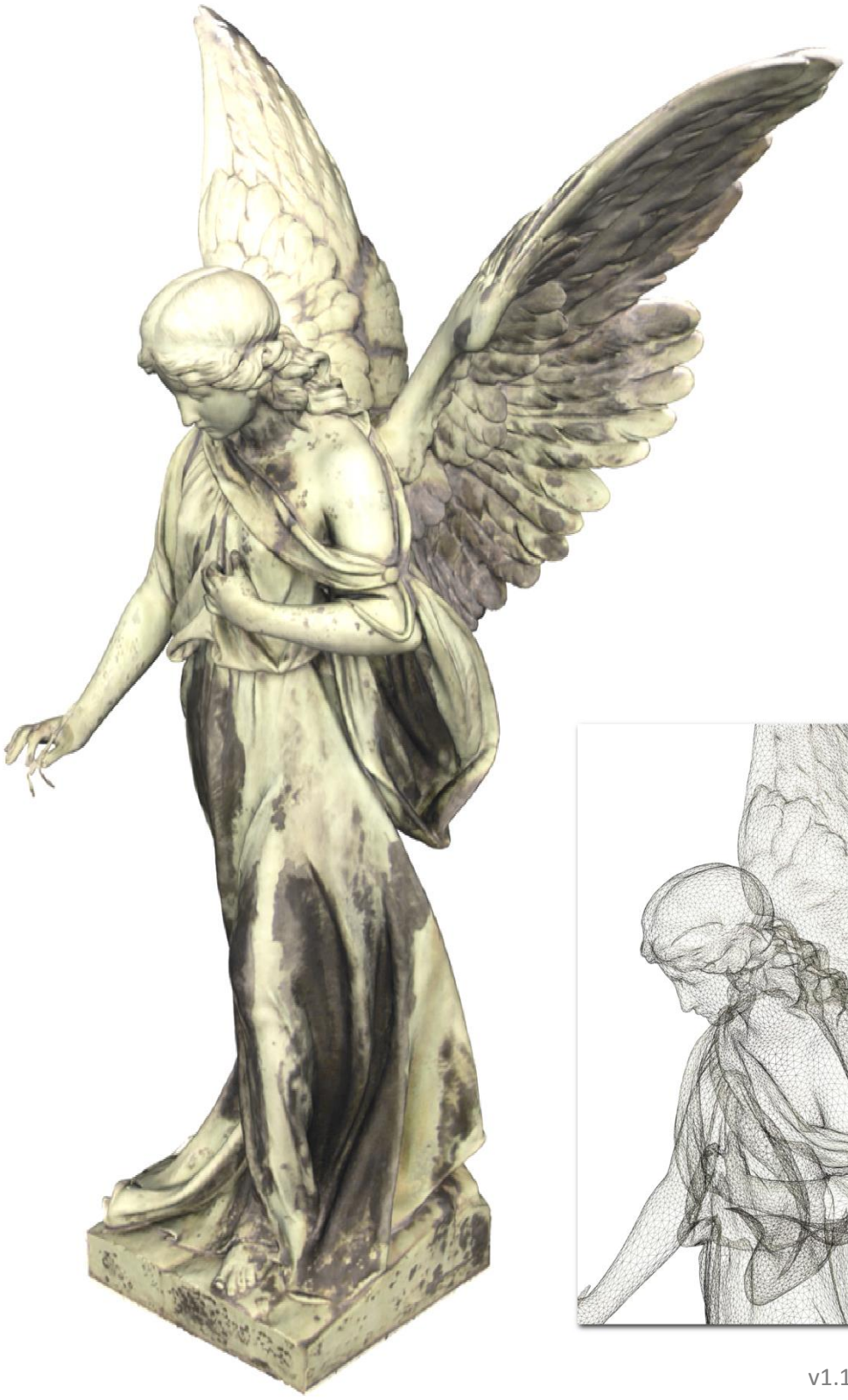
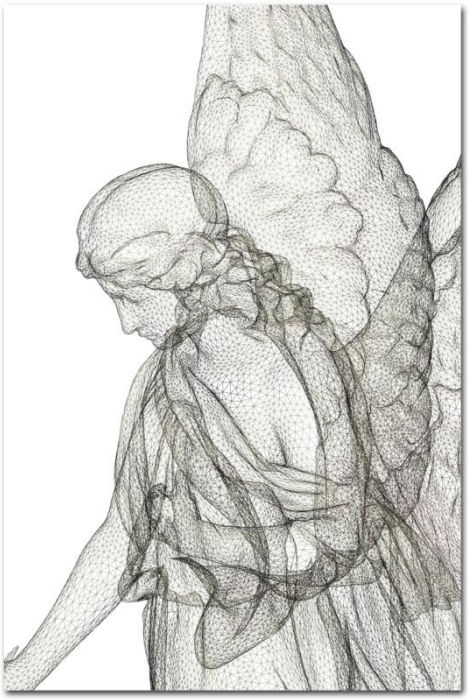
Quick Reference Guide – QTSculptor v6.0





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1 Installation

1.1 Preparation

Administrator rights are required to install QTSculptor and to connect the scanner to your computer. They can be set in the Windows User Account Settings.

The delivery contains two disks. One disk contains the setup of the QTSculptor software. The second volume contains system-specific files (hardware settings and calibration) that are needed to install your scanner.

The license management of QTSculptor is stored in a hardware dongle that is delivered with the system.

1.2 Installation of the Software

Insert the CD with the QTSculptor setup in your disc drive.

Execute the Setup File and follow the instructions of the installation routine.

Please restart your computer after the installation is complete.

1.3 License Dongle Setup

1.3.1 Single User License

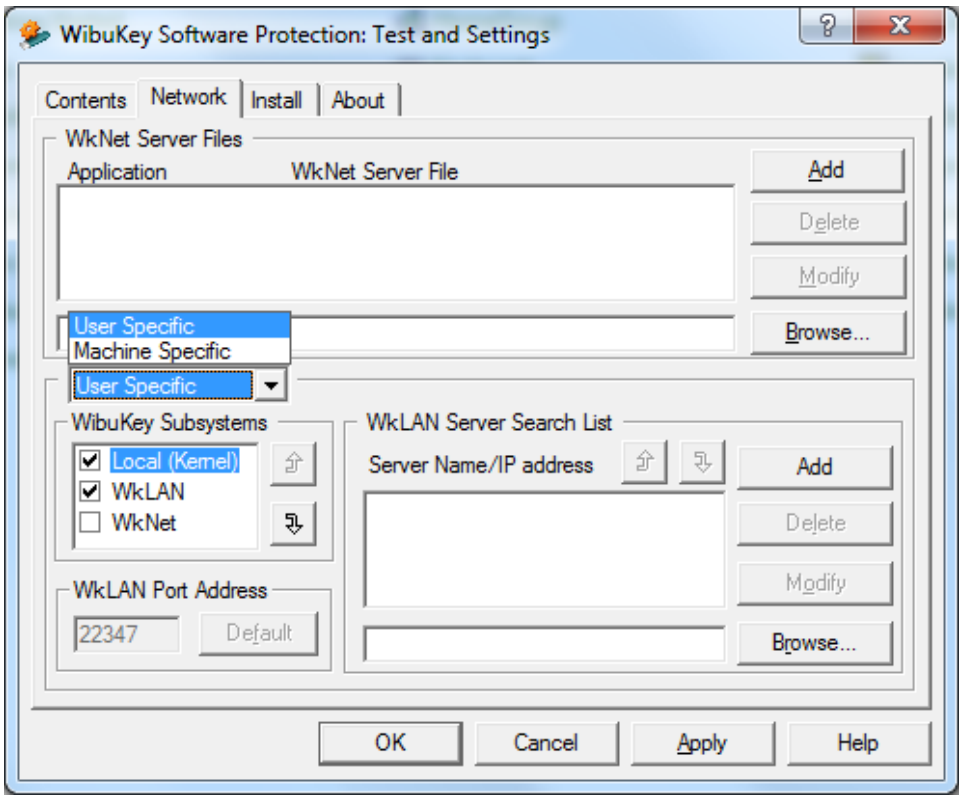
If you are using a single user license you just need to plug the dongle to your computer. QTSculptor will find the license when started.

1.3.2 Network License

General configuration (Client and Server)

Open “WibuKey” at the Windows control panel.

Choose the tab “Network”.

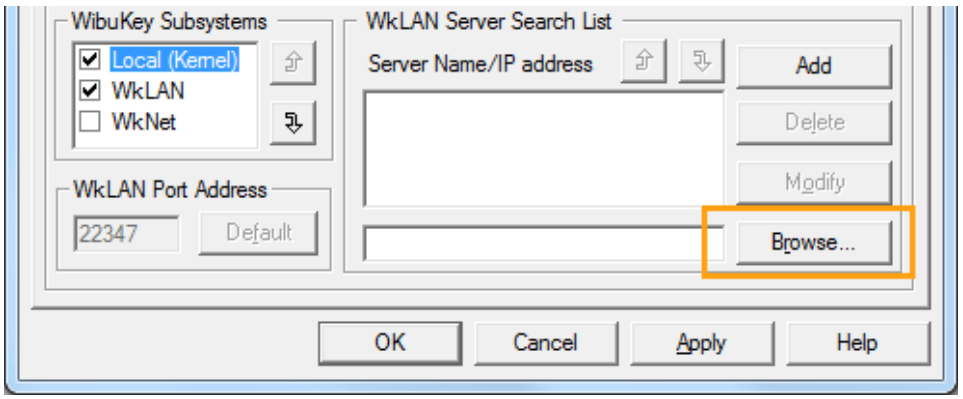


Activate “Local” and “WkLAN”, for “User Specific” as well as for “Machine Specific”.

