle. Note that many modeling packages may automatically generate UVs.

We will need the UVs in order to 3D paint onto the texture and to blend the different projection camera shaders by painting on the transparency channel (See 8.4).

We click "UV Editor" in the UV menu in Maya. The Maya UV Editor pops up, and we click "Automatic" in the Create menu.

If needed, we can also click the square box right of "Automatic" to adjust the settings prior to generating the UV layout. For example, it may make sense to adjust the shell spacing based on the texture resolution we will end up using (for example a 1024x1024 probably needs less of a percentage space to achieve an appropriate spacing without border artifacts). Alternatively, you can also use any other tool to generate your UVs for your 3D model.

The automatic UV layout computation can take a significant amount of time, especially, with the large number of triangles created with SCENE, and no progress bar is visible within Maya. The Maya application window will freeze until the computation is completed.

A recommendation may be to retopologize the mesh, to simplify the topology and reduce the triangle count. For example, you can use this to have less triangles in planar areas. This approach will also speed up 3D painting performance in Maya and/or other packages such as Mudbox or Mari.

Alternatively, the UV Editor also gives you the flexibility to create your own UV layouts as you may see fit. Just ensure that the mesh that you are texturing does not contain any overlapping UVs.

Note that projection mapping for automatic UV layouts only works on a single object at a time. If you need to apply a projection to multiple meshes in a single step, combine the objects into one first, and then apply the projection.

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

9.3 **Assigning a Projection Shader / Material from SCAN2FX**

We then assign the shader for the first camera generated by the SCAN2FX Exporter to see how that particular image textures the model. Simply go to "Hypershade" (Menu: Windows -> Rendering Editors -> Hypershade) and select the first shader with SCAN2FX in the name from the Materials tab. You can drag and drop the material with the middle mouse button pressed onto the model,
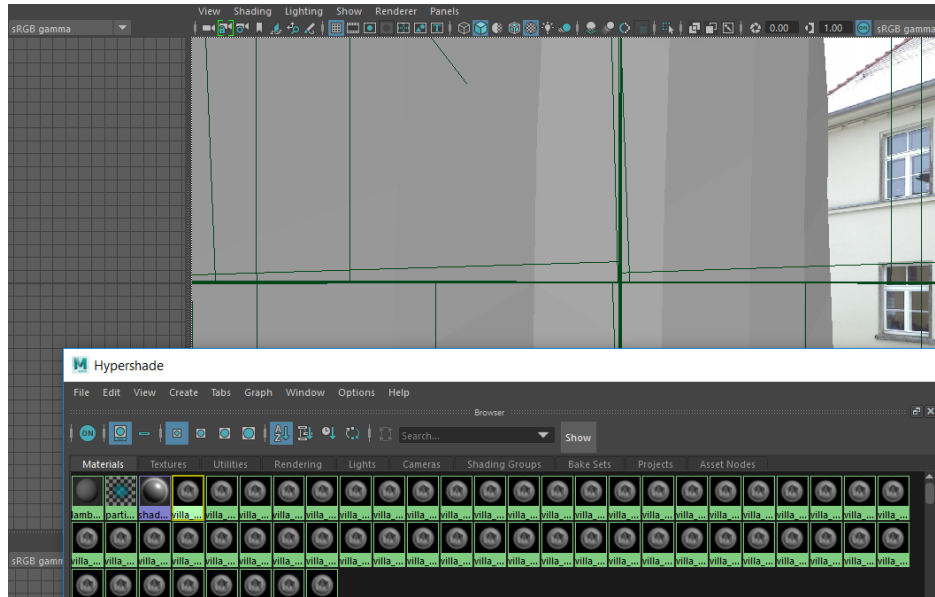
or alternatively right click the model and assign the according material you want to use to the model (-> Assign Existing Material and then the material name).
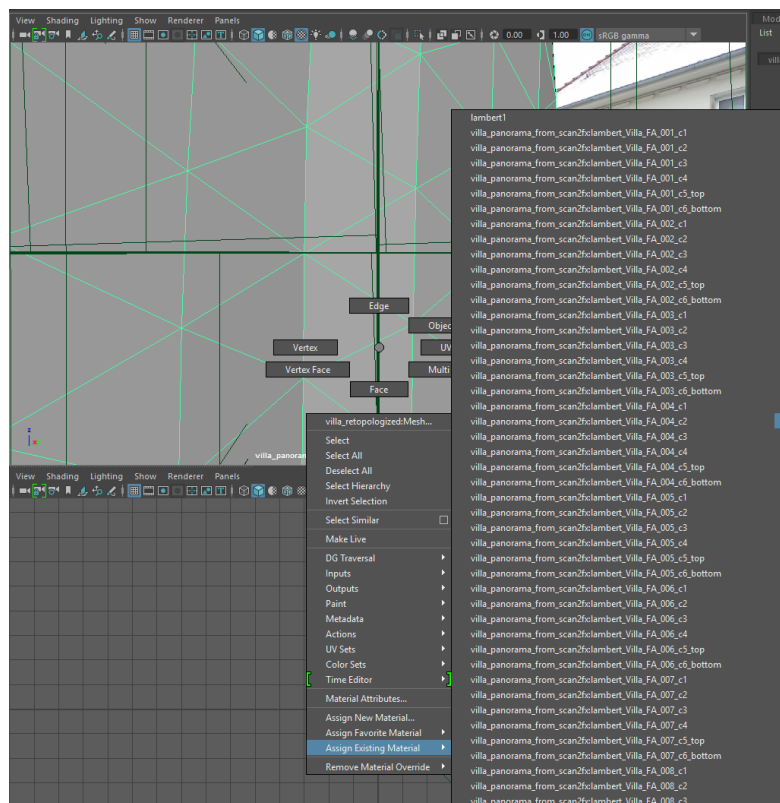
You can see how the nearby area gets well textured with a lot of detail, while further away areas show a stretched or incorrect texture. Note that the default mask fill was set to "Opaque" upon export from SCAN2FX, since otherwise the mesh would appear completely transparent.
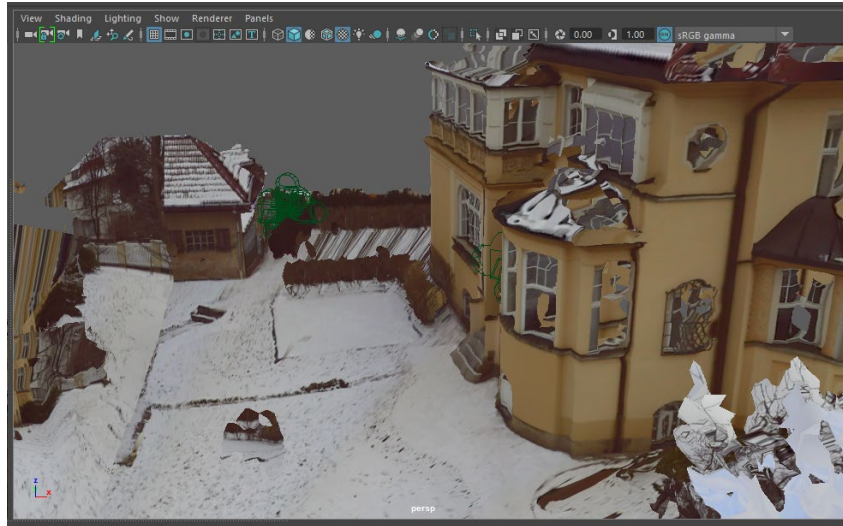
9.4 3D Painting Transparency Channel

We will now determine where exactly this particular projection should apply by softly masking out areas where the projection is not right, i.e. where a different scan/camera needs to get projected.

Select the model and right click "3D Paint." Important: UVs need to have been generated by now – and without overlap!

