

Texture

Manual

Version 3.8.0.9 November 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 Texture

SCAN2FX Texture focuses on automatically texturing a mesh. Textures are computed of the scanned panorama images rather than solely the point cloud, allowing you to fill in a texture onto a mesh even where no 3D point cloud data exist. The toolset provides various settings such as considering occlusion or not, as well as the ability to create masks and layers to provide additional control to artists and designers to obtain the look they want.

SCAN2FX Texture is a module of SCAN2FX's application plug-in for FARO[®] SCENE. It is purchased separately or in combination with the other modules. Without any additional SCAN2FX Exporter modules, SCAN2FX Texture will read OBJ with UV layout, and output an OBJ with material and one or more texture images (depending on the settings).

SCAN2FX Texture provides an automated way to create a baseline texture without the need for manual intervention or 3D painting. SCAN2FX Texture can also consider occlusion where e.g. a scanner is occluded by part of the mesh. Texture computations can take a while depending on texture resolutions, but do not require intervention.

SCAN2FX Texture also offers the ability to create masks, including occlusions masks, scan bottom masks, and distance from scanner masks. These masks can assist in tweaking the textures later in a paint application. SCAN2FX Texture can also separately compute the contribution of each scan to the texture to allow further control and modification as required (e.g. for color blending).

SCAN2FX also allows highlighting of occluded areas in a certain color (where no scanner had coverage) to quickly identify areas of the texture that need to be filled in with a 2D or 3D paint application or maybe where additional photos should get applied with SCAN2FX Photo Projector or by importing projections from SCAN2FX Exporter (separate modules).

Finally, SCAN2FX Texture includes the ability to adjust scans color balance to one of your scans so the images fit better together.

SCAN2FX Texture provides a way to obtain a great baseline texture automatically that can then be further tweaked for a final visualization or asset.



1.3 Enhancements to other SCAN2FX Modules with SCAN2FX Texture

SCAN2FX Texture receives some enhancements in combination with certain other SCAN2FX modules:

 In combination with the separately available SCAN2FX Exporter for Maya module, SCAN2FX Texture will enable the option "Texture Mesh to Maya." This option creates a Maya .MA file that loads the resulting mesh straight into Maya, but also generates shader materials for each texture layer (contribution by scan) and mask type generated. A "master" shader material combines the texture layers for a combined preview.

SCAN2FX Exporter for Maya by itself also provides the ability to export cameras, image backplanes, projections, and shaders for 3D projection painting and modeling.

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.

 In combination with the separately available SCAN2FX Exporter for Mari module, SCAN2FX Texture will enable the option "Texture Mesh to Mari." This option creates a Mari .PY file that loads the resulting mesh straight into Mari, but also generates layers for each texture layer (contribution by scan). Additional masks generated can be imported from disk.

SCAN2FX Exporter for Mari by itself also provides the ability to export cameras, image backplanes, projections, and shaders for 3D projection painting and modeling.

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.



1.4 Other SCAN2FX Modules Available

SCAN2FX Mesh Modeler is a great solution to automatically mesh surface with high accuracy, as well as to create fill polygons or simplified mesh geometry.

SCAN2FX Mesh Modeler enables users to create polygons directly on top of the point cloud to fill holes in meshes or to create a simpler representation of part of a 3D scene. SCAN2FX Mesh Modeler also allows extracting shapes of planar surfaces with a range of unique settings.

SCAN2FX Mesh Modeler also allows meshing a region of your point cloud using unique SCAN2FX algorithms to capture hard edges. The meshing toolset allows marking different regions with different settings, and batch meshing them during export.

SCAN2FX Mesh Modeler also has capabilities to extract or place primitives such as boxes, cylinders, spheres or planes, place locators and extract particle systems.

SCAN2FX Mesh Modeler is an ideal companion to SCAN2FX Texture, but SCAN2FX Texture will also function with meshes created with any other software that can output OBJ meshes with UVs in the same coordinate system as the FARO Scene project used.

Another module of interest may be the **SCAN2FX Photo Projector** module. SCAN2FX Photo Projectors allows a user to align photos with the 3D point cloud, and then estimates the 3D camera pose that was used to capture the photo. The photos can later be re-projected onto a mesh with Maya, Mari, Nuke or Flame (requires the according SCAN2FX Exporter) to add additional texture detail or automatically used 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 Photo Projector you get more control over what texture gets applied exactly where and can add additional detail on top of the texture that was automatically computed by SCAN2FX Texture.

In contrast to typical mesh texturing capabilities, SCAN2FX Texture utilizes the full panoramas scanned, empowering users to fill in image data even where no 3D point cloud was captured in an area. Moreover, SCAN2FX Texture provides users with additional outputs and masks to more easily fix up the resulting texture and control where which color gets applied e.g. to blend different exposures or transitions or fill in scan bottoms.

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 and Version History

- 2.1 System Requirements
 - For improved alignment with Faro scans and high-res color option on Faro scans:
 FARO[®] SCENE or Scene LT 2018+ (may work with previous versions, but not tested)
 - Windows 10 (may work with previous versions, but not tested)
 - \circ 3D application with Wavefront OBJ files support that can generate UV layouts
 - Fast GPU with 8GB+ memory
 - 32GB+ RAM (better: 64GB+)



2.2 Version History

Release 3.8

3.8
 Fixes for Colorize Point Cloud – Fix for missing data occasionally; fix for grayscale scan issue; fix if no scan set for color transfer; single scan for panorama-based colorization

Release 3.7

- Point Cloud Colorization utilize Photo Projectors and/or Scans to colorize existing project point clouds (see Texture/Colorize Point Cloud option – see Chapter 13)
- Point Cloud Colorization with Non-Zero Root Transform Warning Point cloud colorization warning and instructions in case of non-zero root transform. There is currently a bug in SCENE in case of a non-zero root transform the colorization will be off.
- Point Cloud Colorization Tips for how to align creates scans with existing point cloud –
 SCENE does not always import the created scans from colorization the correct way, users need to manually set the rotation and position of the imported scan to 0, 0, 0.
- Setting for Automatic Scan Processing new setting to choose if to automatically process newly created scans or not (applicable to Texture/colorize point cloud and Depth Fixer point cloud conversion in Mesh Modeler)

Release 3.6

- Support for non-360 degree scans texturing now supports non-360 degree scans as long as vertically 300 degrees are covered (i.e. maximum vertical coverage 90 to -60).
 Please email <u>support@scan2fx.com</u> if you encounter any issue with non-360 scans.
- **Improved scan bottom filling** improvements to color balancing and scan bottom filling for certain scenarios.

Release 3.5

- **Full High-Res Color Option** new special mode for Faro scans that allows accessing the highest possible resolution image data even when scanning at lower scan resolution.
- Improved Alignment for certain Faro Scans highly improved texture alignment for certain Faro scans.
- **Utilize SCAN2FX Photo Projectors to Texture** new capability to texture with photos or panoramas that were aligned with SCAN2FX Photo Projector.
- Memory warning for texturing with larger of scans enabled if blending / 3D color balancing enabled – will warn when running out of memory and will attempt to finish texturing without blending and 3D color balancing (reduces memory consumption).

Release 3.4

 Mesh UVing from within SCAN2FX Texture – SCAN2FX Texture can now automatically compute a UV map if the input OBJ mesh has no UVs. Also a "Force UV" option always generates a new UV map. UVing from within SCAN2FX requires a Maya installation on the same system.