Apply these Settings.

Client configuration

“Browse” for the WkLAN Server and “Add” it to the server search list.



Add the server for “User Specific” as well as for “Machine Specific”.

“Apply” these settings.

Server configuration

No further configuration is necessary.

Troubleshooting

If the server is not shown in the search list, please restart the Wibukey network server on the server machine:

You will find the symbol of the network server in the taskbar (

Click the symbol with the right mouse button.

“Stop” the server, then “Start” the server again.

Now again search for the server on the client machine as described in “Client configuration”.

If the client machine does not get provided with a license, make sure the server machine is running and that not all available licenses are already in use on the network.

1.4 Scanner and Turntable Setup

Please refer to the separate hardware manual for information about connecting and setting up your hardware.

2 Loading and Saving Data

QTSculptor uses different files to save the information about single scans.

The scan (*.tif) holds the xyz-coordinate-information about all measured points in a scan, or the additional color information.

If saved over "Save Project" the scan also contains information about the mapping (see below).

If saved over "Export Images" the Scan also contains information about the mask and the mapping (see below).

The mask (*.msk) holds information about what measured points are masked out in a scan.

The mapping (*.map) holds information about the orientation of a scan and if a scan is already registered to another scan.

The project file (*.cfg) references scans, masks, mappings as well as a 3D model (if available) to save all infomation about the current state of your project.

2.1 Saving

2.1.1 Save Project

"File → Save Project" saves all information about your current project to a folder. The scans, the masks and the mappings as well as the 3D model (if available) will be stored and referenced in a project file (*.cfg).

Note: The masks and the mappings will additionally be saved in separate files. The scans themselves do not contain the mask information.

Organizing projects

In the process of calculating a triangular model from various scanning directions, QTSculptor combines and converts the original scandata. In order to be able to always fall back to the original data, you should create a folder structure for storing the various processing steps.

The following structure has proved to be very practical:

- `YYYY-MM-DD_ProjectName`
  - `10_Scans`
  - `20_Segmented`
  - `30_Registered`
  - `40_Optimized`
  - `50_Redundancies`
  - `60_3DModel`
  - `70_3DModel-Optimized`
  - `80_Textured`
  - `99_Results`

Note: During the calculation of the 3D model the scans are combined and altered (use of redundancies). Please make sure that the project is saved before starting “Automatic Procedure”.

2.1.2 Export Images

"File → Export Images" saves scans (including the mask and the mapping information), as well as separate mapping files. You can also choose a 3D model to be saved in this dialog.

2.1.3 Export Geometry

"File → Export Geometry" saves the 3D model in common file formats. You can choose to export to different formats at once.

Note: Only VRML and OBJ can store the color information as high resolution textures (texture mapping). PLY can also contain color information, but only in low resolution (vertex coloring).

Scale

You can scale the model to any size. Please note that you cannot subsequently import and re-texture a scaled model.

Export complete surface

Exports the complete model, including the interpolated areas.

Export measured surface and borders

Exports only the measured parts of the geometry, including the border triangles to the interpolated areas. Very small holes stay closed.

Export measured surface

Exports only the measured parts of the geometry without the interpolated areas.

You can display the model with and without interpolated areas in the 3D viewer (see section “Examining the model”).

Selected surface only

Exports only parts of the model that are manually selected (see section “Selection”).

2.2 Loading

2.2.1 Load Project

"File → Load Project" loads all saved information of your stored project.

Note: Project Files from Riegl-Scanners (*.rxp) can also be loaded directly.

2.2.2 Import Images

"File → Import Images" gives you the opportunity to load all information about your current project (scans, masks, mappings, 3D model) separately. You can use "Import Images" to integrate a 3D model into an existing project in a way that the Scans and the 3D model are in the same cluster.

Note: Scans without mask information can only be loaded separately from a project folder.

2.2.3 Import Geometry

"File → Import Geometry" loads a 3D model in QTSculptor.

Note: The imported 3D model will not be integrated in the scan cluster.

3 Preparation for Scanning

3.1 Setting up the Scanner

The Polymetric scanners use a white-light stripe pattern for 3D scanning. For good results the pattern has to be represented in high contrast on the surface of the object. Very bright ambient light is therefore counterproductive for 3D scanning. It is recommended to dim the ambient light and, above all, to avoid direct lighting. For the same reason it is not possible to scan transparent or very shiny surfaces. Very dark surfaces will also reduce the contrast and therefore the quality of the scans.

The scanner as well as the object needs to stand still while scanning. Please use a stable tripod that allows for a shake-free acquisition. After moving the scanner, be sure that the device is no longer resonating before starting the next scan.

3.2 Setting up the Illumination for Color Acquisition

Avoid hard shadows on the objects surface for the acquisition of color information. The more uniform and diffuse the illumination of the object, the more uniform will be the resulting texture of the 3D model.

The lighting situation should not change fundamentally between scans. If it is not possible to provide a diffuse, homogeneous illumination, it is recommended to keep the scanned object static to the light source and to move the scanner around the object instead.

3.2.1 With External Flashes

The scanner can control external flash equipment. Flash light is only used for the illumination of the color image, and therefore has no negative impact on the 3D acquisition.

In order to achieve diffuse and homogeneous illumination, multiple flash units should be used, if possible targeting a wall to provide indirect illumination.

If a bracket is used to mount the flashes to the scanner (optional equipment for viSense scanners), the scanner should be placed in a corner, with the flashes facing the corner, to illuminate the object indirectly.

3.2.2 Without External Flashes

Without external flashes the ambient light has to be set up as diffuse as possible to prevent hard shadows. The lightning conditions should still not be too bright, so that there is good contrast in the projected stripe pattern for 3D acquisition.

3.3 Basic Settings in QTSculptor

3.3.1 Loading the Calibration

Every scanner has a calibrated scanning distance. 3D data will only be gathered in this certain range to avoid inaccurate data. Information about the scanning distance for your device can be found in the hardware manual. The calibration file for the viSense scanner is loaded automatically. For the viSense vario and the PT-M scanner the calibration file needs to be loaded manually (File → Load Calibration → From File) after starting QTSculptor with an initialized scanning device.

3.3.2 Setting the Storage Path for the Scans

Operation → Acquisition → Options → Scanner → Scan path

Create the project folder and the folder for the scans (see above).

If no explicit path is specified, the scans are automatically stored in the QTSculptor installation directory. Note that the scans may be overwritten at the next program start if you do not specify an individual folder.

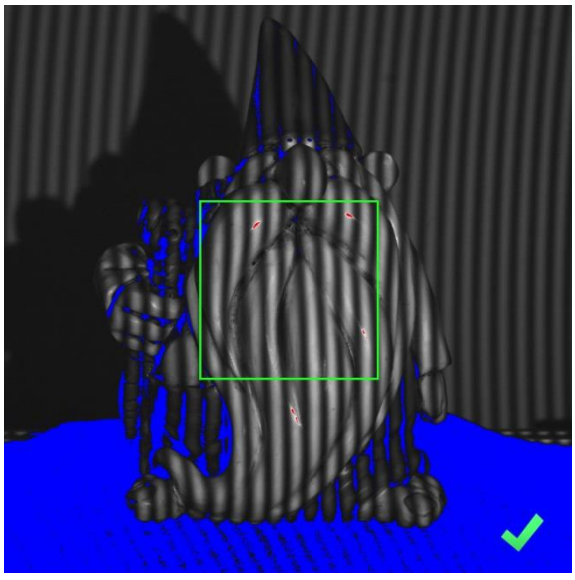
3.3.3 Setting the Brightness for 3D Acquisition

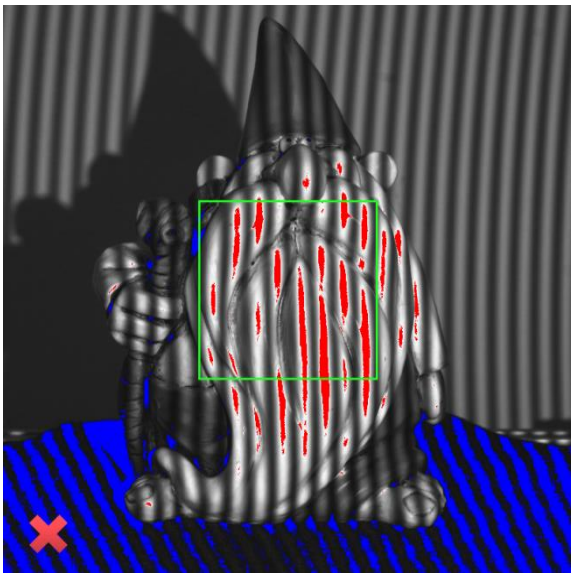
Place the object that you want to scan in front of the scanner and activate the projector light.

Operation → Acquisition → Options → Scanner → Light

Operation → Acquisition → Options → Scanner → Virtual Exposure Time

Use the slider to adjust the brightness of the live image until no, or for shiny objects just few, red areas are displayed on the relevant surface.





After the brightness is adjusted you can turn off the projector by clicking the “Light” button again.

High Dynamic Range (HDR)

Operation → Acquisition → Options → Scanner → HDR Disable/Enable

For objects with a high contrast in color a single exposure time may not be enough to scan all parts of the object. On dark surfaces, for example, the exposure time needs to be set to a higher value which may cause brighter areas to be overexposed.

If you enable HDR you will recognize that a second slider for setting the exposure time appears.

The first slider is used to set the exposure time for bright areas. Set the slider to a value that the bright areas are not overexposed (red).