Important Note: Make sure to **not** assign the same material to more than one object! Otherwise Maya will show the following error when launching the 3D Paint tool ("// Warning: Some surfaces have no file texture assigned to the current attribute. //") and 3D paint will not work.
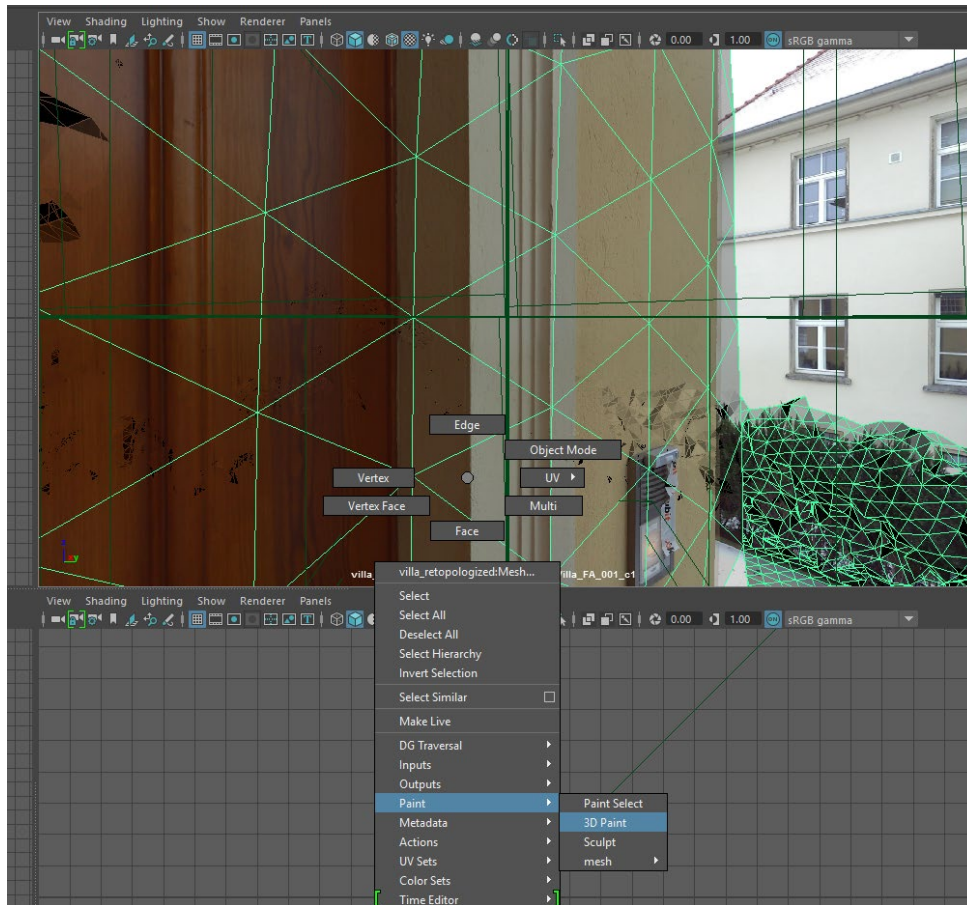
In the 3D Paint dialog box, first select "Transparency" as the Attribute to paint instead of Color (Note: if you created a transparency mask with SCAN2FX Exporter, this should work right away. Otherwise, you will have to manually create an image and configure a File node and 2D texture for transparency on your shader).
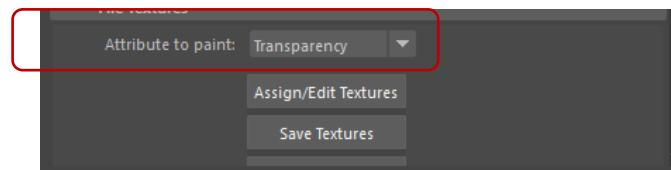

Also make sure to select **"Artisan" to paint onto the texture** under "Paint Operations" instead of "Paint Effects."

Tip: If the object is still selected, you may want to turn "Selection Highlighting" off in your Maya Viewport under the "Show" menu.

Pick white as "Color" and pick an appropriate "Brush Scale", you now can paint in 3D onto your mesh and you'll see the projection disappear where not desired. For your Maya Viewport, make

sure to set lighting to "Flat" (to get the original lighting and colors) and to turn "Hardware Texturing" to On under Shading.
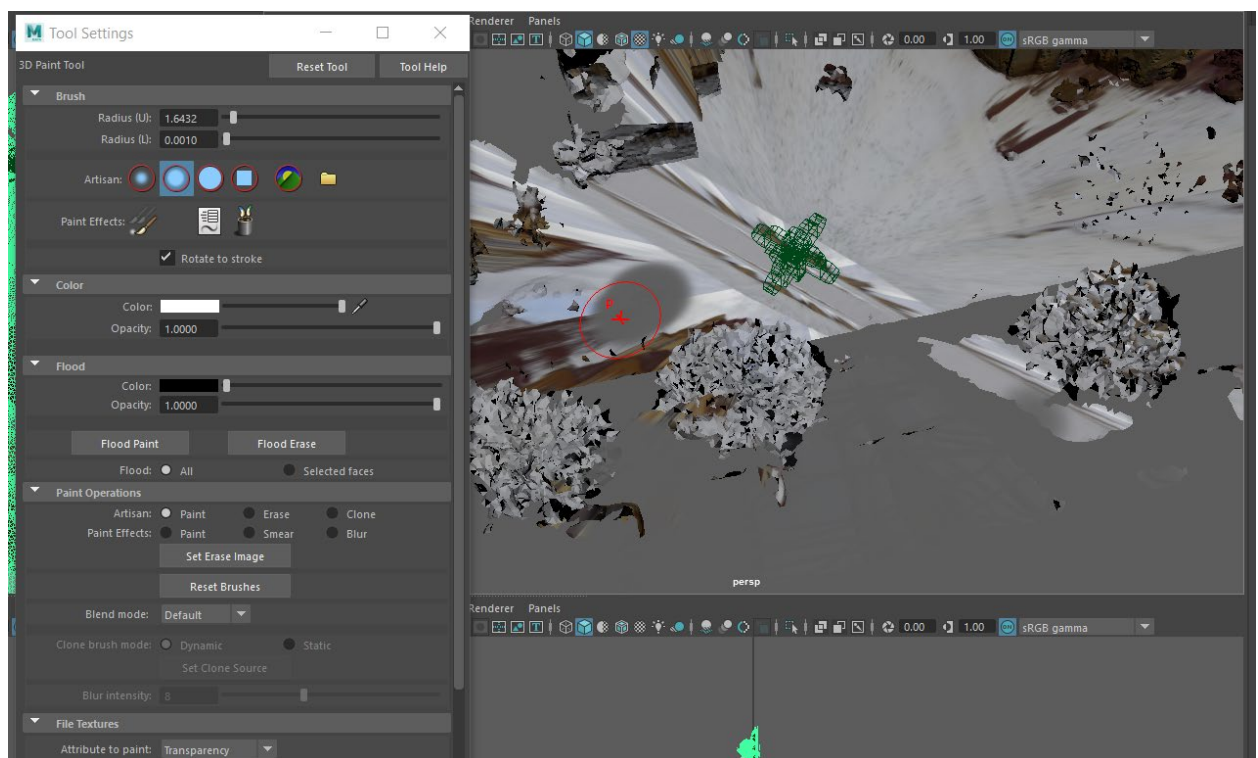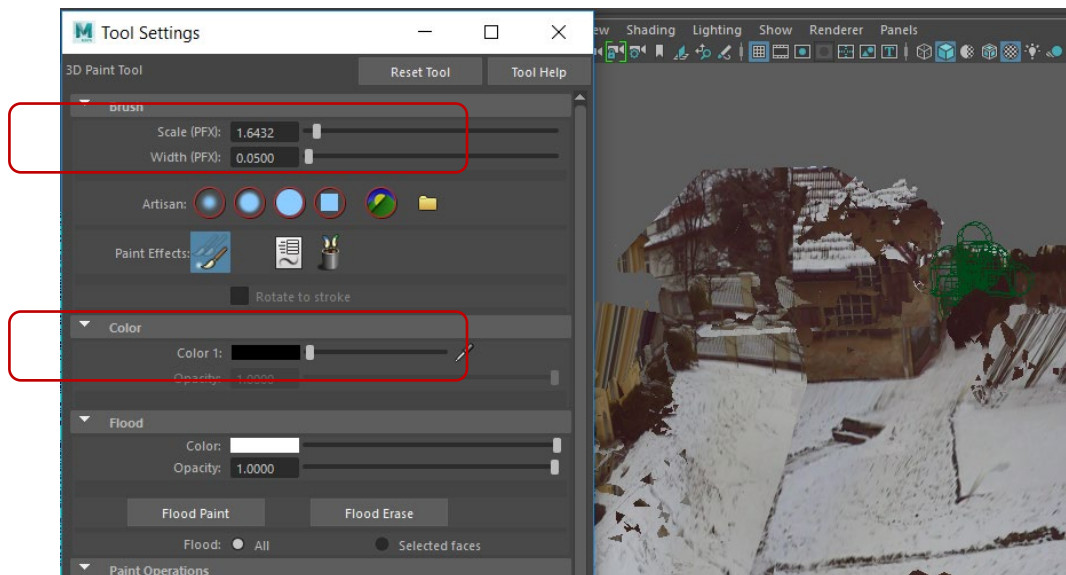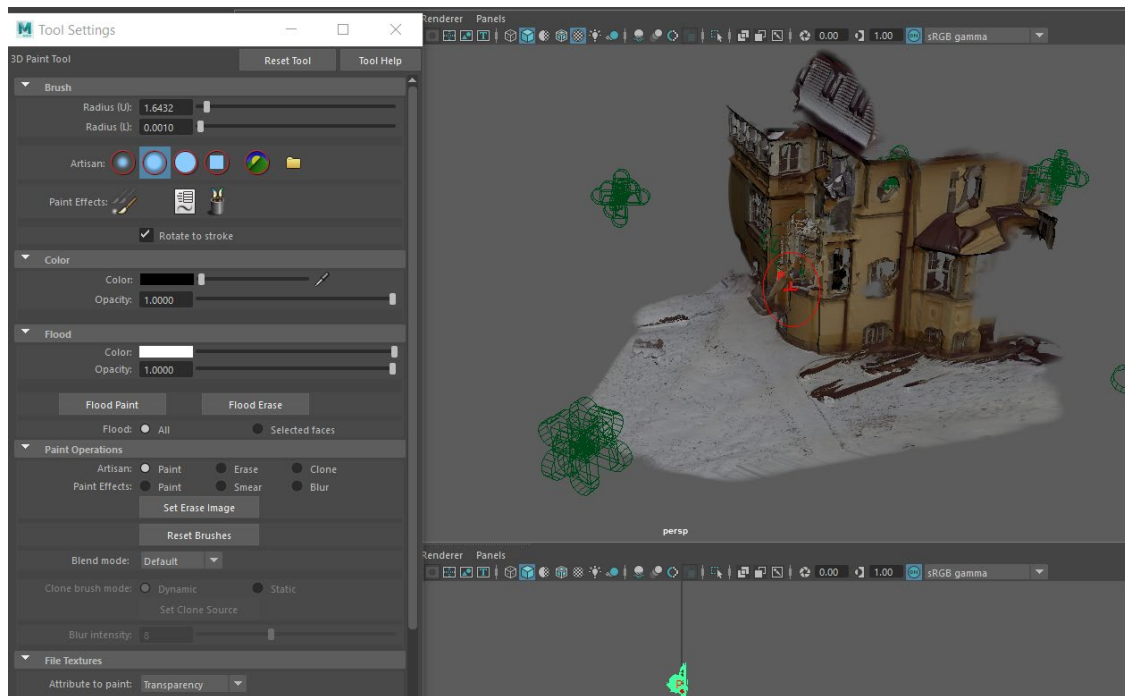