NEW with Release 3.7

• **Option to create UDIM texture** – achieve full 16K resolution by creating multiple tiled image textures at a lower resolution e.g. for use with game engines.

Release 2.5

- **GPU-accelerated texture computation** significant speed-up for large models (requires significant memory depending on the number of scans to process)
- **3D-based color balancing** better adjust colors between scans and increase sharpness
- New bottom fill algorithms with blending support
- **GPU-accelerated dilation algorithms** must faster dilation
- Smaller PNG image file sizes
- Improved Support for 3rd party scanners through E57 import

Release 2.0

- **3D Studio OBJ format support** import OBJs with UVs from 3D Studio
- General Fixes and Improvements



3. Installation

- 1. Open SCENE or SCENE LT (tested with version 2018 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).

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- 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 Texture module, a valid license key needs to be authenticated. You can purchase the SCAN2FX Texture 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 <u>sales@scan2fx.com</u> 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 Texture

Before your first export with SCAN2FX Texture, it is recommended to briefly review the "Texture Settings."

- 1. Click on **"Settings"** in the SCAN2FX menu.
- 2. Review the "Texture Settings" section on the right side of the dialogue box.

ari Export Settings		Texture Settings
Add Layer Mask for each Projection (3D Paint Alpha for where which Panorama should g	jet projected)	Texture with: Scans Only ~
Make Spherical Projections Paintable by Default		UDIM textures to cover 16Kx16K
Create Environment Sphere as back-drop (e.g. for outdoor scenes)		Occlusion / Do not texture occluded areas
Apply Distance Falloff Start 10.0 End 15.0	Texture Resolution: 16Kx16K V	✓ Fill Scall Bottom Holes by other scalls ✓ Dilate Textures to avoid border artifacts
aya Export Settings		Image-Based Color Transfer from scan:
∠ Create Projection Shader for each Camera Created (Assign to geometry to 3D Paint Alpl	ha of where to apply particular projection)	2D Baced Color Transfer
Create Transparency Texture Image for each Shader (to enable 3D Painting of Alpl Alpha Mask Fill: Opague	ha Mask for Projection)	✓ Distance-Based Blending if multiple scans
Create Master Layerd Shader to Apply All Projection Shaders (Assign to geometry t	to view all Projections based on Alpha)	Generate layer texture for each scan
Shader Type: Lambert ~		Generate masks for missing scan bottoms
		Generate masks to identify occluded areas
eneral Settings		Fill Color for Texture-Less Area: Black \sim
lata to Include in Exports: Scan Panoramas	J	Force new UV Generation
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imail Address (Associated with License): Licensea ICAN2FX License Key: SCAN2F SCAN2FX	X Exporter for Mari X Exporter for Mari	
Authenticate License SCAN2F2	X Exporter for Nuke X Exporter for Flame	SCAN2FX
Buy / Renew License SCAN2E	X Photo Projector	

You will find several key settings here:

NEW with Release 3.5

- "Texture with:"

By default, this setting is set to "Scans Only." *Scans Only* will only consider the panorama scans for texturing.

With the optional **SCAN2FX Photo Projector** module, photo projectors (i.e. photos or panoramas from other cameras) can also be used for texturing. To include such photo projectors during texturing, make sure to choose one of the options that includes Photo Projectors.



Texture Settings				
Texture with:	Scans Only \sim			
Texture Resolu	Scans Only Photo Projectors Only Scans + Photo Projectors			
	Photo Projectors + Fill Scans			
✓ Occlusion / Do not texture occluded areas				
Fill Scan Bottom Holes by other scans				
✓ Dilate Textures to avoid border artifacts				
Image-Based Color Transfer from scan:				
✓ 3D-Based Color Transfer				
✓ Distance-Based Blending if multiple scans				
Generate layer texture for each scan				
Generate masks for missing scan bottoms				
Generate masks to identify occluded areas				
Generate	Generate distance maps			
Fill Color for Te	exture-Less Area: Black 🗸 🗸			
Force new UV Generation				

The *Photo Projectors Only* option will texture the mesh only with the aligned photo projectors. This mode allows to completely replace the surface color with new photos (e.g. daylight photos for a scene that was scanned at night). This mode can also be handy for fast, grayscale scans to add high quality photo imagery e.g. from a DSLR.

The *Scans + Photo Projectors* option will equally utilize scan panoramas and photo projectors. This mode allows to cover additional areas that maybe were not scanned or add additional detail with close-up photos where the scanner was far away or could not reach an area.

The *Photo Projectors + Fill Scans* option will always prefer the photos and then only use scans to fill any gaps on the mesh that were not covered by photos or panoramas aligned with Photo Projector. This will give you the high quality of your photos, but still enable to achieve the best coverage possible of your mesh when creating the texture.

- Texture Resolution

This setting determines the resolution of the texture image that gets generated by SCAN2FX Texture. Texture resolution can be set in standard increments from 512x512 to 16Kx16K. Computations will be significantly faster for smaller resolution, buy you may miss visual detail for larger areas without utilizing the full resolution. You may also want to texture separate meshes for larger scenes to obtain separate image textures for each mesh portion of your scene at the full resolution.



- "UDIM textures to cover 16Kx16K"

This option will generate multiple texture tiles to cover the maximum 16Kx16K texture if the texture resolution is set to less than 16Kx16K. For example, if using 8Kx8K texture resolution, one would obtain 4 texture files in addition to the full 16K texture. This type of texturing enables to retain the full texture resolution e.g. for game engines that may be limited to support only 8K textures. Important: in the game engines such as Unreal

Engine or Unity, multiple materials or textures will need to be manually combined to apply the different textures to the same mesh based on the UV coordinates. (See chapter 11.6 for details).

- "Occlusion / Do not texture occluded areas"

Note that this option will add substantial computation time. With occlusion turned on, SCAN2FX Texture will only texture a particular pixel with image data from scanners that can actually "see" the 3D point. So, if part of the mesh occludes a scanner for the given 3D point, no texture will get added at that point from that scan. With this option turned on, you will receive a more realistic texture as scanners will not project images through walls.

However, for some basic texture exercises where no surfaces occlude the scanner, you may want to turn this option off to greatly accelerate the computation.

- "Fill Scan Bottom Holes by other scans"

With this option, SCAN2FX Texture will attempt to fill a scan bottom hole with another scan even if further away. Without this option, SCAN2FX Texture will keep the scan bottom as is per the panorama image so you may need to paint it in e.g. with a clone brush.

- "Dilate Textures to avoid border artifacts"

This option adds extra borders on your texture around the triangles to reduce visual artifacts on edges and borders. This option can add significant computation time, so you can keep it off to obtain a quicker preview before committing to generate a full quality texture.

- "Image-Based Color Transfer from scan"

With this option, you can pick one of the scans from your SCENE project and SCAN2FX Texture will try to color correct the other scans to more closely match the chosen scan. This feature will not completely eliminate color transitions between scans (e.g. due to exposure or lighting changes). However, in some cases, Image-Based Color Transfer will help get a more consistent look e.g. when scans were taken over a longer period of time when lighting changed. This option will add a bit of computation time.



- "3D-Based Color Transfer"

3D-based color blending will adjust colors locally based on your UV texture structure, to better match up colors between different scans on models. It will also integrate more potential fill from scan bottoms if scan bottom filling is turned on. This feature is new with release 2.5. This option will add computation time if layer generation is turned off.