The second slider is used to set the exposure time for dark areas. Set the slider to a value that there is good contrast in the stripes in dark areas. You can ignore the overexposed (red) regions in the bright areas.

Note that the scanner will do several scans in a row to cover all exposure times needed. Therefore the time for a single scan will increase.

Number of Integrations

Operation → Acquisition → Options → Scanner → Integration Steps

A higher number of integration steps will improve the quality of the single scan, but also increase the time needed for scanning.

If you are using the viSense or the viSense vario scanner in snapshot mode the scanning time is short enough to even scan slow moving objects like faces. For very cooperative persons the scan quality can be improved by using two integrations. For less cooperative persons a single integration should be used to get better results.

If you scan a static object, the number of integrations can be increased without causing problems.

3.3.4 Color Calibration of the internal Texture Camera

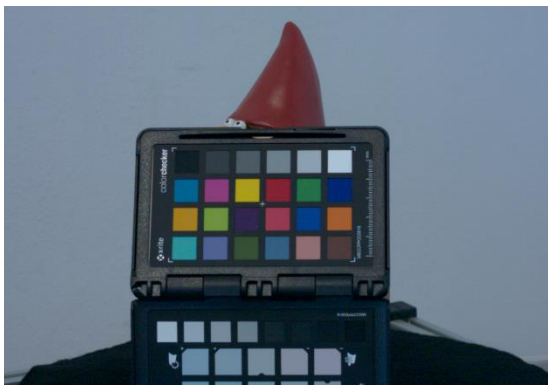
Operation → Acquisition → Options → Texturepicture → Camera parameter set (Texture Camera)

Color calibration of the internal camera is the advisable way to get the most natural result for texturing. In QTSculptor the X-Rite “ColorChecker Passport Photo” or “ColorChecker Classic” are used for color calibration.

Set up the illumination for color acquisition as described above. Place the ColorChecker reference chart in front of the scanner so that it can be clearly seen with the color camera of your scanner. Avoid shadowing on the chart.

Color Calibration includes “Brightness Adjustment” and “White Balance”.

In the process of calculating the color calibration a number of images will be taken. Please keep the color chart placed in front of the scanner during the whole process. After the calculation is finished, the resulting image will be displayed in the main window.



Before Color Calibration

After Color Calibration

without external flash lights

The Color Calibration will set the exposure time of the color camera to achieve the best result.

with external flash lights

If external flashes are used, the brightness needs to be adjusted directly on the flash devices.

If the brightness is set too low, the Color Calibration will compensate this by increasing the gain level which may result in a noisy image.

If the brightness is too high, the color calibration cannot compensate this and will inform you to lower the brightness of the flashes.

Hint: Always start with a high flash intensity and reduce the intensity if asked for.

3.3.5 Brightness Control and White Balance for Color Acquisition

Operation → Acquisition → Options → Texturepicture → Camera parameter set (Texture Camera)

Brightness Control and White Balance can be performed separately from the Color Calibration if the illumination has only changed marginally. Better results will be achieved by performing a full Color Calibration.

In the process of calculating the brightness control and the white balance a number of images will be taken. Please keep the color chart or the gray surface placed in front of the scanner during the whole process. After the calculation is finished, the resulting image will be displayed in the main window.

Brightness Control

Brightness Control can be performed by using a color chart and the built-in mechanism to automatically adjust the exposure time or by using the slider “Exposure Time”.

If you are using the slider and external flash lights, the result of your adjustment will be displayed for a few seconds after releasing the slider.

White Balance

White Balance can be performed by using a color chart or a plain gray surface.

If you don’t own a color chart please choose “Manual White Point” from the drop-down menu and select a gray area in the preview picture after clicking “Go”. Make sure that the chosen area is not overexposed in the color image.

4 Grabbing and Editing of Scan Data

Scans will be saved at the path that you have defined before. For every processing step it is recommended to create project save points, according to the structure described above. You can save the current status of the project by choosing "File" → Save Project from the main menu. If problems occur during a processing step you can restore the last saved point ("File → Load Project").

4.1 Scanning

Operation → Acquisition

Requirements:

- For faultless 3D acquisition, the object may not move during the scan.
- The ambient light must not be overexposed to ensure good contrast in the projected stripe pattern.
- Specular or transparent surfaces cannot be measured. Semi-transparent or slightly shiny surfaces are difficult to measure which will result in a loss of scan quality. Please use 3D laserscanning anti-glare spray for these kind of surfaces.

4.1.1 Single Scans

Scanning 3D + color

Push the button "3D + Color" in the main window.

Scanning 3D

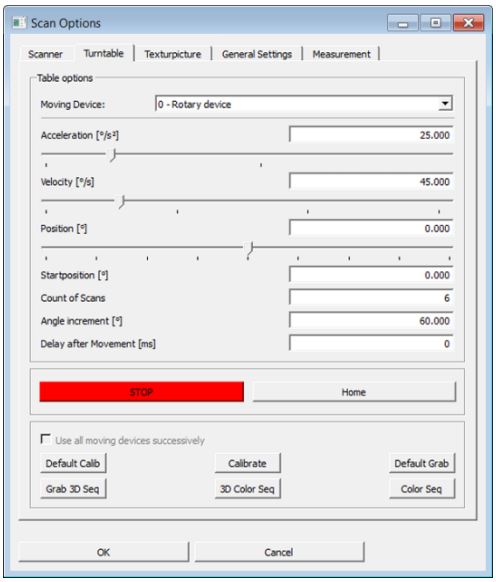
Push the button "Grab 3D" in the main window.

If you are satisfied with the result, you can save the scan by pressing "Save Scan" in the block of six buttons in the right corner above the main window.

If you are not satisfied with the result and want to refuse this scan, click "Live Scan".

4.1.2 Using the Rotary Device

Operation → Acquisition → Options → Turntable



Polymetric's rotary devices enable you to grab a series of scans that are automatically registered to the same coordinate system.

"Count of Scans" defines how many scans are taken in a sequence.

"Angle increment" defines how many degrees the rotary device will turn between the scans.

"Position": This slider can be used to turn the rotary device to a defined position.

“Acceleration / Velocity”: For objects that tend to tilt or that are non-rigid it may be necessary to decrease the acceleration and velocity of the rotary device to avoid movement.

“Delay after movement”: Non-rigid objects tend to oscillate after rotating to the next scanning position. Use this parameter to define the delay time, the object needs to stop oscillation before the next scan starts.

Calibrating the rotary axis

The axis of the rotary device needs to be calibrated, so the software is able to register a series of scans correctly.

Put the scanner in the right scanning distance facing the object on the rotary device. The object needs to have significant geometry.

“Default Calib” sets the parameters (“Count of Scans” and “Angle increment”) for the calibration sequence.

“Calibrate” starts the calibration sequence.

After the axis is calibrated you can use this calibration to perform scanning sequences as long as you don’t move the scanner or the turntable. After changing the physical orientation of any of these two devices, the calibration needs to be redone.

Scanning sequences

“Default Grab” sets the parameters (“Count of Scans” and “Angle increment”) for a small 360° sequence with 6 scans.

Usually it makes sense to define the sequence as a full round, e.g. with 8 scans and an angle of 45° or 12 scans and an angle of 30°. Nevertheless you can also define different sequences, e.g. 5 scans with 20° to just scan the front of your object with a small angle between the scans.

“Grab 3D Seq” starts a scanning sequence of just 3D scans.

“3D Color Seq” starts a scanning sequence of 3D scans with additional color images.

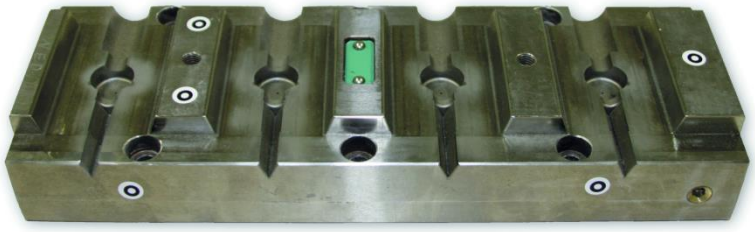
“Color Seq” starts a scanning sequence of just color images.

4.1.3 Using Reference Markers

Operation → Acquisition → Options → General → Marker Detection

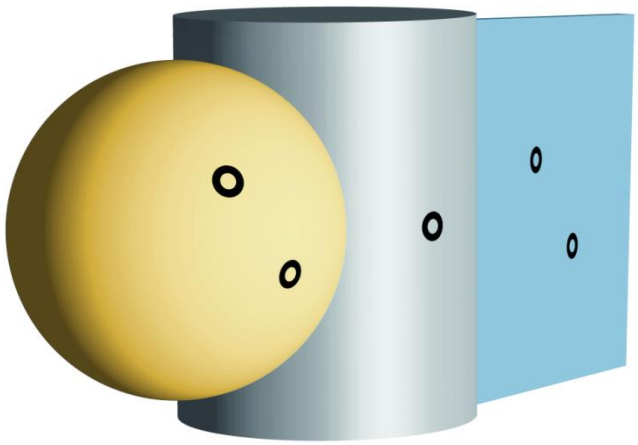
If activated reference markers will be detected in single scans as well as in scanning sequences.

Place the reference markers on planar surfaces or on surfaces with low curvature.



Fixation of non-significant geometry

QTSculptor uses the object's geometry to register scans to the same coordinate system. Scans therefore need an overlap with some significant geometric details to lock against each other. However, some objects have very regular parts that are not sufficient for registration (e.g. a tube or the planar surface of a table. In these cases reference markers can be useful to fixate the scans.