Pick white as color to softly bring back an area of the mesh with the projection texture.

As a reverse approach: If you want to start off with the entire scene not being texture, click Flood Paint with the black color selected.
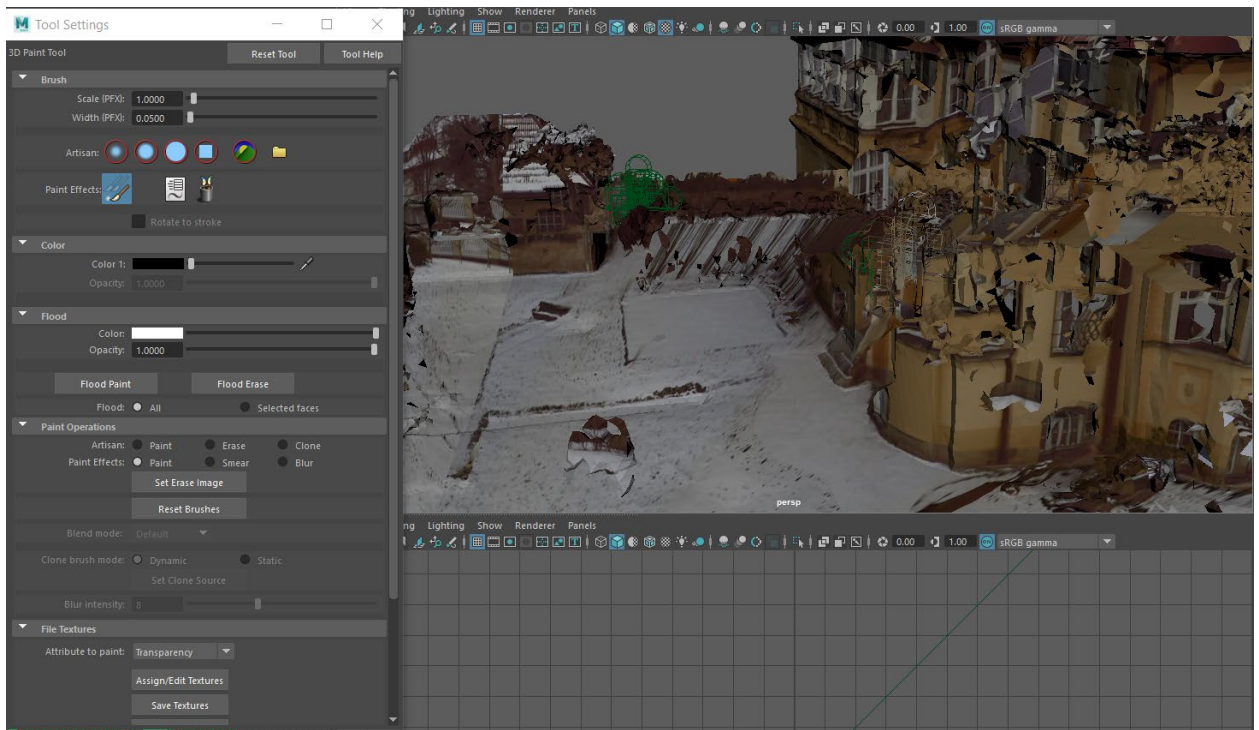
You can now **paint in areas where to apply the texture** (rather to mask out areas where the scan should be occluded / i.e. transparent).

As of now, you have only a single camera-based texture. You can now repeat the process with other cameras you want to utilize to get your overall finished texture.
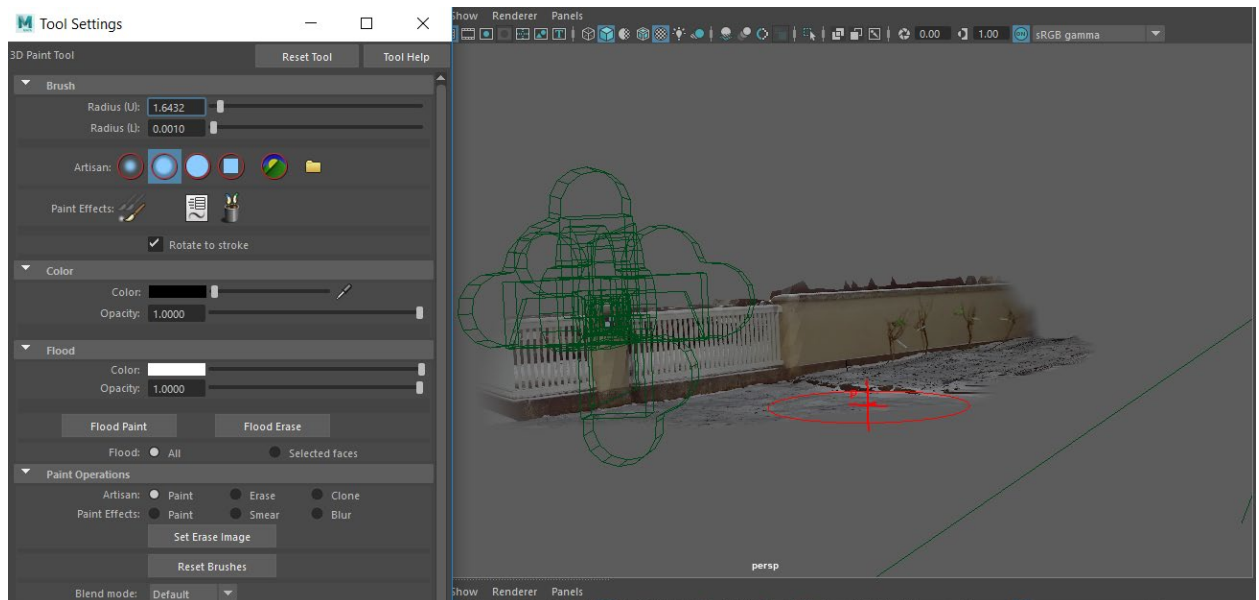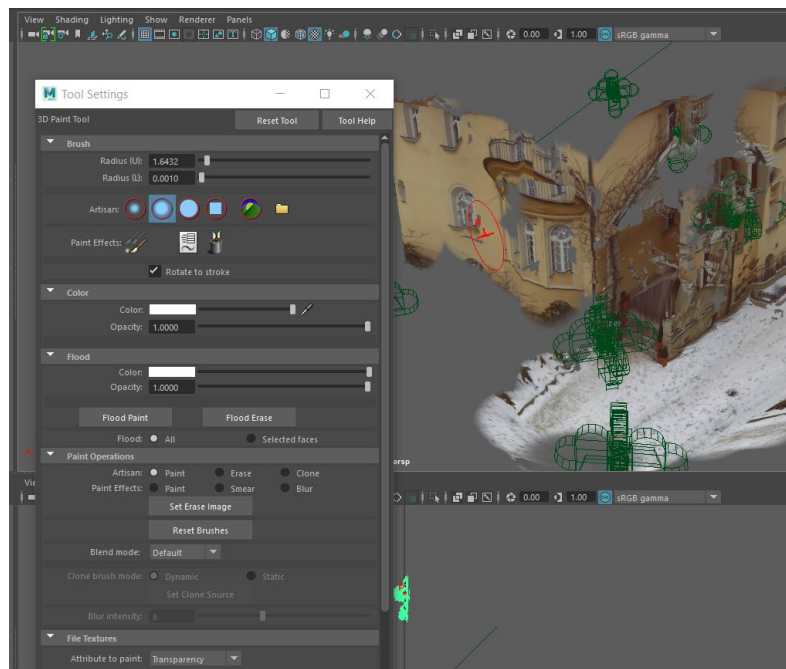
To preview the combined results of multiple textures, assign the MasterLayer from the HyperShade Editor (if it was turned on during export). It may be worthwhile to step through the cameras in the order they are layered, as otherwise for another camera you have not painted, your mask for it may get overwritten by another projection.