- "Distance-Based Blending if multiple scans"

This feature will blend multiple scans for pixels where multiple scans can "see" the 3D point. Note that this will also behave differently whether or not occlusion is turned on.

This option will help adjust colors and make scans blend better together in case of harsh shifts in color and transitions. However, this option may also product some blur in transition areas between scans. This option will add computation time if layer generation is turned off.

- "Generate layer texture for each scan"

This option will not only create a full, master texture considering all scans, but also store the potential contribution of each scan to the scene ignoring occlusion. This feature is useful to blend in the contributions of different scans with a paint application onto your master texture for better transitions between scans or to achieve a certain look.

This feature will add more computation time as the number of scans increases.

- "Generate masks for missing scan bottoms"

This option only applies if "Generate layer texture for each scan" is turned on. This option will generate a mask for each scan identifying the scan bottom for that particular scan within the UV / texture space of your mesh. These masks can be handy to paint in scan bottoms without over-painting the main texture by accident.

This feature will add more computation time as the number of scans increases.

- "Generate masks to identify occluded areas"

This option only applies if "Generate layer texture for each scan" and "Occlusion" are turned on. This option will generate a mask for each scan identifying the occluded areas within the UV / texture space that this particular scanner could not see.

This feature will add more computation time as the number of scans increases.

- "Generate distance maps"

This option only applies if "Generate layer texture for each scan" is turned on. This option will generate a map highlighting the distance from the scanner in gray scale. This image mask allows you to identify easily where a scanner is located based on the texture, but also



to blend scans based on distance. For example, the distance values could be used for alpha blending or could also be manipulated with a curve before blending.

This feature will add more computation time as the number of scans increases.

- "Fill Color for Texture-Less Area"

This option will pick the color to use for texture-less areas e.g. an occluded area where no scan provided texture information for your 3D scene. Color options could be e.g. green to make these areas easily visible for future paint work, or e.g. black to hide these areas a bit more in case no further paint work should take place.

- "Force new UV Generation"

This setting will force the generation of a new UV map even if the source OBJ mesh already had a UV map assigned to it. This option is not recommended as it may not make sense to recompute a new UV map each time if your mesh already has a UV map. Generating UV maps requires Maya to be installed on the same system and may take a significant amount of time for a large mesh (See chapter 7 for additional details).

- "High res color independent of resolution" und General Settings

Under General Settings, there is an additional option to utilize full color resolution images from Faro scans when texturing even when the scan resolution was lower. This capability requires SCENE 7.2 or higher and only works with native FLS scans from FARO scanners. Also note that the data I/O will take substantially more time, and the system needs to be equipped with sufficient RAM and a powerful GPU to process the very high-resolution imagery. If you run into an issue during texturing, try to turn off the "High res color" option. You may still achieve an acceptable result without it.

- 3. Once you are satisfied with your settings, click **"Save Settings"** and the dialogue will close. SCAN2FX Texture will use these settings for all texturing until you change the settings again.
- 4. Now, to texture a mesh click "Texture Mesh to OBJ" in the SCAN2FX menu.



NEW with Release 3.4

NEW with Release 3.5

Important Note: Your OBJ will require a UV layout (see chapter 7) and needs to consist only of triangles. You can use a 3rd party 3D application to generate UV layouts for your OBJs, and to triangulate your mesh in case not all faces are triangles.

If you purchased **SCAN2FX Exporter for Mari**, you will also have the option "Texture Mesh to Mari." Likewise, if you purchased **SCAN2FX Exporter for Maya**, you will also have the option "Texture Mesh to Maya."



- 5. Select a OBJ file with UV layout and click "Open."
- 6. Select a path and **enter an output filename for your Wavefront OBJ export file** (Maya .MA with Texture to Maya, and Mari .PY with Texture Mesh to Mari).

Note: It is recommended to ensure that there is sufficient disk space before this step. SCAN2FX Texture will require large amounts of storage for the computation on the target drive likely in the 10s of Gigabytes range in case of a small – medium number of scans.



It is also recommended to use a separate, clear directory for each export. SCAN2FX Texture does not just generate the main output file, but also various other image files and possibly mask image files, 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 full vertical height scans. If you imported FLS FARO® scans, SCAN2FX will provide a warning if a certain scan is not a full dome (360x300 scan) given that may result in some issues. Scans not covering 300 degrees vertically (i.e. 90 to -60 degrees vertically) will block processing. With imported scans from different formats (E57, XYZ, etc.), 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.

7. SCAN2FX Texture is now computing the textures for you.

You will see a progress bar trying to approximate the estimated progress. This operation can take a significant amount of time depending on the settings (especially if occlusion and/or layers are turned on). The computation is multi-threaded and will take advantage of multicore or multi-CPU machines. Your computer may not be very responsive during at least a large portion of the computation.

Computing Texture Cancel	SCAN2FX Exporting	×
Cancel	Computing Texture	
		Cancel

8. Once finished, SCAN2FX Texture will message you that it successfully finished its computation.

You are now **ready to import your Wavefront .OBJ** into your 3D application of choice for further processing if needed. (*Maya .MA with Texture to Maya, and Mari .PY with Texture Mesh to Mari)*.



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 OBJ 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 before assigning a UV layout (e.g. with Maya).

It is critical to add a UV layout to the OBJ file before texturing the OBJ with SCAN2FX.



Important Note: SCAN2FX Texture requires an OBJ mesh with UV layout. Remember to create a UV layout or have SCAN2FX create a UV layout for you (requires Maya to be installed on the system). Various applications exist for generating UV layout, and chapter 7 provides an example.

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. Note that you will need to add a UV layout after exporting your OBJ from SCENE before texturing it with SCAN2FX Texture. Standard SCENE meshing will work better with organic or blobby shapes vs. manmade structures.

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.

One thing to consider is to include most of the 3D scene in your mesh in case certain scans that were occluded would no longer be occluded by your new, partial mesh. In some cases, for accurate textures with occlusion, you need to make sure that the occluded areas are actually included in your mesh. Otherwise, there may be unwanted side effects with your texture.

As a next step when working with SCENE's meshing capability, it is critical to add a UV layout to the OBJ file before texturing the OBJ with SCAN2FX.

Important Note: SCAN2FX Texture requires a OBJ with UV layout. Remember to create a UV layout prior to trying to SCAN2FX texture a OBJ mesh generated with SCENE. Various applications exist for generating UV layout, and chapter 7 provides an example.



6.3 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 also use the projected cameras from the optional SCAN2FX Exporter for Maya module 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. SCAN2FX Exporter for Maya module is a separate purchase.

Important Note: SCAN2FX Texture requires triangles. If you used for example quads for modeling, please make sure to triangulate them first in your 3D modeling application before exporting them as an OBJ mesh for use in SCAN2FX Texture.



7. Creating a UV Layout and Exporting an OBJ with UVs for use in SCAN2FX Texture

To texture your mesh, SCAN2FX Texture requires an OBJ mesh with a proper UV layout defined. The UV layout needs to be non-overlapping for the texture to get properly generated. SCENE does not generate any UVs for meshes so this may be an important step if you intend to use the mesh from SCENE.

The UV coordinates are needed so that SCAN2FX knows which part of a texture is supposed to color which triangle, but also give you control over how a texture should get laid out.

There are many 3D applications that allow you to edit or even automatically create UV layouts (Blender, Maya, Modo, 3D Studio Max, Houdini, etc.)