Automatic marker registration

Reference markers can also be used for semi-automatic registration purposes (see section "Marker Registration")

4.2 Filtering

Operation → Images

Image Filters only effect 3D scans, not color images. These filters are always performed on all 3D scans, not just on the displayed scan.

Parameters for the filters can be modified in the “Filtering Options”.

Detect/Dilate Jump Edges

Jump Edges are distance-jumps in the scans from a certain viewing direction. Scan artifacts (noise) are likely to appear in these areas. Therefore Jump Edges are automatically masked out, shown as a yellow mask in the scans. You can enlarge these areas with “Dilate Jump Edges”. Detect Jump Edges resets the mask to it’s original size.

Mask Small Regions

Scan artifacts usually appear as small patches of unconnected measured points. “Mask Small Regions” masks these small unconnected areas as noise.

Reject Large Angles

The steeper the view angle between the scanner and the objects surface, the more inaccurate will be the measured points. Therefore all measured points with an angle over 85° are automatically filtered in the scans (PT-M scanners and viSense vario scanners in quality mode). “Reject Large Angles” allows you to also filter areas with smaller angles. The smaller the given angle, the more measured points will be masked out.

Note: If you have already rejected a relatively small angle in the scans and want to get back to a larger angle you will have to delete the noise mask in the scans (see section “Segmentation”) before performing “Reject Large Angles” with a larger angle.

Mask Out Markers

If you are using reference markers, these will automatically be masked out by “Mask Out Markers”

Interpolate Blemishes

Blemishes are small holes in the scans. They can be closed by interpolation.

2D Filering

Performs a smoothing on the scans.

Redundancies

Performs a quality based use of redundancies between the scans.

Note: The use of redundancies is part of the meshing process (see section “Automatic calculation of the 3D model”). It should not be performed separately as the scans are modified during the calculation of the redundancies.

4.3 Segmentation

Operation → Segmentation

Drag and drop the scan that you want to segment from the list on the right into the main window.

4.3.1 Noise

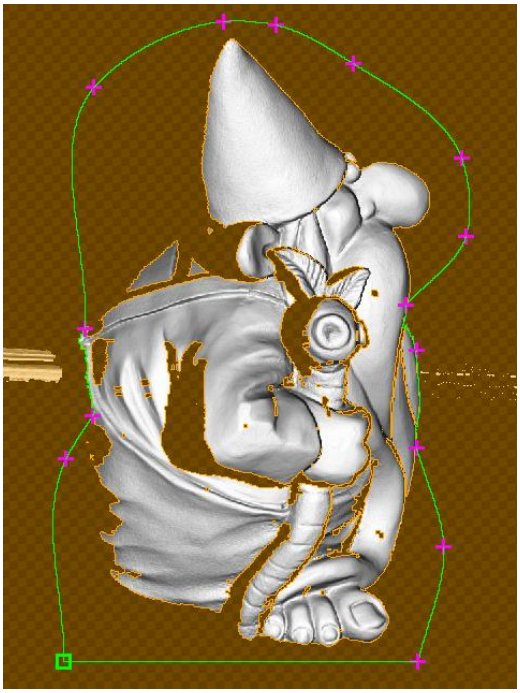
The “Noise” function masks or unmasks all data in the scan. By clicking the left mouse button you can mask the whole scan, the right mouse button unmasks all masked areas.

4.3.2 Foreground

The “Foreground” function unmasks or masks all connected areas in the scan. By clicking the left mouse button you can unmask parts of the scan that are connected to the clicked point, the right mouse button masks all connected areas.

4.3.3 Spline / Contour

With “Spline” and “Contour” you can define an area in the image. The functions “Noise” and “Foreground” can then be applied limited to this restricted area.



“Spline” draws a curve along support points that are set with the left mouse button. The right mouse button removes the last set point. A double-click ends the curve. To draw a closed area, end the line by double-clicking the starting point of the line.

“Contour” draws a curve along a border area in the image. Borders are depth-jumps in the 3D image, borders in the measured geometry or hard color transitions in the color image. You can set support points along the borders with the left mouse button, the right mouse button deletes the last set point. Likewise the Spline function, the line is ended by double-clicking.

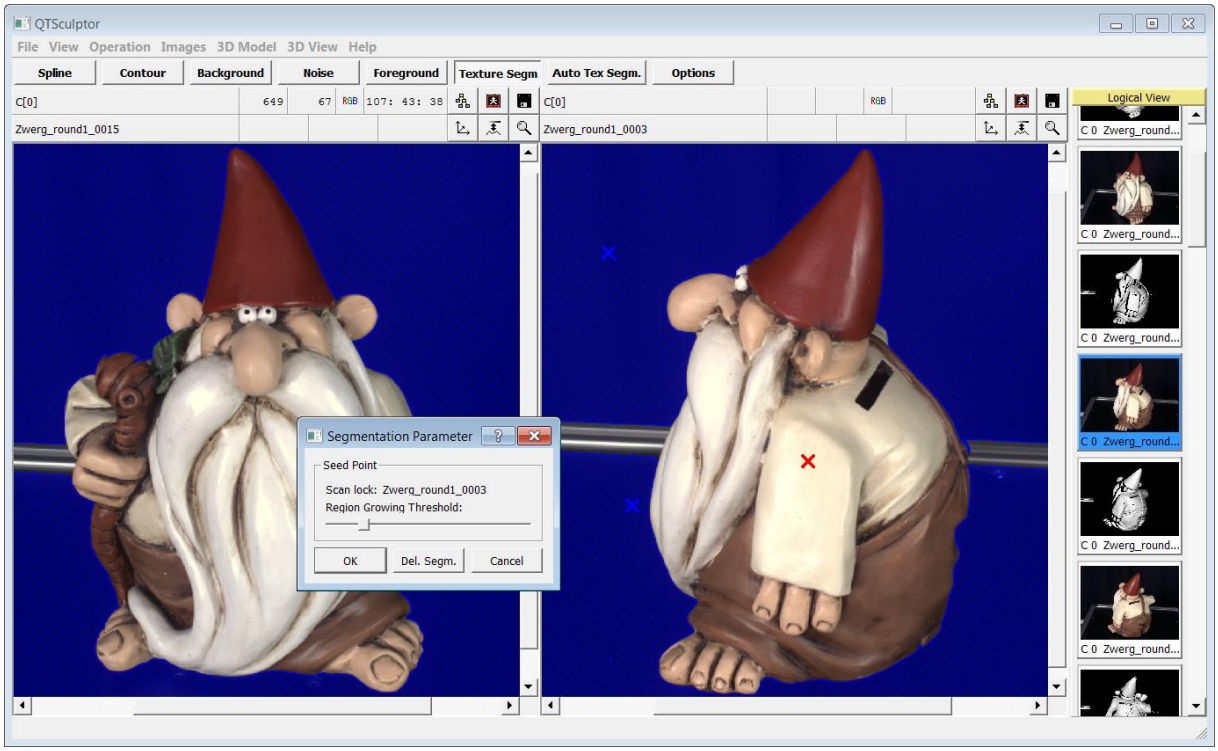
In the Spline, as well as in the Contour function, you can include a straight line to your curve by clicking the middle mouse button. You can also switch between Spline/Contour by holding the “Shift” key.

4.3.4 Texture Segmentation

With “Texture Segmentation” you can quickly remove a uniform background from the color image.

Click with the left mouse button in the area to be masked out. From this starting point the function will mask all connected areas that have a similar color. With the slider you can adjust the accepted color variation to more restrictive (left) or less restrictive (right).

If the function masked out more than you intended you can undo the last segmentation by clicking the right mouse button. Then use the slider to set the function more restrictive and retry.



If you want larger areas to be masked out use another click in a different area and/or set the slider to less restrictive.

As the software cannot know which parts of the image are relevant, that area needs to be marked with a middle mouse click.

"OK" accepts the changes in the image and masks out all areas that are no longer connected to the relevant area.

4.3.5 Segmentation in the 3D Point Cloud

You can also mask out areas directly in the 3D point cloud preview. These cuts, however, will affect all connected scans. Open the context menu in the preview window with the right mouse button and choose, under "Selection", either "AND" or "NOT". Then again, activate "Mask Unselected Volume as Noise" under the item "Selection". Now you can draw a continuous line, similar to the segmentation in the 2D image. Close the polyline to perform the segmentation. Warning: the selection is cutting through the entire volume. Make sure that you do not delete relevant areas accidentally.

"AND": Deletes all data outside the selected area. It can be used to easily separate the relevant parts of the point cloud from artifacts in the background.