10. Tips and best practices for working with the SCAN2FX data within Maya

10.1 Utilizing Camera Image Backplanes

One smart approach can be once you have assigned a shader material (in particular if the mask is transparent), to select that particular camera in the Viewport (make sure to not use the camera by accident). In your Maya Viewport, click "Perspective" in the "Panels" menu and select the correct camera matching the shader material.

You can now paint with already seeing the image from that camera as back drop and paint in the areas where you want the texture to be projected. This can be quite intuitive to quickly achieve a baseline texture.

With default lighting, the image backplane will show brighter (see light snow in the front left for example) and the painted in area dark (see darker snow in the front right in the following example picture).
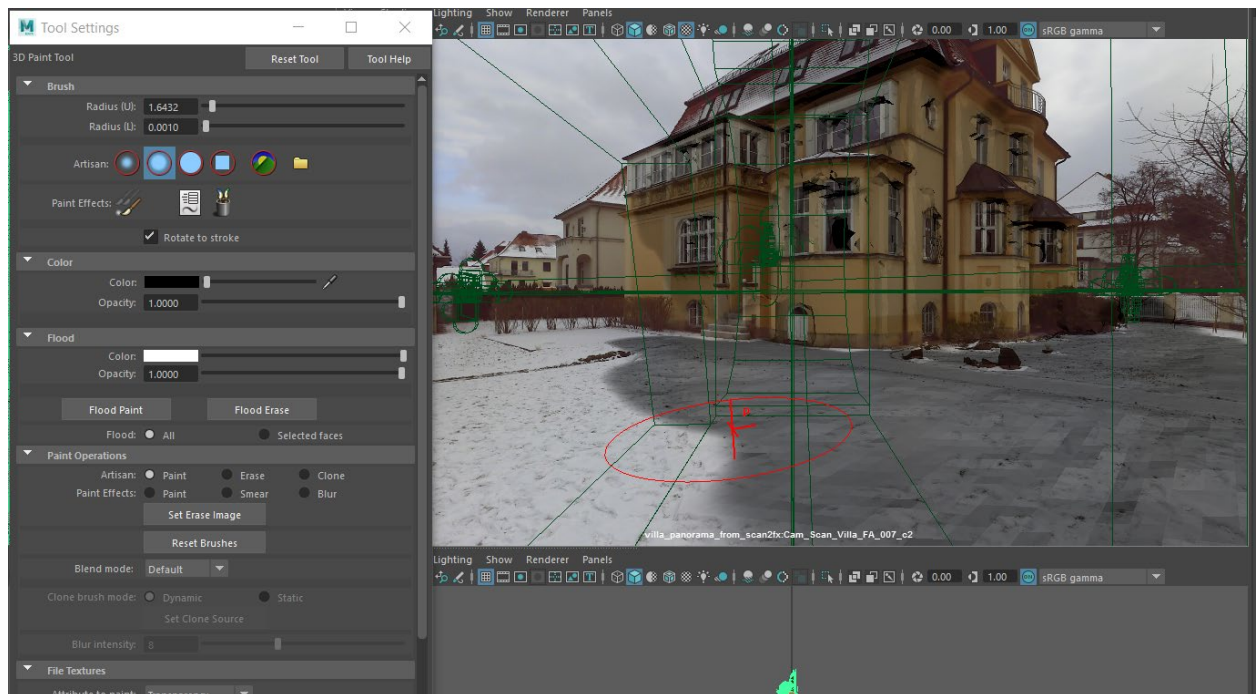
You can now switch back to your perspective camera, and change your perspective to see how the applied texture looks like.
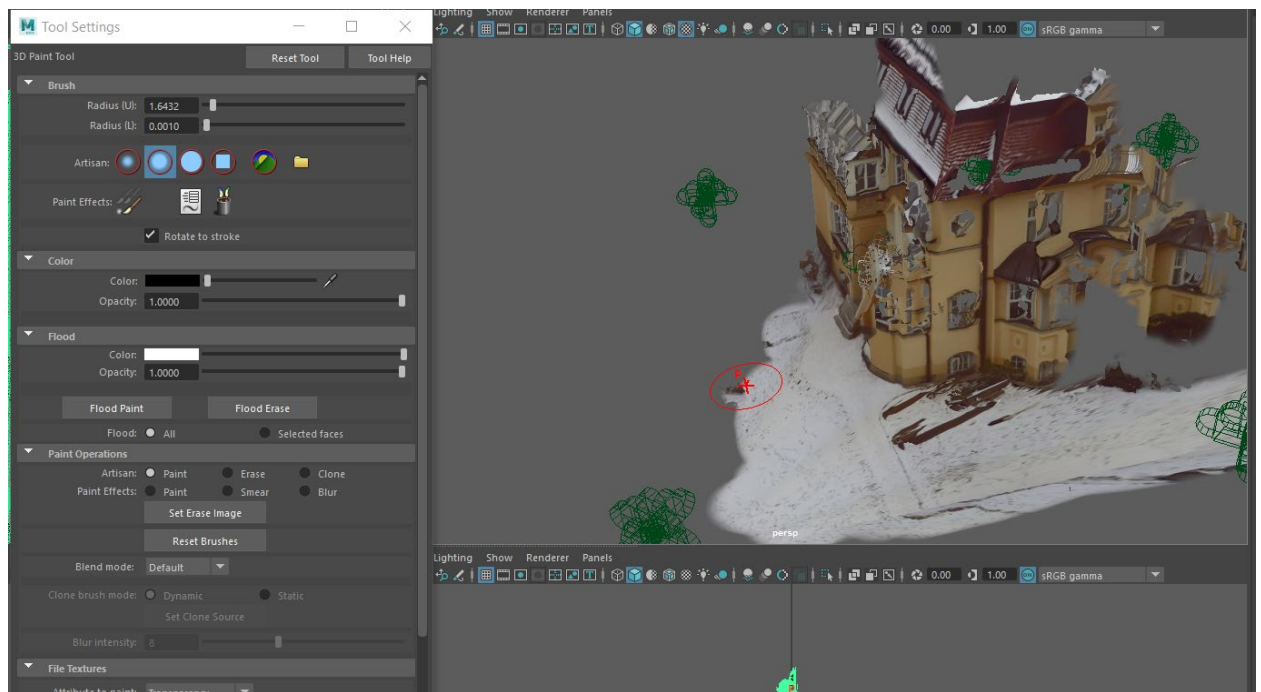
10.2 Working with Master Layered Shader Material for Previews

Sometimes it may be a good idea to reduce the number of shaders to the minimum required (from everything that was exported). Maya may have some limit on the GPU memory to be used, and especially high-resolution textures can become quite large. Alternatively, you can reduce the texture resolution in an external program such as Photoshop and reload the textures. However, that approach will also reduce the visual "fidelity" of your textures.

You can also easily remove layers you do not need in the attributes section of the Master Layer by clicking the "X" under the texture.

Or you can change the order in which texture projections get applied by dragging a projection while pressing the middle mouse button.