If Maya is installed on the same machine as SCAN2FX Texture, SCAN2FX Texture can automatically generate a UV mapping for your mesh. If a mesh does not include a UV layout yet, SCAN2FX Texture will ask if you like to create a UV map automatically.

UV Generation	on				×
Your OBJ me	esh has no UVs ass	igned.			
Would you li	ke SCAN2FX to cre	eate an automa	tic UV layout for	you?	
Note: This or Warning: Co	peration requires A mputing UVs on co	utodesk Maya omplex models	to be installed or may take a long	n your sy time witł	stem. nout the
progress bar	moving.				
				_	
			Yes		No

Click "Yes" to proceed. Clicking "No" will cancel the texturing process. If Maya is found, SCAN2FX Texture will open a terminal window and compute the UV map. Please ignore any messages in the terminal popup and wait until the UV map computation is completed. For complex models, this can take a significant amount of time.



Important Note: Please note that you will need to make sure your Maya binary folder is configured in the system path for SCAN2FX to find Maya and to compute the UV layout.

To alter the system path, go to Windows settings and then look for the setting to Edit the system environment variables:

Stor
Local
5
-

In the following, System Properties dialogue, click the "Environment Variables" button.

	System Properties	×			
	Computer Name Hardware Advanced System Protection Remote				
	You must be logged on as an Administrator to make most of these changes.				
	Performance				
	Visual effects, processor scheduling, memory usage and virtual memory				
	Settings				
	User Profiles				
	Desktop settings related to your sign-in				
	Settings				
	Start-up and Recovery				
	System start-up, system failure and debugging information				
	Settings				
	Environment Variables.				
	OK Cancel App	ly			
In the next dialogue ("Enviro	nment Variables"), identify "Path" under the	e lower "System variables"			
section and click "Edit" Ma	ke sure to add the correct Maya binary folde	r for your version of Maya			
Environment Variables	×				
User Edit environment variable					
Va					
IU C:\Program Files\Autodesk\Maya2018\b	n New				
Then click OK twice to close	the dialogues Now restart SCENE and try te	exturing again			



NEW with Release 3.4

If you want to force SCAN2FX Texture to create a new UV map even if a UV map already exists, check the **"Force new UV generations"** in the Texture Settings. However, note that creating a new UV layout may take a long time and may be unnecessary if a good UV layout already exists in your OBJ mesh file.

Texture Settings				
Texture with:	Scans	Only		\sim
Texture Resolut	tion:	16Kx16K		\sim
UDIM textures to cover 16Kx16K				
✓ Occlusion / Do not texture occluded areas				
✓ Fill Scan Bottom Holes by other scans				
Dilate Textures to avoid border artifacts				
Image-Based Color Transfer from scan:				
				\sim
✓ 3D-Based Color Transfer				
✓ Distance-Based Blending if multiple scans				
Generate layer texture for each scan				
Generate masks for missing scan bottoms				
Generate masks to identify occluded areas			areas	
✓ Generate	distanc	e maps		
Fill Color for Te	exture-l	ess Area:	Black	\sim
Force new UV Generation				



Alternatively, you can also manually create a UV layout with many 3D software applications.

Here is a brief example of how to create a UV layout with Maya.

- 1. Import your OBJ into Maya.
- 2. Select the mesh.
- 3. Open the UV Edit by clicking "UV Editor" in the UV menu in Maya. The Maya UV Editor pops up.
- 4. Click "Automatic" in the Create menu of the UV Editor.



If needed, you 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 you 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.

5. Once the UV layout generation is finished, export the selection as OBJ mesh for use with SCAN2FX Texture.

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 object first, and then apply the projection.



You could also **retopologize** the mesh, to simplify the topology and reduce the triangle count. For example, you can have less triangles in planar areas.

With release 2.5, SCAN2FX will be able to process much larger meshes much faster due to GPU acceleration, allowing to apply textures to meshes without retopologization as well.

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

In Blender, "Smart UV Project" can generate automatic UV layouts.

Note that the quality of the UV layout will make a difference on how well colors blending togethers with "3D Color Transfer" turned on, and makes a big difference overall on how much texture resolution gets allocated to which part of the mesh.



8. Data generated by SCAN2FX Texture

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



We are texturing a UV-ed mesh that we reduced to roughly 233K triangles.

A UV layout has also been generated (here already visible with a texture).





SCAN2FX Texture will generate a range of files for you, depending on which options are selected:

scan2fx_text_villa.mtl	scan2fx_text_villa_texture_layer_4_mask_distance_from_scan.png_dilated.png
scan2fx_text_villa.obj	scan2fx_text_villa_texture_layer_4_mask_obstruction.png
scan2fx_text_villa_texture.png	scan2fx_text_villa_texture_layer_5.png
scan2fx_text_villa_texture_alpha.png	scan2fx_text_villa_texture_layer_5_dilated.png
scan2fx_text_villa_texture_dilated.png	scan2fx_text_villa_texture_layer_5_dilated_alpha.png
scan2fx_text_villa_texture_layer_0.png	scan2fx_text_villa_texture_layer_5_mask_bottom.png
scan2fx_text_villa_texture_layer_0_dilated.png	scan2fx_text_villa_texture_layer_5_mask_distance_from_scan.png
scan2fx_text_villa_texture_layer_0_dilated_alpha.png	scan2fx_text_villa_texture_layer_5_mask_distance_from_scan.png_dilated.png
scan2fx_text_villa_texture_layer_0_mask_bottom.png	scan2fx_text_villa_texture_layer_5_mask_obstruction.png
scan2fx_text_villa_texture_layer_0_mask_distance_from_scan.png	scan2fx_text_villa_texture_layer_6.png
scan2fx_text_villa_texture_layer_0_mask_distance_from_scan.png_dilated.png	scan2fx_text_villa_texture_layer_6_dilated.png
scan2fx_text_villa_texture_layer_0_mask_obstruction.png	scan2fx_text_villa_texture_layer_6_dilated_alpha.png
scan2fx_text_villa_texture_layer_1.png	scan2fx_text_villa_texture_layer_6_mask_bottom.png
scan2fx_text_villa_texture_layer_1_dilated.png	scan2fx_text_villa_texture_layer_6_mask_distance_from_scan.png
scan2fx_text_villa_texture_layer_1_dilated_alpha.png	scan2fx_text_villa_texture_layer_6_mask_distance_from_scan.png_dilated.png
scan2fx_text_villa_texture_layer_1_mask_bottom.png	scan2fx_text_villa_texture_layer_6_mask_obstruction.png
scan2fx_text_villa_texture_layer_1_mask_distance_from_scan.png	scan2fx_text_villa_texture_layer_7.png
scan2fx_text_villa_texture_layer_1_mask_distance_from_scan.png_dilated.png	scan2fx_text_villa_texture_layer_7_dilated.png
scan2fx_text_villa_texture_layer_1_mask_obstruction.png	scan2fx_text_villa_texture_layer_7_dilated_alpha.png
scan2fx_text_villa_texture_layer_2.png	scan2fx_text_villa_texture_layer_7_mask_bottom.png
scan2fx_text_villa_texture_layer_2_dilated.png	scan2fx_text_villa_texture_layer_7_mask_distance_from_scan.png
scan2fx_text_villa_texture_layer_2_dilated_alpha.png	scan2fx_text_villa_texture_layer_7_mask_distance_from_scan.png_dilated.png
scan2fx_text_villa_texture_layer_2_mask_bottom.png	scan2fx_text_villa_texture_layer_7_mask_obstruction.png
scan2fx_text_villa_texture_layer_2_mask_distance_from_scan.png	scan2fx_text_villa_texture_layer_8.png
scan2fx_text_villa_texture_layer_2_mask_distance_from_scan.png_dilated.png	scan2fx_text_villa_texture_layer_8_dilated.png
scan2fx_text_villa_texture_layer_2_mask_obstruction.png	scan2fx_text_villa_texture_layer_8_dilated_alpha.png
scan2fx_text_villa_texture_layer_3.png	scan2fx_text_villa_texture_layer_8_mask_bottom.png
scan2fx_text_villa_texture_layer_3_dilated.png	scan2fx_text_villa_texture_layer_8_mask_distance_from_scan.png
scan2fx_text_villa_texture_layer_3_dilated_alpha.png	scan2fx_text_villa_texture_layer_8_mask_distance_from_scan.png_dilated.png
scan2fx_text_villa_texture_layer_3_mask_bottom.png	scan2fx_text_villa_texture_layer_8_mask_obstruction.png
scan2fx_text_villa_texture_layer_3_mask_distance_from_scan.png	