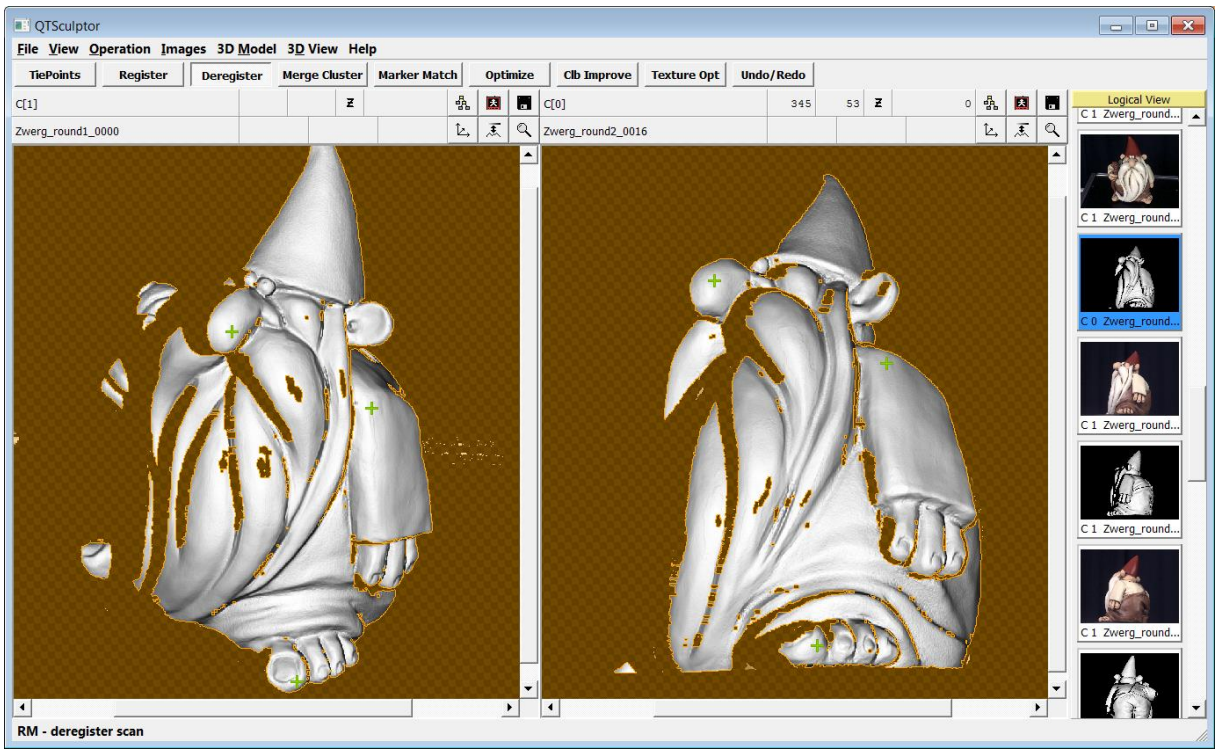
"NOT": Deletes all data inside the selected area. It can be used to selectively remove small artifacts.

4.4 Registration

Operation → Registration

4.4.1 Manual Registration

To be able to connect scans the software needs a rough indication which parts in the scans show the same surface. For each set of two 3D images the software needs at least one, up to three or more corresponding reference points to find the match. If three points are used, they should be set to form a triangle on the surface, not a straight line. Color images, taken with one of Polymetric's scanning devices, are permanently linked to the corresponding 3D image. They do not have to be registered manually.



In order to display more than one scan at the same time, change the view via the menu item "View". Drag and drop the required images from the list on the right to the main window. Choose images from similar viewing directions with much overlapping surface to make it easier to find the correspondences.

To connect two scans first click on the button "TiePoints". Then click the first point in one image, then the corresponding point in another image. These two points are now associated. You can repeat this process until you have assigned three points between these two images. With the right mouse button you can delete reference points - the assigned point in the other image is automatically removed.

You can now connect the scans by clicking "Register". Alternatively you can first set more corresponding points between other scans to register more than two scans at the time.

4.4.2 Automatic Registration

Operation → Registration → Auto Reg

QTSculptor can perform an Automatic Registration of 3D scans.

There are several presets for different kinds of scanned objects:

“Rigid” / Rigid Fast”: For inflexible objects.

“Rigid Multipart”: For projects with multiple scanned objects that are inflexible.

“Faces” / “Faces Still”: For flexible objects with minor changes in geometry in between the scans.

“Teeth”: This mode is specialized for the use of QTSculptor with a dental scanning device.

Select the appropriate preset and click “OK” to start the Automatic Registration.

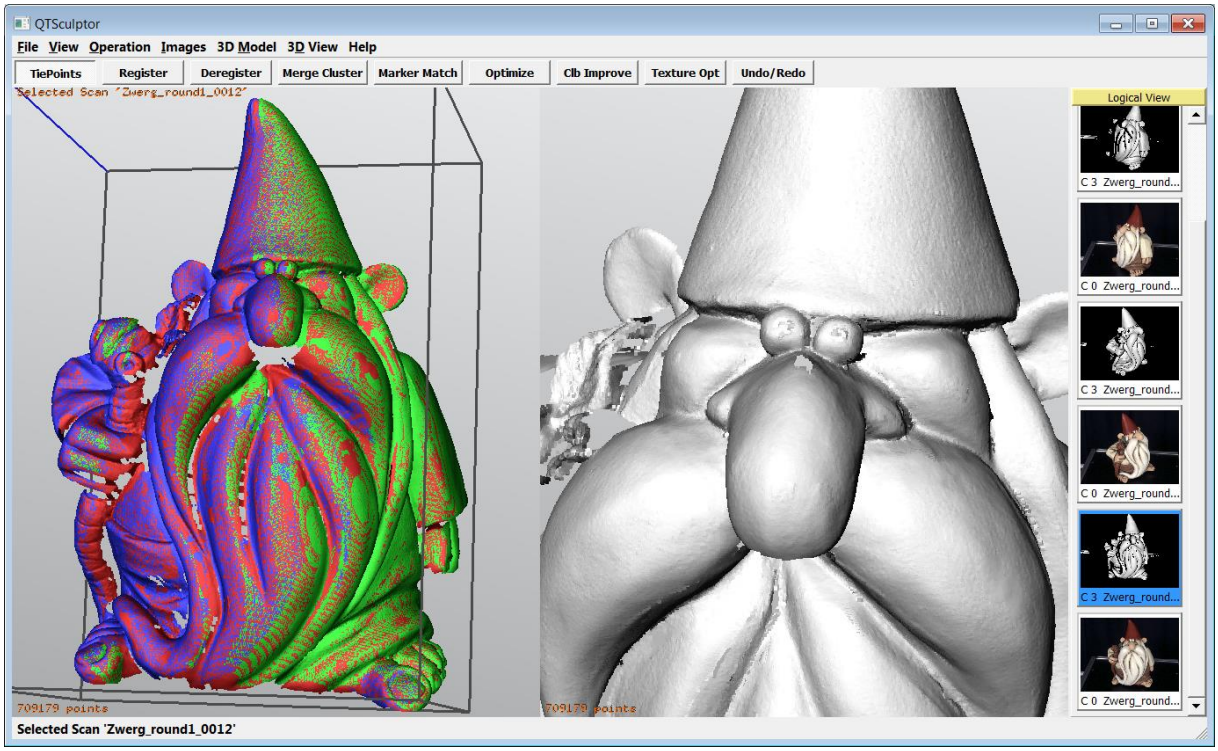
Note: Do not stop the Automatic Registration before Feature Detection is finished. If you stop the Automatic Registration before the registration is finished, all connections found until then will remain.

4.4.3 Marker Registration

If reference markers are used and detected in the scans, all clusters that contain at least 3 reference markers in overlapping areas can be automatically registered by the use of “Marker Registration”.

4.4.4 Checking the Result of the Registration

The result of the registration can be reviewed by clicking “Show preview” from the block of six buttons in the right corner above the main window. A 3D preview will open where you can turn and zoom the point cloud with your mouse. To close the preview open the context menu with the right mouse button and click “Quit Viewer”.



If the registration failed, you can withdraw the last registration with “Undo/Redo”, or specifically deregister a single scan (Deregister → right mouse button in the incorrectly registered Scan in the main window). Depending on the situation, the already set reference points need to be deleted with

the right mouse button or more points need to be added to stabilize the registration before clicking “Register” again.

If the scans are registered correctly, but they seem to be slightly shifted, the registration can be improved by clicking the button “Optimize”.

5 Calculation and Optimization of the 3D Model

After all scans have been registered and improved, the model can be calculated. Please note that the original scans are merged and changed during the model calculation. If you intend to add more scans after the model calculation, you will have to restore a saved project.

5.1 Automatic Calculation of the 3D Model

3D Model → Automatic Procedure

The data that is shown in the main window, respectively in the upper left window, will be used to calculate the 3D model. This can be useful if you have several objects scanned into a single project and specifically want to calculate a specific one of these datasets.

"Go" starts the calculation with all parameters set in "Preprocessing", "Triangulation" and "Texturing".

5.1.1 Preprocessing

Optimization

Performs a global optimization of the registration between all scans to minimize the registration deviation.

"Maximum runtime" specifies the maximum time spent for global optimization. If the value is set to 0, the optimization is performed until no further improvement can be achieved.

Redundancy

Improves the quality of the scans in areas that are seen in multiple scans.

"RMS" indicates the search area for scanned points in redundant areas. The standard value is calculated from the resolution of your scans and will be good for most cases. If the scans have high level of noise or the objects geometry is not rigid, a higher value might give a smoother result but may also cause loss of detail.

"Number of Iterations" should be set fixed to 2 iterations. Thus the function is called twice, as there will still be minor improvements in the second run.

Default preprocessing settings

Resets all preprocessing parameters either to the calculated values if you have chosen "use estimated settings" from the "Settings" tab or to the last saved values if you have chosen "use current settings" from the "Settings" tab.

5.1.2 Triangulation

Kind of Triangulation

"Surface triangulation" calculates only the largest measured object in the scans and therefore calculates very quickly. If there are several small objects in the scan data, the more time-consuming "Volume triangulation" needs to be run.

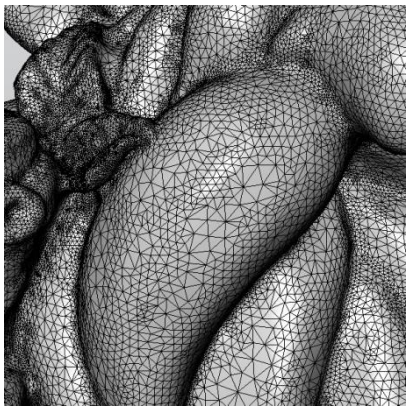
Settings

"Final resolution" specifies the target resolution of the model in mm. If "Final resolution" is, for example, set to 0.1, the smallest calculated triangles have an edge length of 0.1 mm. Note that a "Final resolution" smaller than the "Lateral resolution" calculated in the "DOF Calculator" is not advisable.