You can also clear your layered shader and only add select material shader with the projections that you masked out already.
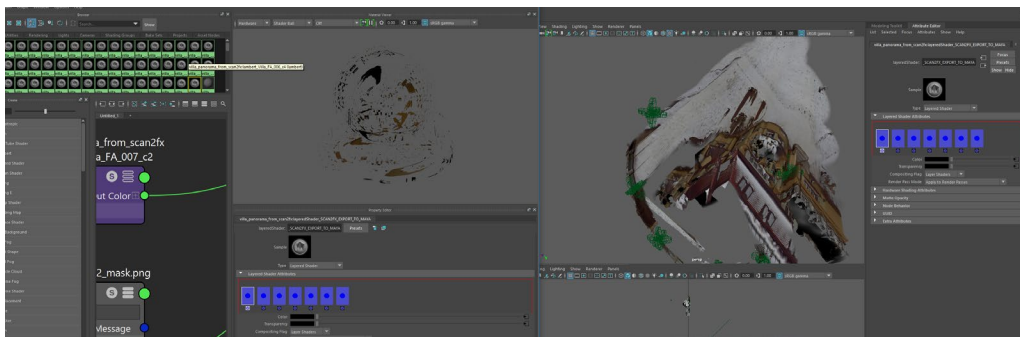
This way you can gradually build up your texture model with full control of where which colors get applied.
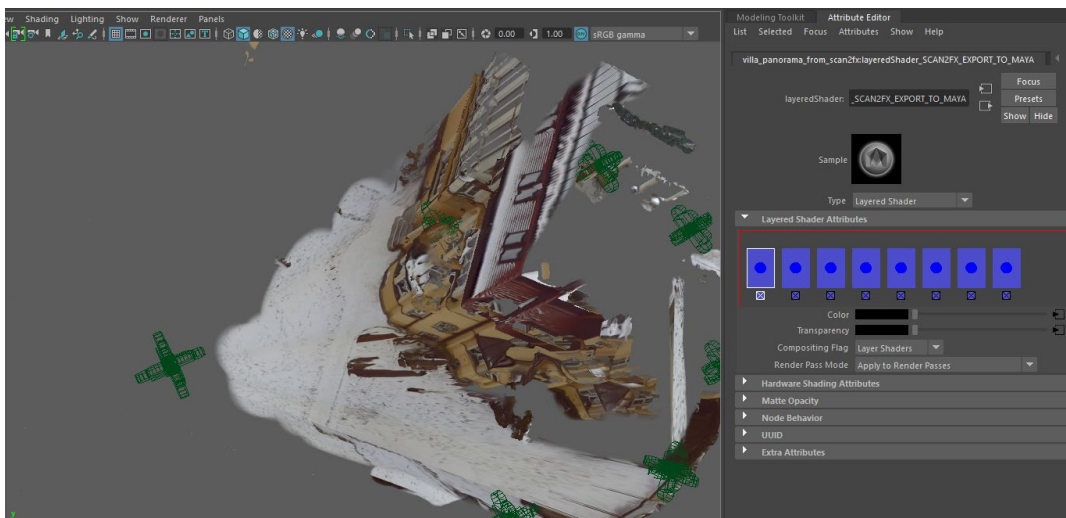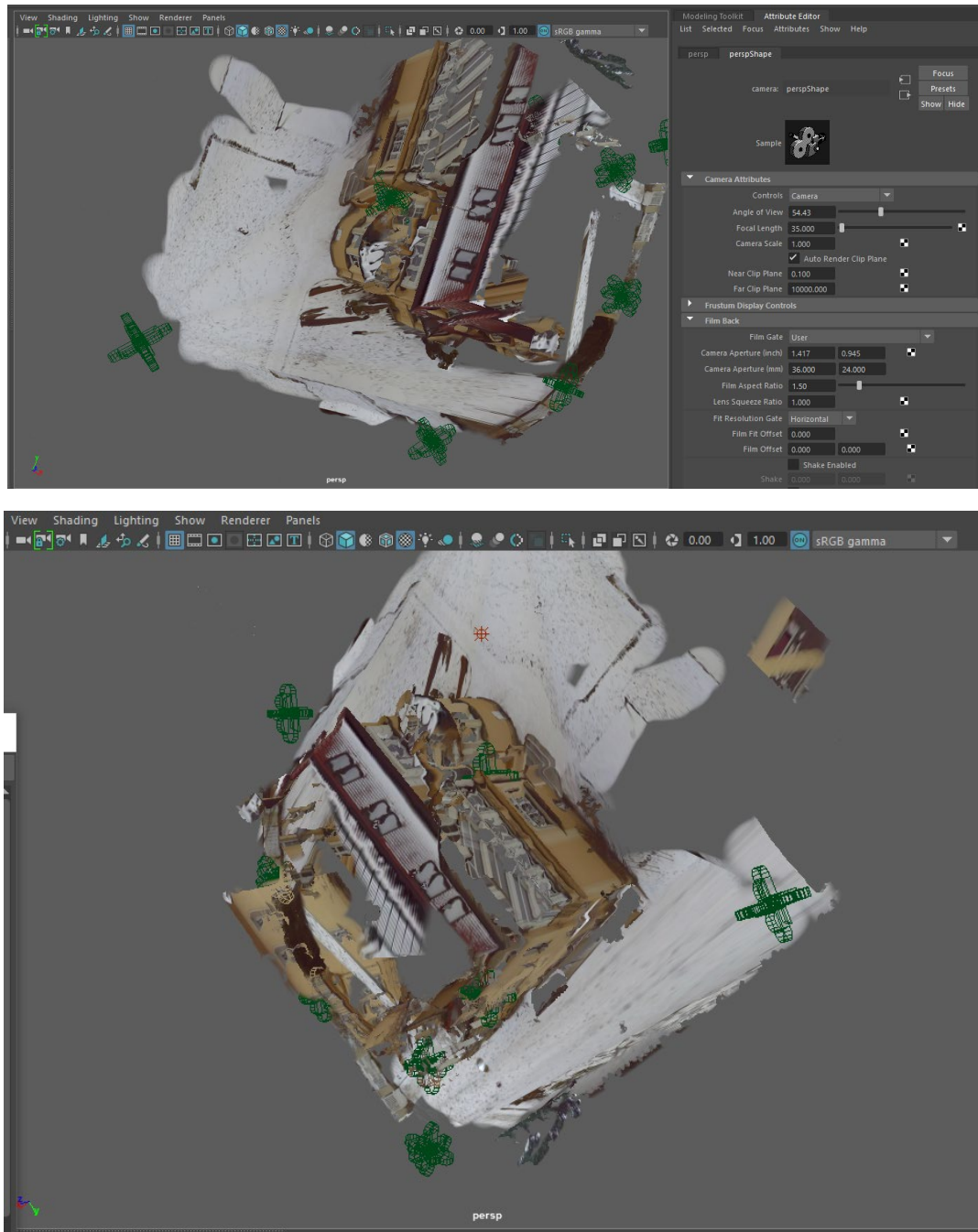
## 10.3 Filling in texture holes and scan bottoms

One tool that may be useful is the Clone Brush in the Maya 3D Paint tool. Often with laser scans, there might be certain areas that were occluded by all scans. However, in your 3D scene as you move the camera around that previously "occluded" area may become visible. For example, there could be a piece of wall with a certain fabric.