The data generated by SCAN2FX Texture, depending on the settings, includes the following:

8.1 **OBJ Mesh with Material defined**

scan2fx_text_villa_texture_layer_3_mask_distance_from_scan.png_dilated.png

scan2fx_text_villa_texture_layer_3_mask_obstruction.png

scan2fx_text_villa_texture_layer_4.png
 scan2fx_text_villa_texture_layer_4_dilated.png
 scan2fx_text_villa_texture_layer_4_dilated_alpha.png
 scan2fx_text_villa_texture_layer_4_mask_bottom.png
 scan2fx_text_villa_texture_layer_4_mask_distance_from_scan.png

SCAN2FX will save an OBJ mesh file, but with a material added to identify the texture. Note that the OBJ will not carry over normals from the original OBJ for storage efficiency.

8.2 Waverfront MTL file

The MTL file defines the texture to be applied. SCAN2FX applies the texture to both the main color channel and the ambient channel. When 3D painting, you may want to remove the ambient color channel. Otherwise, you will always see part of the original texture shine through.



8.3 Master Texture Image

The file matches the name of your OBJ file, but ends in _texture.PNG. This file will not contain dilation (if dilation option is selected).

Occluded areas will get highlighted in the selected occlusion highlight color (green in this example):



8.4 Master Texture Image Alpha Mask

The file matches the name of your OBJ file, but ends in _texture_alpha.PNG. This file will not contain dilation (if dilation option is selected).

The mask highlights all areas that were textured (i.e. not occluded) without dilation. It can be used e.g. if you want to create your own edge padding with a photo editing application.





8.5 Master Texture Image with Dilation

The file matches the name of your OBJ file, but ends in _texture_dilated.PNG. This file contains dilation / extra edge padding around the texture islands. The file only gets generated if dilation was turned on in the SCAN2FX Settings.

Dilation is important to not get visible artifacts on the edges of triangles where different colors may meet.

In this example, you see the occluded areas highlighted in green:



To better understand the difference between the dilated texture and the non-dilated texture, please see here an image comparison. You can see how on the edges additional padding gets added:





The remaining files will only get generated if "Generate layer texture per scan" is turned on. Other settings may also be required to be turned on to obtain a certain file. Each file would get generated for each scan.

For each scan (depending on the settings):

8.6 Texture Layer Images with Per-Scan Contribution (Optional)

This file gets only generated if "Generate layer texture per scan" is turned on. The file matches the name of your OBJ file, but ends in _texture_layer[SCANNUMBER].PNG where [SCANNUMBER] is the number of the scan starting at 0. This file will not contain dilation (if dilation option is selected).

Here is an example for SCAN 0 (the first scan). You can see how even the occluded areas have texture information, applying the projection from the panorama. This way you could paint in the colors from any scan in occluded areas in the hope to get a matching look.



Here is another example for SCAN 2 (the third scan).





8.7 Texture Layer Images with Per-Scan Contribution and Dilation (Optional)

This file gets only generated if "Generate layer texture per scan" and dilation were turned on in the SCAN2FX Settings. The filename matches the name of your OBJ file, but ends in _texture_layer[SCANNUMBER]_dilated .PNG where [SCANNUMBER] is the number of the scan starting at 0. This file contains dilation / extra edge padding around the texture islands. This is the same texture as in 7.6, but with dilation added.

8.8 Texture Layer Alpha Mask (with or without Dilation) (Optional)

This file gets only generated if "Generate layer texture per scan" was turned on in the SCAN2FX Settings. This layer provides an alpha mask for the scan contribution. It may be dilated or not depending on the setting. The filename matches the name of your file in 7.6 or 7.7, but with _alpha.PNG added.

8.9 Scan Bottom Mask (Optional)

This file gets only generated if "Generate layer texture per scan" and "Generate masks for missing scan bottoms" were turned on in the SCAN2FX Settings. The filename matches the name of your OBJ file, but ends in _texture_layer[SCANNUMBER]_mask_bottom.PNG where [SCANNUMBER] is the number of the scan starting at 0.

The white circle identifies the scan bottom in UV space and can be used for masking or painting in the scan bottom in a 2D or 3D paint application.





8.10 Distance Map (Optional)

This file gets only generated if "Generate layer texture per scan" and "Generate distance maps" were turned on in the SCAN2FX Settings. The filename matches the name of your OBJ file, but ends in _texture_layer[SCANNUMBER]_mask_distance_from_scan.PNG where [SCANNUMBER] is the number of the scan starting at 0.

Here is an example of a distance map for SCAN 1 (the second scan). You will notice that area where the scanner based is the brightest and the further away a point is from the scanner, the darker the map gets. Note that the background (where no map was computed) is white. An alpha mask from the master texture can assist in masking out the background if required.



You could e.g. blend the texture of SCAN 1 into the master texture now by using intensity values. Color curves can adjust the fall off by lifting darker areas or more quickly darkening.

8.11 Distance Map with Dilation (Optional)

This file gets only generated if "Generate layer texture per scan," "Generate distance maps," and dilation were all turned on in the SCAN2FX Settings. The filename matches the



name of your OBJ file, but ends in

_texture_layer[SCANNUMBER]_mask_distance_from_scan.png_dilated.PNG where [SCANNUMBER] is the number of the scan starting at 0. This is the same distance map as in 7.10, but with dilation added.

8.12 Occlusion Mask (Optional)

This file gets only generated if "Generate layer texture per scan" and "Generate masks to identify occluded areas" were turned on in the SCAN2FX Settings. The filename matches the name of your OBJ file, but ends in

_texture_layer[SCANNUMBER]_mask_obstruction.PNG where [SCANNUMBER] is the number of the scan starting at 0.

Here is an example for SCAN 0 (the first scan). All the white areas were occluded, i.e. obstructed by other parts of the mesh and not visible from the scanner. This mask can help restrain where to apply the scan image when painting with layers.



SCAN2FX will also output a log file. If you run into issues, email the log file with your settings to support@scan2fx.com.


9. Texture Mesh to Mari

If you purchased the additional SCAN2FX Exporter for Mari module, you will also have the "Texture" Mesh to Mari."