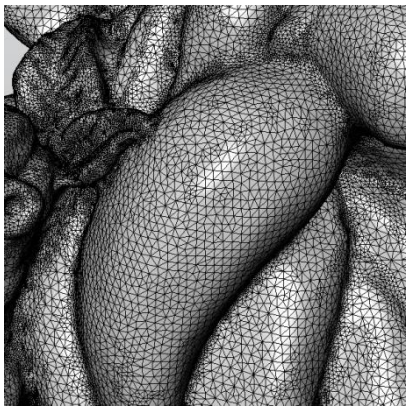
"Subdivision steps" indicates how many subdivisions steps will be calculated to achieve the "Final resolution". With a target resolution of 0.1 mm and 2 subdivision steps, the model calculation starts with triangles of side length 0.4 mm. In the first subdivision step, triangles in regions of high curvature will be subdivided to 0.2 mm side length; the final resolution of 0.1 mm is reached after the second subdivision step.

"Subdivision Accuracy" specifies, at which deviation from the point cloud the triangular mesh needs to be further subdivided top meet the accuracy of the point cloud. The standard setting is calculated to fit the resolution of the scans. Using a smaller setting usually only unnecessarily increases the noise as well as the number of triangles in the 3D model. Bigger numbers reduce the number of triangles in the result, therefore the level of detail will be lower. Note that a "Subdivision Accuracy" smaller than the "Depth resolution" calculated in the "DOF Calculator" is not advisable.

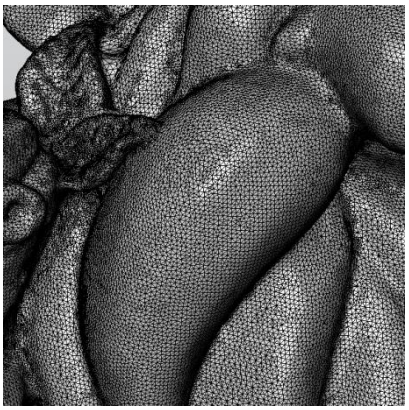
Smaller target resolution and less subdivision steps will result in more detailed results. However the computation time will increase significantly and the result will be a much larger model with a higher number of triangles. One way to reduce the number of triangles with little loss of quality will be explained in section "Optimization of the model".



Final Resolution: 0.3mm
Subdivision Steps: 3



Final Resolution: 0.3mm
Subdivision Steps: 2



Final Resolution: 0.3mm
Subdivision Steps: 1

Options (Smooth)

"Options" gives you the possibility to automatically smooth the triangle mesh. However, this is not recommended and we refer to manual smoothing as described in section "Optimization of the model".

Default mesh settings

Resets all triangulation parameters either to the calculated values if you have chosen "use estimated settings" from the "Settings" tab or to the last saved values if you have chosen "use current settings" from the "Settings" tab.

5.1.3 Texturing

Calculates photorealistic texturing for the 3D model from the given color images.

As texturing should always be the last step in computing the 3D color model the texturing function in “Automatic Procedure” is deactivated by default. Please continue with computing, optimizing and finishing the 3D geometry of your model, then see chapter “Texturing”.

5.1.4 Settings

You can store the current settings of the “Automatic Procedure” dialogue. Activate “Use Current Settings” and click “Save Current Settings”. Those settings will then automatically be loaded at the next start of the software.

Note that the saved “current settings” will also be used as default settings if you click the “Default … settings” in one of the processing tabs.

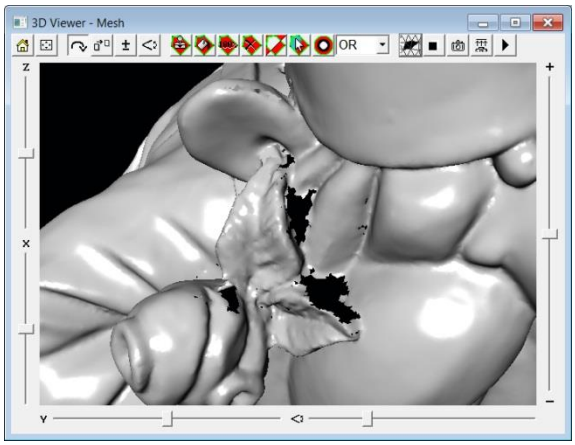
5.2 Examining the 3D Model

3D View → Mesh

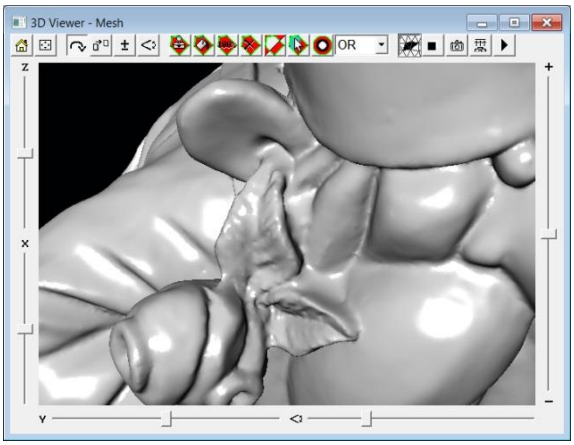
In the mesh viewer you can rotate, zoom and move the model with the mouse, and switch between different display options. You can also set surface selections for further processing (see “Optimization of the model”).

Show and hide unmeasured areas

right mouse button → Display → Unmeasured Surface



Unmeasured Off



Unmeasured On

Display triangular mesh

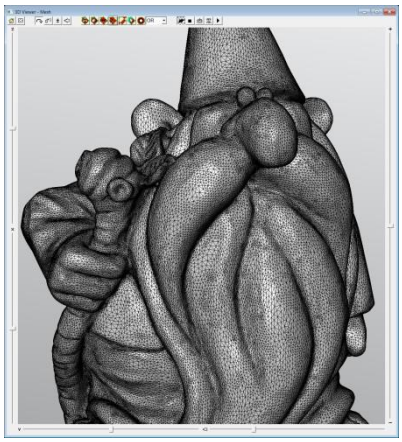
right mouse button → Rendering Mode → Smooth + Line

Display smooth shaded model

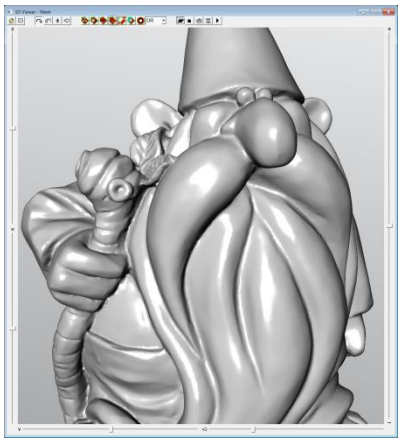
right mouse button → Rendering Mode → Smooth Shading

Display textured model

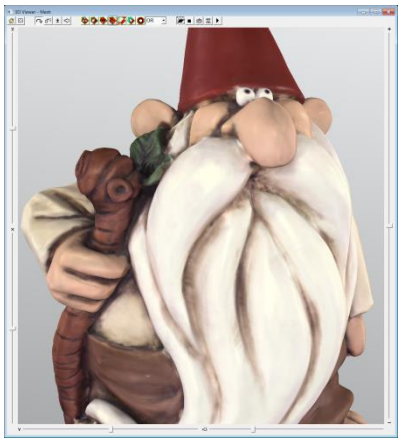
right mouse button → Rendering Mode → Texture Mapping



Smooth + Line



Smooth Shading



Texture Mapping

5.3 Optimization of the 3D Model

All the following functions can be applied either to the entire model or to a selected area.

5.3.1 Selection

In the header of the 3D viewer you will find four buttons to selectively mark areas.

Select volume

Sets a selection through the volume of the mesh. Also the non-visible parts of the model are marked. Draw a line by clicking the right mouse button. Close the line by clicking the starting point of the line. The volume inside the selection will be marked.

Select surface

Sets a selection only on the connected surface inside the selected area. After closing the selection, line with a mouse click on the starting point of the line, a click with the middle mouse button selects the relevant area (inside or outside the selection).

Note: If you leave the surface of the object with the selection line also the connected parts of the backside, lying inside the selection, will be marked.

Select all

Selects the complete surface of the model.

Clear selection

Clears all current selections.

Invert selection

Inverts the current selection.

Select Interpolated Areas

Unmeasured areas will be highlighted and can specifically be selected and deselected by clicking them with the left mouse button.

Logical Operators

"OR": The next selection will be added to the current selection.

"NOT": The next selection will be subtracted from the current selection.

"AND": Only areas that are part of the new selection AND of the current selection will be marked as selected.