Now, instead of painting onto the transparency channel as before when blending different scan projections, you can paint onto the color channel. To do select "Color" as "Attribute to paint" and then click "Assign/Edit Textures." You probably will want to use a higher resolution texture than 4Kx4K, but that is the listed maximum as of now. Click "Assign/Edit Textures" and the projection texture will now get baked into a UV-based color texture with the selected resolution.
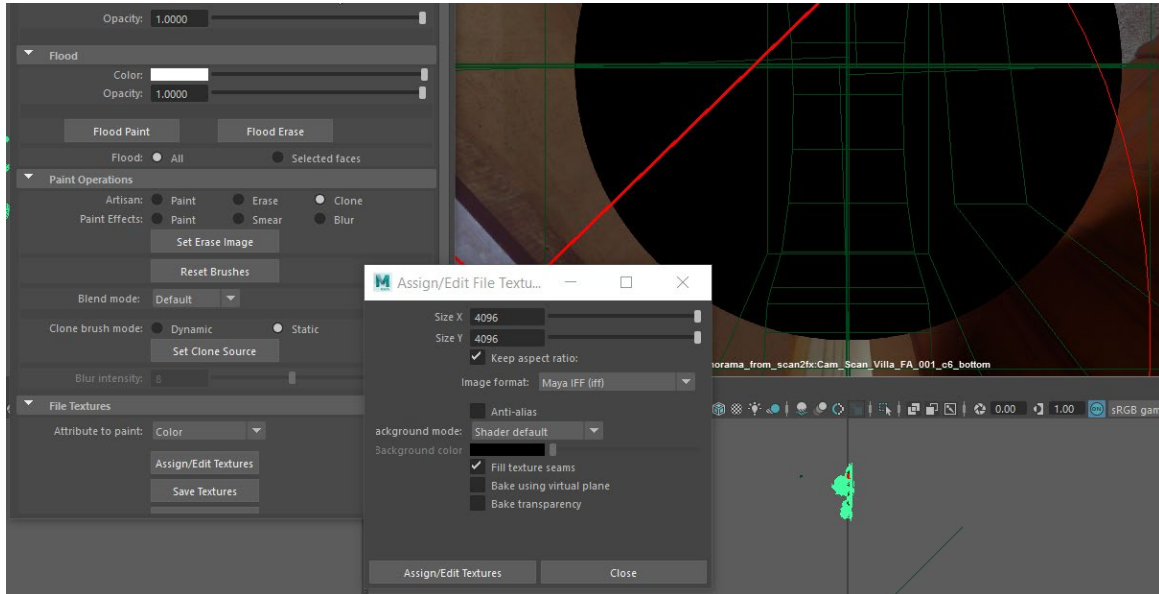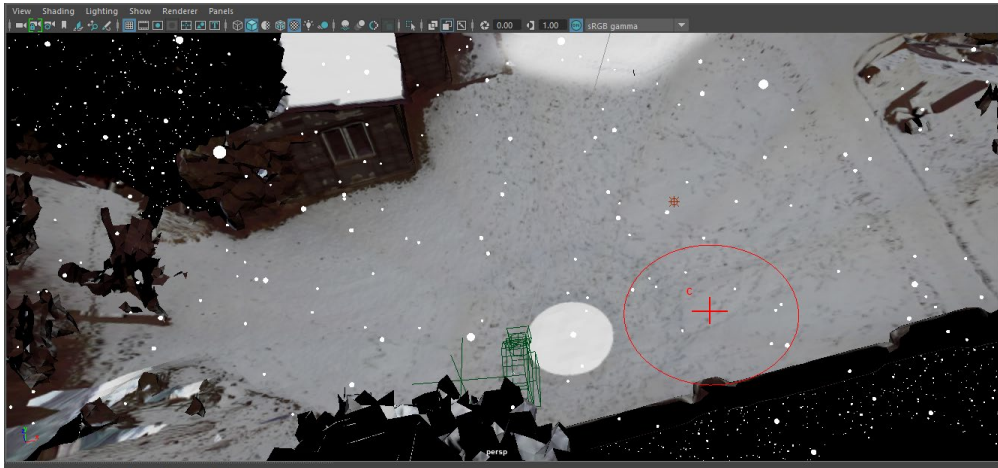

Select the "clone" brush, and click "Set Clone Source." Pick an area to clone on your and click the left mouse button.
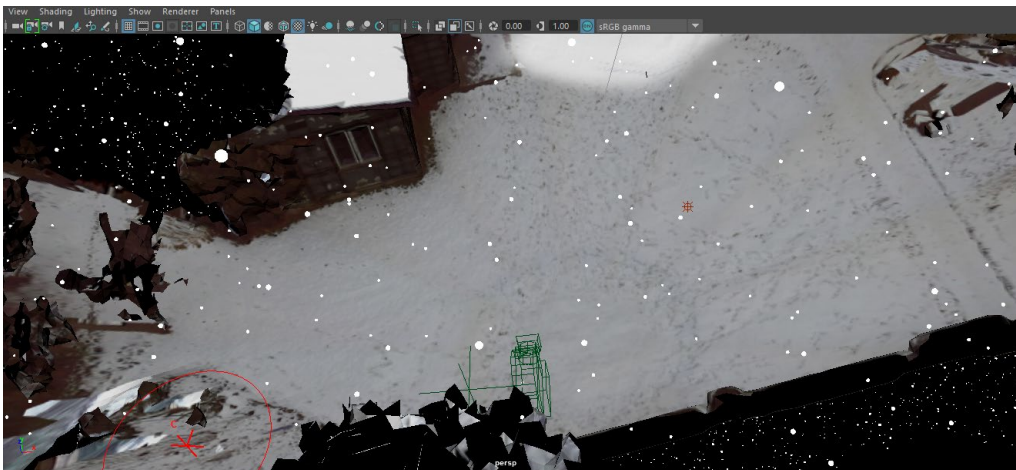
You can now paint in part of the "scan bottom" with the stone pattern.
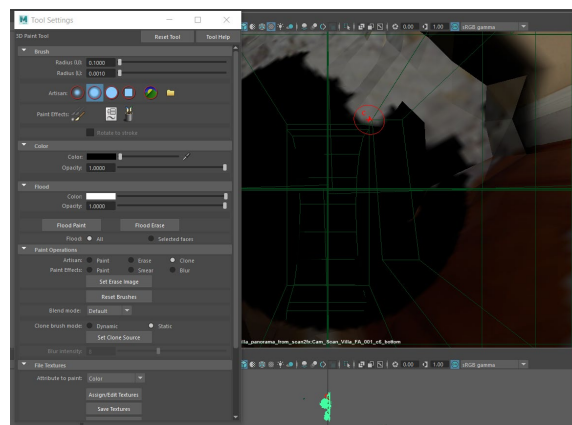
Here is another example:

After painting in the "scan bottom" with the clone brush:

You can also use another scan to fill in the texture.

If you have purchased the SCAN2FX Photo Projector, you can also utilize a Maya camera with one of your DSLR photos to project the photo to fill in holes.

Scans from further away may be blurrier than the original texture from the close by scan and the exposures between may be different. You can carefully blend different colors to make adjustments and obtain the look you would like for you mesh.

10.4 Creating seamless transitions between scans and photos

As mentioned, different scans may have different exposures and lighting. For example, over time, the lighting may have changed and scanning may simply take a while. As a result, an earlier scan may have different coloring and slight variations in lighting compared to a later scan.

However, with the paint toolset you can now precisely apply the photo-realistic color and control where which color goes. In contrast, to automatic texturing, with the SCAN2FX Exporter and Maya you can control where and how the textures get blended.

10.5 Picking the best texture for good detail

As you navigate your 3D scene by moving the perspective camera, you can see where maybe a texture is not right due to either distortion or occlusion, or where the detail is not sufficient (e.g. far away). You can then mask out those areas and find the relevant camera in the top view that points in the direction of where you need to fill in texture detail. This could be a camera from the scan, i.e. scanned panorama, or an additional camera created through SCAN2FX Photo Projector based on additional close-up photos taken during the capture session. You can easily look up the name of the selected camera and note down the scan name and camera number to later assign the according shader material or look through the camera for painting. Note down the name including the camera number.
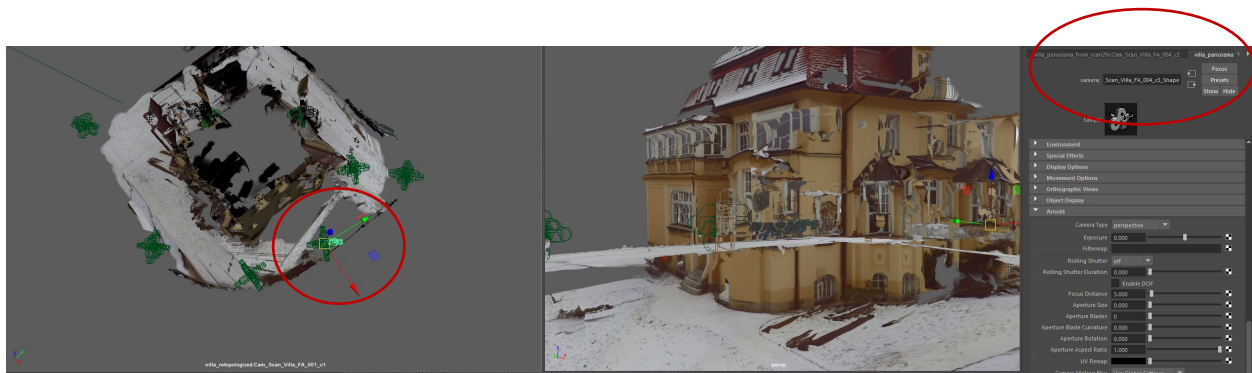
10.6 Making micro adjustments if camera alignment seems to be slightly off

If ever a camera seems to be slightly off in terms of alignment to a mesh (e.g. when further apart), you can make small camera adjustments by selecting the according camera and then moving it slightly until the alignment is as you like. However, be cautious with accidental or unintentional camera movements. You can then 3D paint a mask or texture for that particular area, bake the texture, change the alignment slightly and paint with the different perspective.