Texture Mesh to Mari will generate a Python .PY file for Mari that automatically loads the mesh and texture layers, if applicable into Mari for you. Depending on the mask settings in the Mari Export Settings of SCAN2FX, an opaque or transparent mask will get added for each layer. Other masks or maps generated by SCAN2FX Texture can be imported as images into Mari for use.

Any per-scan layers generated by SCAN2FX will be hidden in Mari by default so you can see the master texture first before painting in additional details from the per-scan layers.

To import your SCAN2FX Texture data, 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.



Note: Requires SCAN2FX Exporter for Mari ^{and} the Foundry's Mari

Python Console Built on 2017-05-16 at 08:58, using Python 2.7.3. Welcome to Mari 3.3vl! Type help() to get started.	?48:	
Script Path : Evaluate Clear He	elp	Selects a file for evaluation in the console. After selecting a file, click p Evaluate to run the code.

2. The path of the Mari script will get displayed. Now click **"Evaluate"** to run the SCAN2FX import script.



Mari will now load the mesh, texture as well as the texture layers (if generate per-scan layers were set on). Once Mari finishes loading the data, you are ready to work with the newly imported mesh with SCAN2FX Texture in Mari.



All imported layers will be paintable layers (identified by). Also depending on the SCAN2FX Exporter for Mari mask settings, a mask will get generated for each layer.

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. 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.

By default, the "master" texture will be visible so you can see the overall texture, while the scan contribution layers will be hidden / invisible (identified by symbol).

Toggle the top layers visible by clicking the symbol next to each layer in order to paint in additional areas (such as highlighted untextured areas).

Here we activated one of the scan-contribution layers with an opaque mask and started masking out areas with a black brush of where the texture should not get applied from this scan (see the white snow shining through).



Color brushes can be used right away given the imported layers are paintable layers. In the following example, we use a clone brush to cover up a scan bottom.



With scan bottom:



Scan bottom covered up:





10. Texture Mesh to Maya

Note: Requires SCAN2FX Exporter for Maya and Autodesk Maya also have the "Texture

If you purchased the additional SCAN2FX Exporter for Maya module, you will also have the "Texture" Mesh to Maya."

Texture Mesh to Maya will generate a Maya .MA file for Maya that automatically loads the mesh and generates a range of shader materials for your use in Maya.

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

1. Click on "Import..." in the "File" menu.



 In the Import dialogue, select Maya ASCII as Files of type to see the relevant Maya files. Select the .MA file created with Texture Mesh to Maya. Click "Import."



Maya will now load the mesh and the shaders (depending on the settings) that were generated by SCAN2FX Texture. Once Maya finishes loading the data, you are ready to work with the newly imported SCAN2FX mesh in Maya.



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.



Press 'f' to center the mesh in your viewport.

This texture was computed with occlusion and with green as "highlight" color. You can now easily paint onto the green areas to fill in texture gaps.

By default, the master texture is assigned as both the color channel and the diffuse channel to the mesh's material. You may want to break the diffuse channel connection depending on your application.

You will also find a large number of shader materials that SCAN2FX Texture automatically sets up for you in Maya.

Depending on the settings chosen in SCAN2FX, these shader materials may include:

- material with the master texture including alpha mask
- material with the master texture without mask
- materials with the bottom scans masked for each scan
- materials that blend the scan based on the distance from the scan
- materials that only highlight the occluded area of each scan
- materials that only show the contribution of each scan to the texture
- a "master" shader with layers to combine all scan contributions (or other materials) by alpha blending





These shader materials can then be easily assigned to your mesh in Maya as needed by right clicking on the selected mesh and then selecting the desired material under "Assign Existing Material."





Each material name starts with scan2fx and includes both the name of the saved Maya MA file ("test" in this example" as well as the original name of the scan from SCENE. Further a string identifies the type of shader making it easy to pick the material one wants to work with.

We will now run through a few examples of some of the more advanced materials.

Example – Distance Maps

Here we assign one of the distance map shader material:



Initially, you will see that the area around the scan bottom is more transparent based on the distance map.

We will now select the material, click on the arrow next to transparency and invert the mask.





scan2fx_text_vi	lla:fileMask_[DISTANCE_BLE	NDVilla_FA_002	1		
	file:)		IDVilla_FA_002		Focus Presets Show Hide	
	Sample					
File Attrib	utes					
	Filter Type	Quadratic Pre Filter	-			
Pre F			- 1			
	lmage Name	er_1_mask_d	listance_from_sca	an.png_o	dilated.png 📔	
		Reload	Edit	View		
UV	Tiling Mode	Off				
		Use Imag	e Sequence			
				5		
	Color Space	sRGB			-	
		lgnore Co Use BOT Disable F	olor Space File R ïle Load	ules		
► Interactive	e Sequence C	aching Optior	าร			
Color Bala	ince					
Effects						
	Filter	1.000				
	Filter Offset	0.000				

Invert is an option under the Effects sub menu in the File Texture Node.

Check it to invert the mask.



The area around the scan bottom is now opaque and the texture becomes increasingly transparent the further a pixel is from the scanner.



As extra tip, you can use a ramp node to modify the ramping of the texture blending.



Example – Scan Bottom Mask Material

Here we assign one of the scan bottom materials:



You can see how the scan bottom has turned transparent and lets the gray background through.



Example – Obstruction/Occlusion Mask Material

Here we assign one of the obstruction materials. This is the scan of a covered hallway in front of the villa, and only the hallway and some parts of the outdoor grounds are visible.





Example – Scan Contribution Material

Here we assign one of the scan contribution materials. It is the same scan of the hallway as before, but now you can see how the 360x300 panorama got projected onto the entire mesh. The material already has a transparency texture defined (opaque in this case) so the entire mesh is visible.



You could now immediately start painting on the transparency channel in Maya to mask out the areas you do not want to use.

To do so, select the model and right click "3D Paint."

Important Note: Make sure to <u>not</u> 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.



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 black 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.



Example – Master Shader Material with Layers

The master shader combines all the scan contributions by default with alpha blending. You can also remove layers or add other shaders as layers (layers get layered left to right based on the transparency mask).

This shader allows you to combine the results from multiple shaders straight in Maya. However, be careful as Maya may quickly reach the GPU memory limit for displaying these textures in Viewport 2.0 especially when working with high-resolution textures.

N2FXMESHShape scan2fx_text_villa:S2F_layeredShader_MASTER_LAYER_
Focus
layeredShader: 'eredShader_MASTER_LAYER_ Presets
Show Hide
Sample
Type Layered Shader 🔻
Layered Shader Attributes
• • • • • • • • •
Color
Transparency
Compositing Flag Layer Shaders 🔻
Render Pass Mode Apply to Render Passes 🔻

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.



11. Tips and best practices for working with the data from SCAN2FX Texture

11.1 Accelerate the Texture Computation to obtain an Initial Preview Faster

One smart approach is to compute an initial preview texture to check that all the scans in the project and the mesh work correctly together for texturing and to verify that the settings are as desired. To run a preview, set the texture resolution to 512x512 and turn off dilation. Depending on the kind of preview required, you could also choose to turn off occlusion and/or turn off layers. This approach should greatly accelerate the time for an initial texture computation. You may also want to delete any irrelevant scans that should not affect the texture as they will slow down the computation.

Once you are satisfied with the preview, increase the texture resolution to obtain a higher resolution version of the texture, and turn on dilation to improve the quality of the texture on edges.