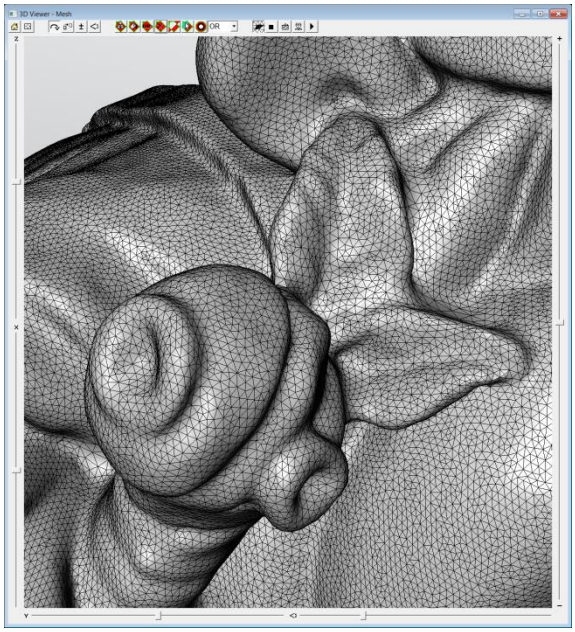
5.3.2 Increasing the Level of Detail

3D Model → Mesh Options → Subdivision

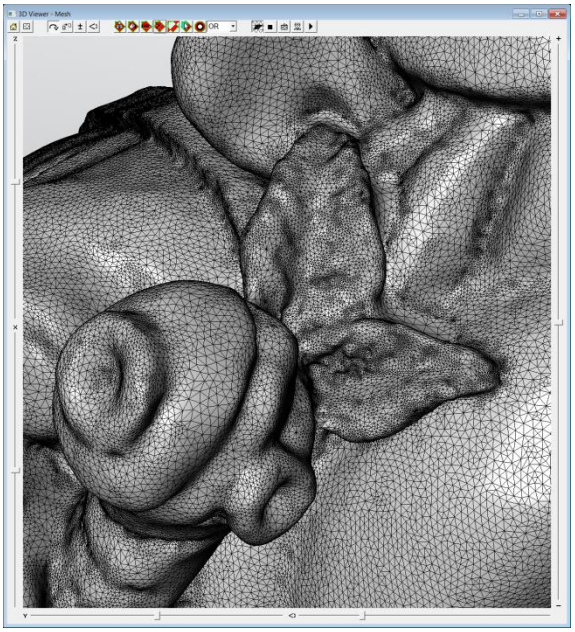
Triangles will be subdivided to represent finer details - only if more details exist in the scanned data.

The smallest useful "Maximum Distance" is limited by the resolution of the scanning device. For the facescans, for example, a "Maximum Distance" of 0.08mm is advisable. For the viSense vario in Quality mode you can set "Maximum Distance" to a minimum of 0.04mm. For PT-M scanners the "Maximum Distance" varies with the setup. Please have a look at the "Depth Resolution" calculated in the "DOF Calculator".

After performing “Subdivision”, please run “Smooth Interpolated”.



Before “Subdivision”



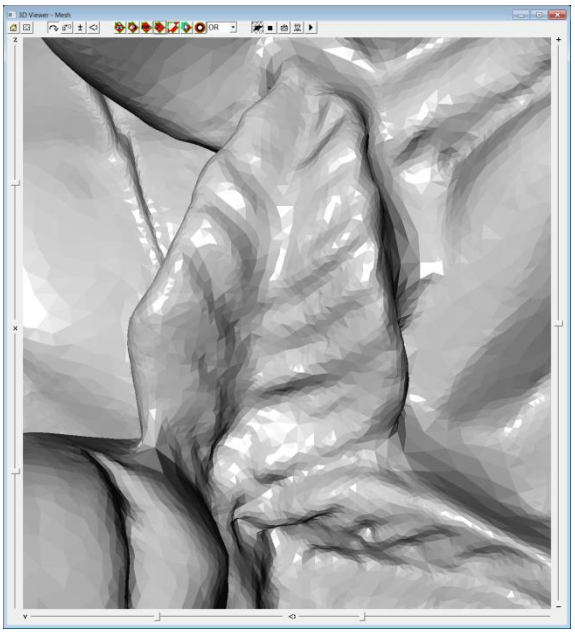
After “Subdivision” and “Smooth Interpolated”

5.3.3 Fine Smoothing

3D Model → Mesh Options → Smooth (Step size: Small)

Works like fine sandpaper and smoothes small edges and spikes.

Before

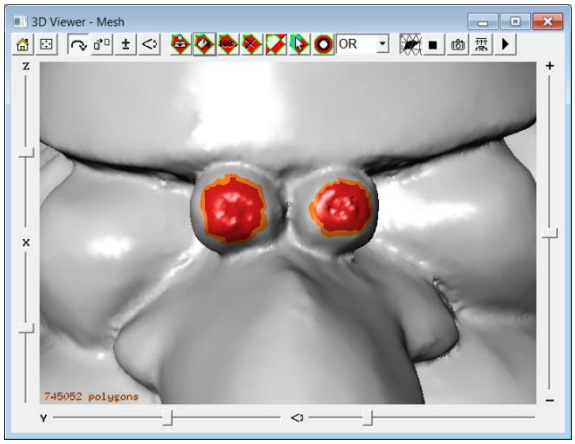


After

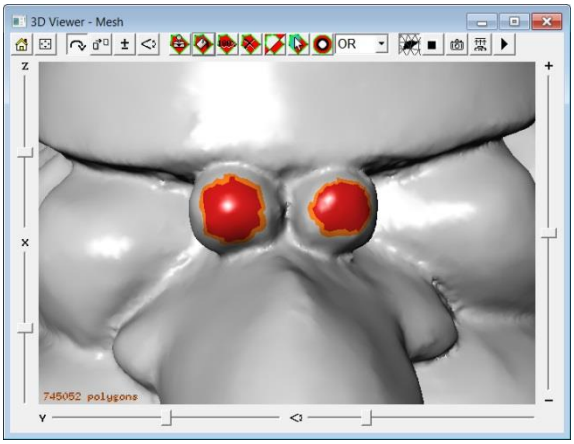
5.3.4 "Cut and Fill"

3D Model → Mesh Options → Smooth (Step size: Large)

Replaces the marked area with a curvature based interpolated area. Useful for selectively consealing coarse errors in geometry.



Before



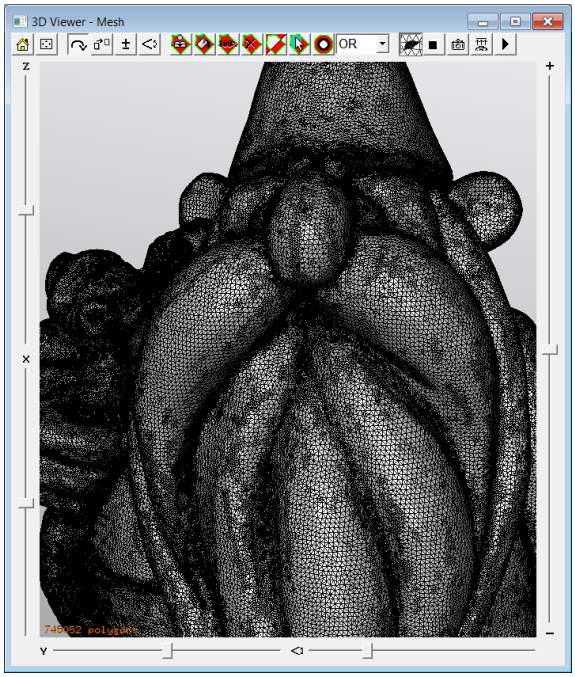
After

5.3.5 Triangle Reduction

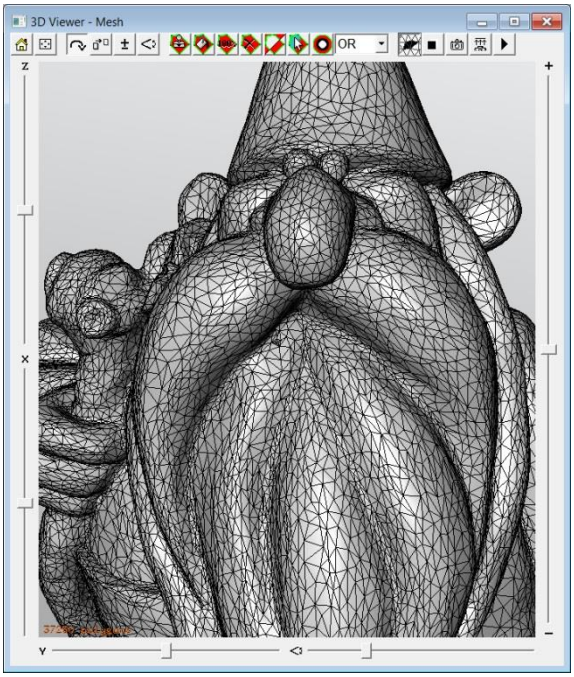
3D Model → Mesh Options → Simplify Mesh

Reduces the number of triangles while keeping the loss of details as low as possible.

Tip: The triangle reduction works more efficiently after "Fine smoothing" was performed.



Full resolution



Reduction to 5%

Settings

"Triangle Quality": The further the slider is to the right, the more uniform will be the angular distribution within the triangles. This will avoid needle shaped triangles.

“Normal Information”: The further the slider is to the right, the more weight gets the curvature in the model. The edges of the triangle will be stronger aligned to the edges in geometry.

The further these sliders are set to the right, the more time consuming will be the computation.

Reasonable settings for faces are: Triangle Quality to 2/5, Normal Information to 3/5.

Progressive Mesh

If “Generate Progressive Mesh” is checked, the software will compute all resolution levels between the current model and the selected target resolution.

Operation

1. If wanted, drag the sliders in the settings to the preferred priority.
2. Keep “Generate Progressive Mesh” checked.
3. Set “Reduction to” to a small value, for example 5%.
4. “Run”
5. The 3D viewer now displays the model reduced to 5% of its original number of triangles.
6. By changing the percentage and clicking on “Apply”, intermediate steps are displayed.
7. You can export the currently displayed resolution as a geometry model (File → Export Geometry / See chapter “Data Export”), but not as a textured model (see “Texturing”).
8. When you have reached the desired resolution confirm with the “Accept” button.
9. You can now texture the final model.