11. Creating a simple Mesh based on the SCAN2FX Exporter for Maya Data

Another workflow possible with Maya is to utilize the different perspective cameras created by SCAN2FX Exporter for Maya to create your own, simplified 3D model of a scene.

You can open 1 or more views with different cameras from SCAN2FX (make sure to not move the cameras by accident).

Now you start drawing vertices in one view and moving the vertex in the other views until the line up in all views/cameras. You could also utilize primitive such as a polygon or NURBS cube, curved surfaces, spheres, etc.

SCAN2FX automatically computes all the cameras for you so you can get a very accurate positioning from different perspectives of your 3D scene. This is a standard modelling technique, but with SCAN2FX you will have all the cameras correctly setup already, saving countless hours per scene, greatly accelerating the workflow.

The advantage of this technique is that one can create a very simplified model, with clean topology, and just enough detail where required with minimal polygon count (e.g. for real-time assets, games, or simulations). The textures can then be applied in the same way as described above, resulting in very light weight assets with photo realistic textures. However, this process can be time-consuming and require a high level of artistic and technical talent.

For scanned meshes, retopologization tools are also available. Please contact support@scan2fx.com if interested in additional retopologization tools.

12. Quality Achievable with SCAN2FX

When you import a mesh from SCENE, Maya will not show any colors normally. SCENE only colors the vertices and does not generate textures when creating a mesh. However, Maya 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:
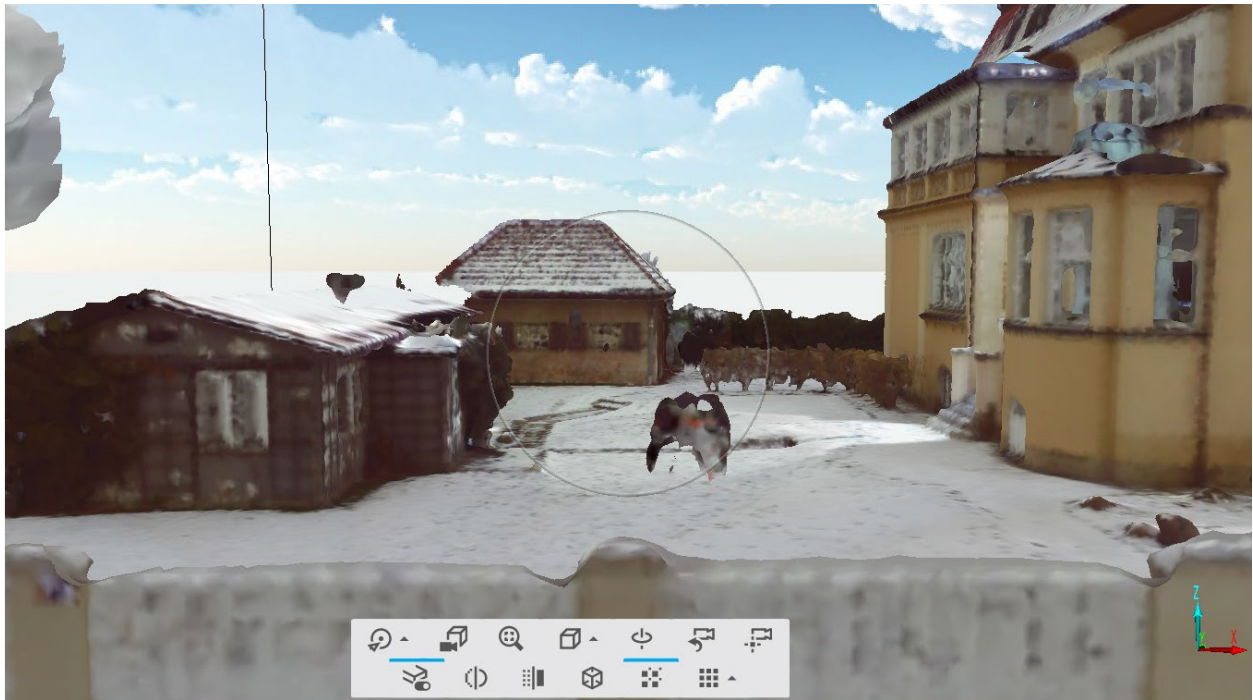
And then here the same mesh with SCAN2FX textures applied in Maya (Viewport 2.0 preview):

Maya's Arnold renderer can add additional effects such as depth of field, and lighting simulations:

The aim with SCAN2FX Exporter for Maya is to enable a high degree of control.

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

13. Re-Lighting, Modifying, and Rendering an exported 3D Scene with Maya

The SCAN2FX workflow opens countless opportunities for FARO® SCENE users to leverage Maya's advanced capabilities with their scanned data to achieve unique visualizations and results.

For example, Maya includes a state-of-the-art renderer called Arnold, but can also hook up to other rendering engines such as V-Ray, Renderman, Octane, or Unreal Engine for real-time visualizations.

This capability opens some exciting opportunities for SCENE users with SCAN2FX. For example, a 3D scene can be re-lit to change the mood or time-of-day.
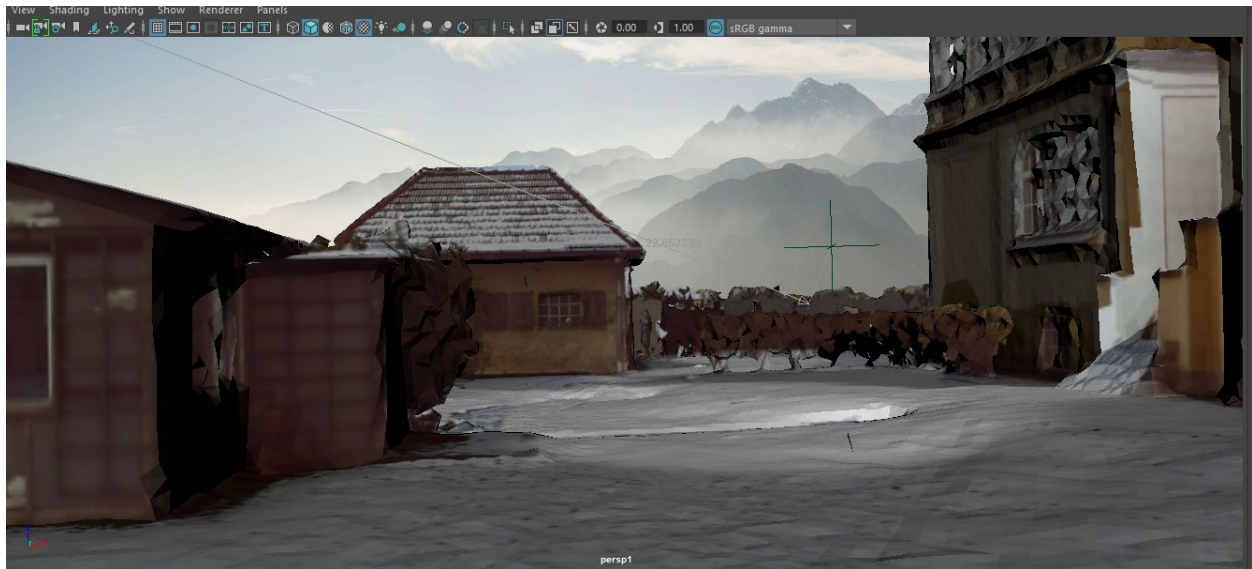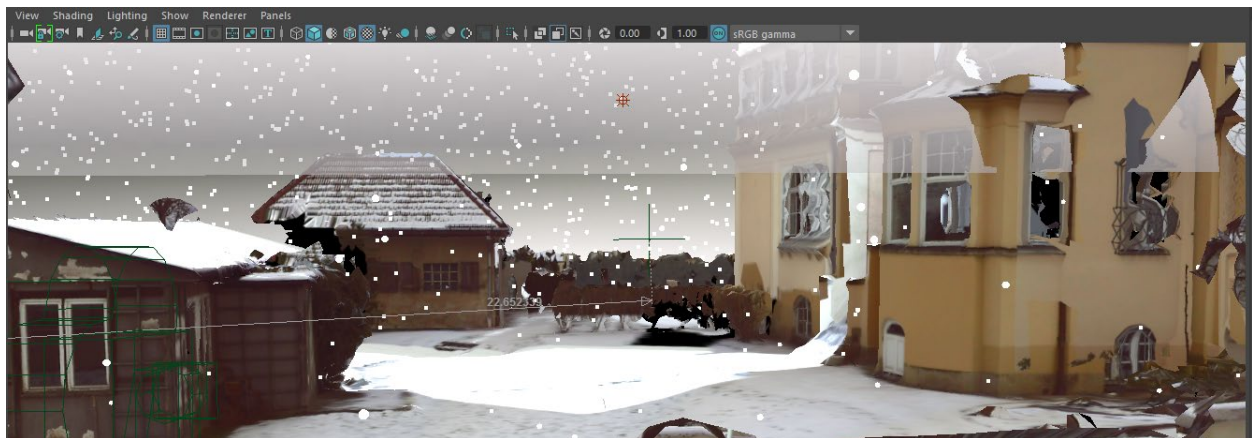
Depth-of-field effects can be added to emulate photo or film camera effects, and achieve more realistic look.