Settings for	fastest texture	computation:
--------------	-----------------	--------------

Texture Settings
Texture Resolution: 512x512 \vee
Occlusion / Do not texture occluded areas
Fill Scan Bottom Holes by other scans
Dilate Textures to avoid border artifacts
Image-Based Color Transfer from scan: Villa_FA_007 ~
3D-Based Color Transfer
Distance-Based Blending if multiple scans
Generate layer texture for each scan
Generate masks for missing scan bottoms
Generate masks to identify occluded areas
Generate distance maps
Fill Color for Texture-Less Area: Black \sim
SCAN2FX



11.2 Filling in texture holes and scan bottoms

There are different strategies to fill scan bottoms, e.g. you could use the option in SCAN2FX Texture to fill scan bottoms with other scans. However, coloring between scans may be different.

In that case, the color balancing option in SCAN2FX Texture may help you to get the scans to look more alike.

Here is an example of a texture with distanced-based blending off and without Image-Based Color Transfer / color balancing:



The second texture has distanced-based blending turned on and has an Imaged-Based Color Transfer configured:



You can see how the scan bottoms and exposure differences are no longer visible in this example. This technique may not always work and also it may result in slightly more blurry textures (especially an issue when there are clear lines/edges such as doors or windows, or text on signs in the texture / panoramas).



Here are the settings for the second texture generated above. Picking the right scan for the Image-Based Color Transfer:

Texture Settings		
Texture Resolution:	16Kx16K	\sim
🗸 Occlusion / Do not	texture oc	cluded areas
Fill Scan Bottom H	oles by oth	er scans
Dilate Textures to	avoid borde	er artifacts
🔽 Image-Based Colo	r Transfer f	from scan:
Villa_FA_002		\sim
3D-Based Color Tr	ansfer	
✓ Distance-Based Ble	ending if m	ultiple scans
Generate layer tex	ture for ea	ch scan
Generate masks	for missing	j scan bottoms
Generate masks	to identify	occluded areas
	e maps	
Fill Color for Texture-L	.ess Area:	Black 🗠
	XX	>
		EV
	NC	

You can also use the **3D-Based Color Transfer** together with **Distance-Based Blending** for SCAN2FX to automatically color correct localized components in 3D and blend them together. This can substantially reduce the visibility of scan bottoms and adjust the look of other parts of the model to better match together in terms of colors and exposures.

Another technique is to utilize a 2D or 3D paint application with a **clone brush**. This technique can also help paint in other "occluded" areas where no texture was captured.

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.



Here is another example where the scan bottom is filled in by another scan but clearly too bright (see white circle in the bottom middle of the screen):



After painting in the "scan bottom" with the clone brush in Maya, it looks as follows:



Alternatively, you could also use the scan bottom mask as a layer mask and use a 2D paint application such as Adobe Photoshop to try to fill in the scan bottom.

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

If you have purchased the SCAN2FX Photo Projector, you can also utilize a camera with one of your DSLR photos to project the photo to fill in holes. You will also need the according SCAN2FX Exporter to export the computed cameras for this purpose.



11.3 Utilizing highlight colors for occluded areas

One trick is to set a bright highlight color in SCAN2FX settings to immediately see where in the texture color image information was missing.



You can simply paint those areas with your 3D paint application or 2D paint application to fill in additional detail.





If your aim is to hide the areas without textures (e.g. maybe in a darker scene), you could also choose black to more easily blend the areas without textures into a background.



11.4 Making the most of SCAN2FX by utilizing the full suite of SCAN2FX modules

SCAN2FX Texture can be combined with other SCAN2FX modules such as SCAN2FX Exporter or Photo Projector for maximum effect.

SCAN2FX Exporter allows to export cameras and panoramas that can then be used to fill in additional texture detail on top of the baseline texture generated by the automatic texturing process in SCAN2FX.

Also, SCAN2FX Exporter for Maya could be used to export image backplanes for 3D modeling based on the 3D images.

Finally, with SCAN2FX Photo Projector, you could align additional DSLR photos to your 3D scene. Based on the alignment and camera parameters, SCAN2FX Photo Projectors estimates the 3D camera pose from where the photo was projected. These "photo projectors" can then be exported with one of the SCAN2FX Exporters as cameras or projectors and used for texturing or modeling. Or you can utilize the photo projectors to automatically texture your mesh.

Contact us today at sales@scan2fx.com to inquire about upgrading to the full SCAN2FX suite.

11.5 Utilize rendering engines to get most out of your textured mesh

Textured meshes open the world of many 3D rendering engines such as Arnold, Mentalray, Octane, Renderman, V-Ray, Renderman, or even Unreal Engine or Unity for real-time visualizations and games.

Lighting effects can be applied, or backgrounds replaced.











11.6 Utilizing UDIM textures for game engines

Certain game engines such as Unreal Engine and Unity only support up to 8K textures currently. However, SCAN2FX Texture can also output higher resolution 16K textures. To not loose the detail when importing the texture into a game engine, SCAN2FX recommends utilizing UDIM textures.

In order to utilize multiple texture on a single mesh and material, you will need to setup a special material. We will run through a brief tutorial below utilizing Unreal Engine and Blueprints.

Also, for Unity, make sure texture resolution is set to 8K upon import to make sure textures do not appear blurry. Unreal Engine will automatically utilize the full resolution of your textures (up to 8K).

To obtain 8K UDIM textures, utilize the following settings in SCAN2FX Texture:

Texture Settings				
Texture with:	Scans Only		\sim	
Texture Resolution:		8Kx8K	\sim	
✓ UDIM textures to cover 16Kx16K				

In Unreal Engine, import your OBJ as usual, but then create a new material. Double click the material to open the material Blueprint and create a node graph similar to below.





NEW with Release 3.4

In this example, we utilize 4 texture sample nodes for the four UDIM texture images we previously imported into Unreal (ending in 1010, 1011, 1020 and 1021).

A TexCoord node gets masked by a Mask node on the R channel, to separate out the U coordinate, and another Mask node on the G channel to obtain the V coordinate. Then an if statement gets used to compare the U coordinate with a static value of 0.5 and a value 0.



The output of the U lerp node gets connected as alpha to two other lerps. One Lerp node is for the top two textures, while the other Lerp node is for the bottom two textures.

For the V coordinate we also put in place an if statement that branches to a Lerp node for V >=0.5. The output of the if statements get fed into the alpha channel of a final lerp that takes as input the two other Lerps we previously created (the top textures and the bottom textures).

The final Lerp gets connected up to the Emissive Color for the material. We use "Emissive Color" since the lighting and shading is already baked into the real-world photos and textures we are applying. This will create the most realistic look and not artificially apply new lighting or shading to the mesh.





If everything is connected correctly, the material will now display the four textures as a single material using one texture for UV [0,0.5]x[0,0.5], another one for [0.5,1]x[0,0.5], another one for [0,0.5]x[0.5,1.0] and the last texture for the [0.5,1]x[0.5,1.0] region on the UV map. So, four 8K textures give us the full 16K texture coverage we wanted by circumventing this Unreal Engine restriction.

Similar techniques can get applied in Unity.



12. Quality Achievable with SCAN2FX

When you import a mesh from SCENE, many 3D applications (such as Mari or Maya) will not show any colors normally. Traditionally, SCENE only colors the vertices and does not generate textures when creating a mesh.

With SCAN2FX Texture, you can obtain the full high-resolution texture including additional layers and masks to fix up and further modify the textures with paint applications.

SCAN2FX Mesh Modeler can generate very realistic looking meshing.