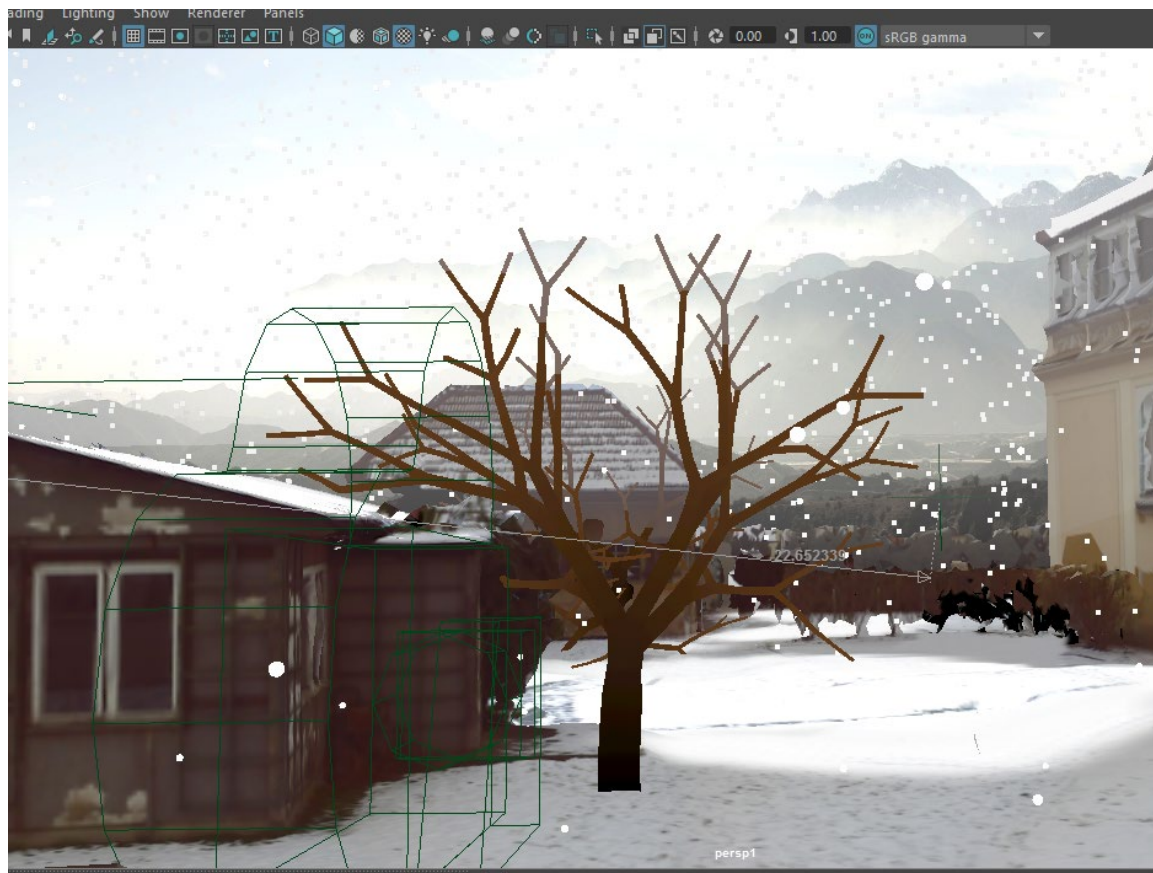Backgrounds can be inserted and easily replaced.

Particle effects can simulate weather effects such as rain, snow, or water.

Vegetation can be added or simulated also with other plug-ins for Maya.

Also, modifications can be made to an existing model for example to extend a set, or modify the environment by combining several scanned physical assets or structures in innovative ways.

Finally, 3D scenes can be fully animated with Maya to create movie clips or interactive content. And visual effects can be added as needed.

14. Known Limitations or Considerations

14.1 FARO® SCENE and Maya Version

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

SCAN2FX Exporter for Maya has been tested with Autodesk Maya 2018 and 2019. 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 from you.

14.2 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.

14.2 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.

14.3 Maya GPU Performance

Layered shaders in Maya where multiple texture get combined may result in Maya running out of GPU memory in the viewport. You may want to reduce the number of layers that get blended if you use several scans. This also may be machine and version dependent. Below is a shader that currently overloads the GPU and shows orange.
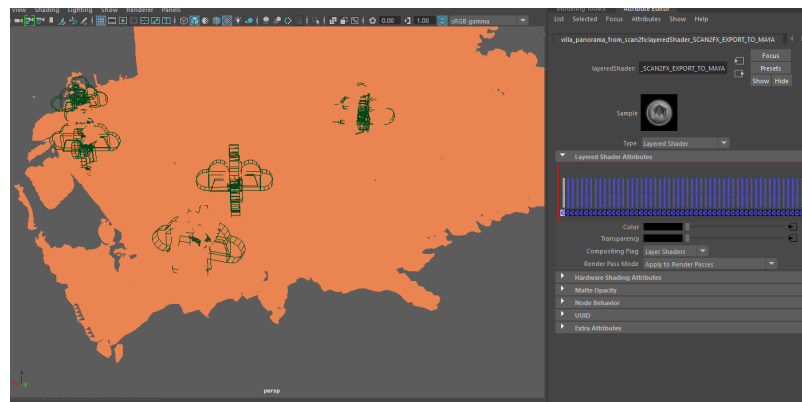
14.4 Alignment of Camera Image Backplanes

If you find that part of the texture does not align perfectly, you can use the camera controls to move the projection camera slightly to adjust and paint in that part of the texture. Depending on the quality of the mesh, there may be minor misalignments.

14.5 Baking of Textures and Border Issues

When trying to bake projections into textures, make sure to use dilation within Maya and provide sufficient border padding. Textures may have border artifacts depending on resolution and spacing of UVs used for padding. Also make sure to have UVs without overlap.

### 14.6 Manual Process vs. Automatic Texturing

SCAN2FX Exporter for Maya 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.

*NEW with Manual 3.5*

14.7 My textures look blurry

Make sure that the texture is not getting automatically down sized after importing.

Starting with Maya 2018, texture clamping seems to be turned on by default in Viewports. In your Viewport, click the square next to Viewport 2.0.
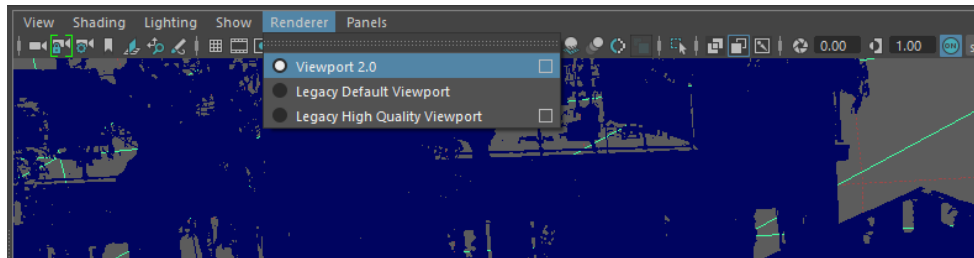
In the following settings pop-up make sure "Clamp Texture Resolution" is turned off. Once turned off, click "Reload All Textures" and close the dialogue.
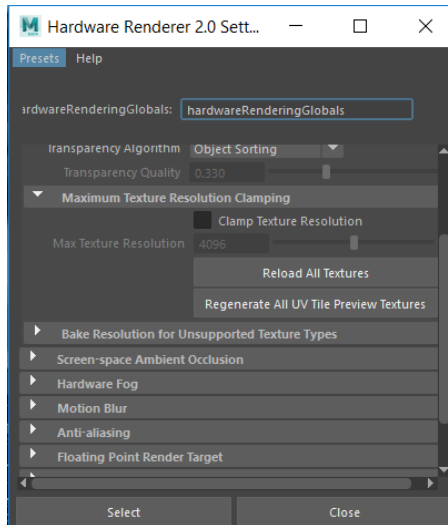
Unfortunately, Maya 2018 does not seem to save this setting as a default and you will need to change this setting again for any new Maya project.

14.8 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.

14.9 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.

14.10 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.

14.11 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.

14.12 Other Issues or Needs

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

15. 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