As a comparison, you see here a mesh generated with standard FARO Scene meshing and vertex coloring:



And here, with SCAN2FX Mesh Modeler and SCAN2FX Texture, the same mesh with textures applied generated with SCAN2FX Mesh Modeler (Maya Viewport 2.0 preview):



A renderer can add additional effects such as depth of field, and lighting simulations:







In contrast to other solutions, SCAN2FX can bring back also elements where no scan data existed. Here's a standard FARO Scene mesh:



You can see how windows, sky, and the water are missing.



And now here the result with SCAN2FX Mesh Modeler and the automatic texturing from SCAN2FX Texture applied:



We then applied some small touch-ups with SCAN2FX Exporter for Maya and Maya's 3D paint functionality. We also selected the water face to increase the reflectivity of the shader:



Here's another example of an interior, solely using the automatic meshing and texturing from SCAN2FX Mesh Modeler and SCAN2FX Texture:





The aim with SCAN2FX Texture is to enable a high degree of control, while providing an automated process to generate textures for your meshes.

To export panoramas as cameras for 3D painting applications for even more control, check out the separately available SCAN2FX Exporter for Maya and SCAN2FX Exporter for Mari modules.



13. Colorizing Point Clouds with Photos

Starting with SCAN2FX Photo Projector and SCAN2FX Texture 3.7, SCAN2FX Texture also enables to colorize a project point cloud.

To colorize the project point cloud, simply click "Texture/Colorize Point Cloud."



To confirm, click "Yes" in the dialogue. If you want SCAN2FX Texture to utilize the SCAN2FX Photo Projectors with your photos for point cloud colorization, please make sure to set "Texture with:" in the settings to a setting including Photo Projectors. SCAN2FX Texture will utilize all Photo Projectors in your scene to colorize the project point cloud then.



Note: If you have converted or imported fill with SCAN2FX Depth Fixer, make sure those imported scans were a) processed, and b) a new project point cloud was generated to include these fill point clouds (make sure to delete the existing project point cloud before creating a new one).



14. Known Limitations or Considerations

14.1 FARO® SCENE Version

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

Please email <u>support@scan2fx.com</u> 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.

Also note that the resulting images may be large, especially with 16Kx16K texture resolution, and when using layers. Each image without any mask may be 600+ MB. Now if you are computing several masks and have a large number of scans, you will need large amounts of disk space available.

14.3 Large Number of Scans

Processing a large number of scans is usually fine, unless you want to utilize "3D-Based Color Transfer" or "Distance-Based Blending." These operations will require a lot of memory and the more scans, the more memory will be required. If SCAN2FX Texture crashes or fails towards the end of the computation and your system has insufficient main memory, make sure to deactivate these two settings before texturing.



NEW with Release 3.5

SCAN2FX Texture may show a memory warning and still try to generate a texture with 3D-Based Color Transfer and Distance-Based Blending deactivated.



14.4 Always Scan full 360x300 panoramas



When scanning for a project that you want to use SCAN2FX on, we recommend scanning full 360x300 panoramas. Starting with release 3.6, 180-degree panoramas as long as they cover the full vertical height are supported as well.

You can always delete any scans before texturing. Deleting some scans may also result in a cleaner texture as less artifacts are likely be introduced.

Also scan subgroups may need to be deleted before texturing.

14.5 GPU Timeouts and Timeout Discovery Recovery

On certain systems, given the heavy use of GPU processing by SCAN2FX Texture, the system / GPU may cut out the processing and present an error message like below or possibly crash.



To prevent a GPU computation/rendering from locking your computer, Windows kills the GPU driver when a GPU computation takes more than a few seconds. When Windows kills the GPU driver, the application will crash.

To avoid this type of GPU driver shut-down, you will have to manually increase the TDR settings:

Run "REGEDIT." The registry window will open. In the left pane, navigate down the tree to the GraphicsDrivers key by going navigating to:

Computer\HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\GraphicsDrivers

Now add or edit the TdrDelay value. If TdrDelay does not exist as an entry, right-click the right pane and select New > Dword (32 bit) value. Name it "TdrDelay". Make sure to follow the precise character casing.

Double click TdrDelay now, select "Decimal" in the pop-up and enter 60 as the "Value data." This value indicates to wait 60 seconds before cutting out the GPU driver.

You also should add or edit the TdrDdiDelay. As before if TdrDdiDelay does not exist as an entry, right-click the right pane and select New > Dword (32 bit) value. Name it "TdrDdiDelay". Make sure to follow the precise character casing.



Double click TdrDdiDelay now, select "Decimal" in the pop-up and enter 60 as the "Value data."

If SCAN2FX Texture still crashes, try to increase the value from 60 to 120 and see if that improves the texture processing stability.

For more information see here: <u>https://docs.microsoft.com/en-us/windows-hardware/drivers/display/tdr-registry-keys</u>

14.6 Texture Computation Time and Memory

Depending on the settings, your texture computation time may be different. With version 2.5, many computations were transitions were shifted to GPU-based algorithms allowing to compute larger models independent of the number of triangles. However, this approach will scale in time with the number of scans and may also require significant amount of memory. If you run into a crash or stalled computation, make sure you have as much memory available as possible.

Dilation was also accelerated.

Computing a preview texture at a lower resolution may help check everything prior to executing a full, high-resolution texture computation

14.7 Occlusion and Partial Meshes

If you are not using a full mesh of a 3D scene, consider that certain scanner positions may no longer be occluded and hence may suddenly project onto surface that should not get textured by that scanner. To resolve this, ensure the mesh retains the occlusion or delete the particular scans that get in the way of your texture computation.

14.8 UV Layout Required

Remember that your mesh will require a valid UV layout without overlapping UVs. You can create UV layouts in various 3D applications and export the UV layout as part of a revised OBJ mesh. For SCAN2FX Texture to compute a UV map for you, make sure Maya is installed on the same system (see chapter 7 for details).

14.9 All Faces Need to be Triangles

While SCENE only outputs triangles, other software may create quads or other faces with more than 3 vertices. To texture such meshes, please ensure to triangulate your OBJ mesh prior to texturing with SCAN2FX Texture.



Many 3D applications include a "Triangulate Mesh" feature. In SCAN2FX Mesh Modeler, export with "triangulation" turned on to avoid having to triangulate your mesh later.

14.10 Manual Process vs. Automatic Texturing

SCAN2FX Texture focuses on an automated texturing process, while providing unique capabilities through layers and optional masks for various applications.

If you like additional control for texturing and frequently employ 3D paint applications in your projections, you may want to check out the optional SCAN2FX Exporter modules, which you can also use in combination with SCAN2FX Texture.

SCAN2FX Exporter can also be useful for image-based modeling work.

14.11 My textures look blurry



Make sure that the texture is not getting automatically down sized after importing. E.g. in Unity, textures get down sampled to 2K by 2K by default. Make sure to manually set the texture resolution accordingly.

Also 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.

14.12 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.

14.13 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.

14.14 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.


14.15 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.

14.16 Other Issues or Needs

If you have ideas for, or need particular solutions or enhancements, feel free to email us at <u>sales@scan2fx.com</u> 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 <u>support@scan2fx.com</u>. Or contact us via our website at <u>http://scan2fx.com/?id=contact</u>. 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 <u>sales@scan2fx.com</u> with your requirements to discuss a possible collaboration and pricing.

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



support@scan2fx.com