6 Texturing

Texturing means calculating the information from color images onto the 3D model. Texturing should be the final step in the generation of the 3D color model. So please complete the optimization of the 3D model before computing the textures.

Note: The texturing functions are only available if the QTSculptor Texturing Module is licensed.

6.1 External Photos

You can use photos from digital cameras for texturing.

For the best result we recommend to use the DNG format. Software for converting camera-specific RAW-files to DNG can be found under “Tools” in your QTSculptor installation folder.

6.1.1 Preconditions

The camera needs to be set to manual mode:

- Fixed aperture
- Fixed focus
- Fixed zoom factor
- Disabled auto white-balancing

The surrounding lightning conditions need to be stable in all photos.

6.1.2 Import and Color Calibration of DNG images

File → Import DNG / Color Calib

To perform Color Calibration during the import of DNG images, it is necessary to include a photo of a color reference chart (X-Rite “ColorChecker Passport Photo” or “ColorChecker Classic”), taken under the same lighting conditions as the photos used for texturing.

If you do not own a reference chart select “No color calibration” in the upper right area of the dialog and skip Step2.

Step1: Loading Images
Select “Choose DNG Files” to select the images you would like to import.

Step2: Selecting the Reference Scan
Choose the Image that contains the reference chart from the list on the left (Images for Adjustment) and drag&drop it to the list on the right (Color Calibration Reference Scans).

Step3: Color Calibration and Import
Klick “Execute image import / colorcalibration” to import the images to QTSculptor.

6.1.3 Import of TIF or JPG images

File → Import Images

When importing photos the default CAMERA calibration needs to be assigned to all photos. Please confirm with “Yes” or “Yes to all” during the import.

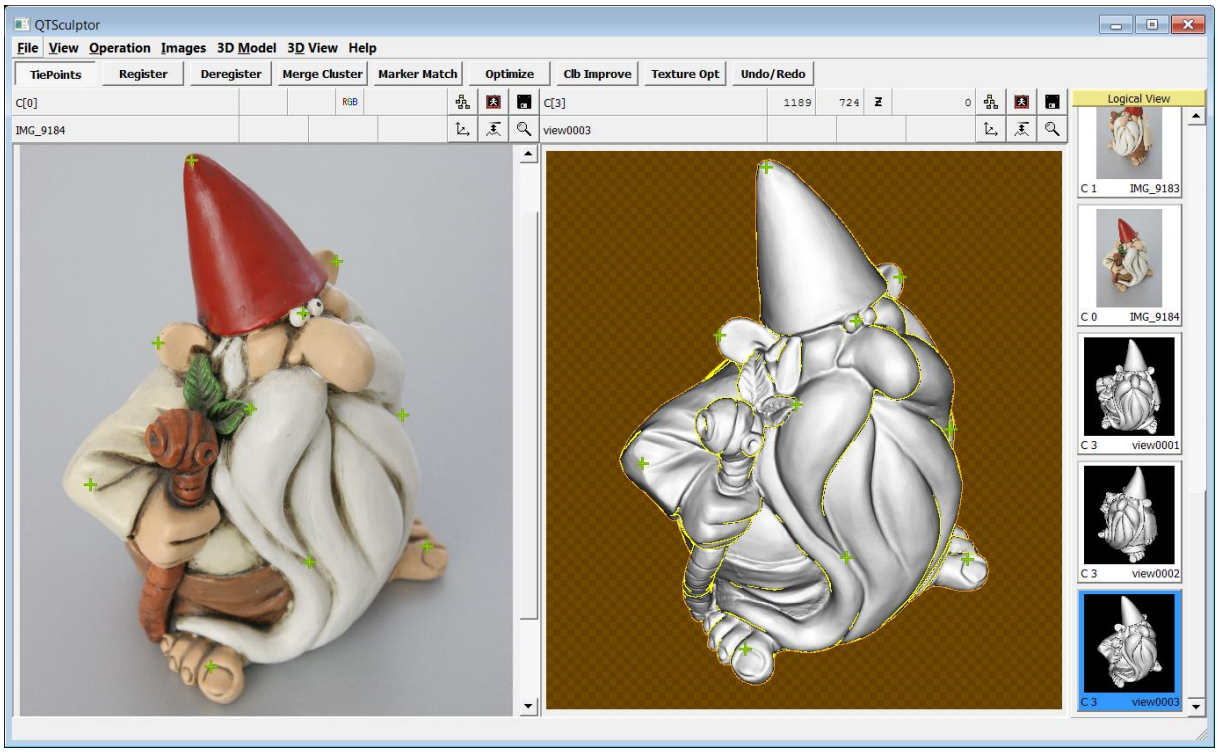
6.1.4 Registration

Operation → Registration

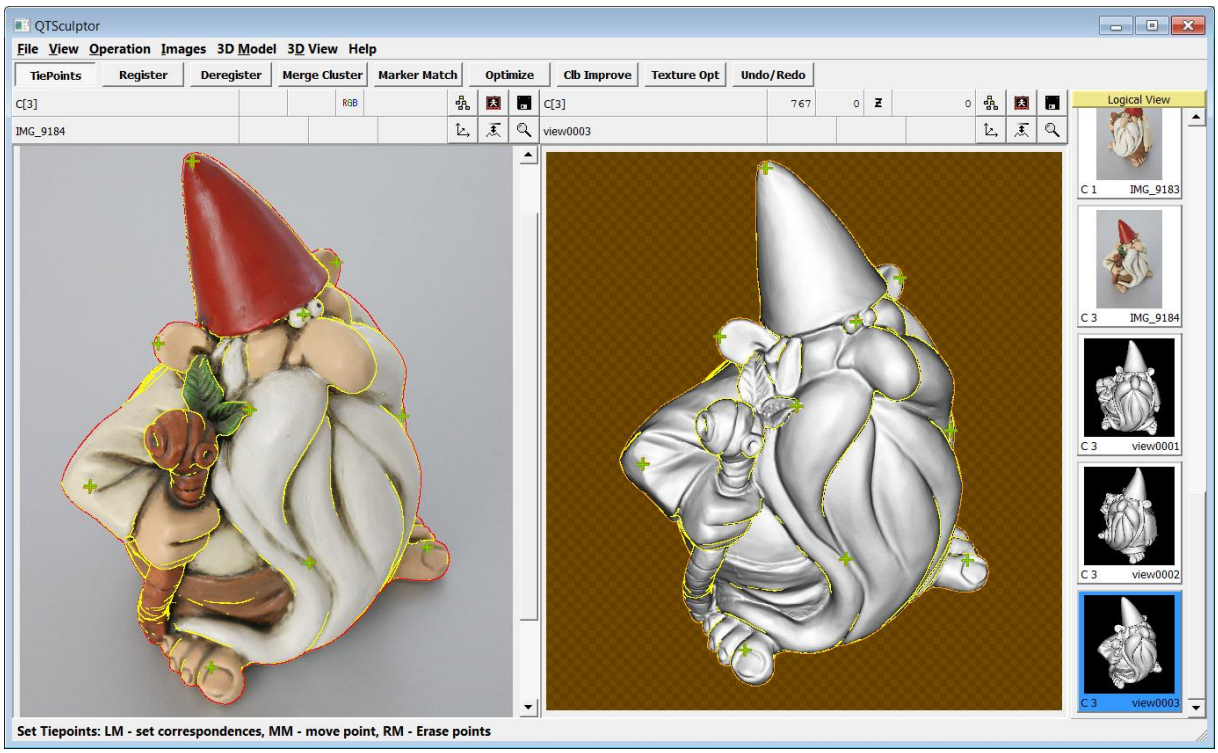
Choose the two-tiled view for the main window. Drag the photo into the first viewer, drag a 3D scan with a similar viewing direction into the second viewer.

If you have problems finding a scan with similar viewing direction you can render a “virtual scan” by opening the 3D viewer for meshes, turning the model into the desired position and clicking “Render viewer contents to range image” ( ). The additional “scan” will be displayed in your list of scans.

For registering color images to the given geometry you need to set “TiePoints”, similar to the manual registration of scans. For color images the software needs at least 4, better more corresponding TiePoints between each color image and the scans. Set the points as accurate as possible. Try to spread the points over the image so that they are far apart from each other – if possible place the points close to the border of the object. Try to choose areas that are different in distance from the camera.



After all Tiepoints are set click “Register”. You will now see how QTSculptor has matched the geometry behind the color image, visualized by the contour lines.



Small differences will be optimized in the next step, after all photos are registrered to the geometry. Nevertheless, if the contours fit the image very badly, you should “Deregister” the color image and try to set the TiePoints more accurately.

After all color images are registered press “Texture Opt”. This will use the overlapping information in all registered color images to improve the registration. You will notice that the contour lines match better after this step.

6.2 Computing Textures

You can perform the computation of the textures in two different ways:

6.2.1 Automatic Procedure - Dialog

3D Model → Automatic Procedure → Texturing

After the optimization of the model is completed, the checkboxes in “Preprocessing” and “Triangulation” have to be unchecked, otherwise the model will be newly calculated (see chapter “Automatic Calculation of the 3D model”)

Size

Specifies the maximum size of the calculated texture images. Reducing the size of the texture images is only useful for quick testing purposes.

“Generate texture atlas” will combine the information from all textured areas into a single texture image.

Supersampling

Optimizes the visualization of very fine structures in distant areas. Supersampling takes up a lot of computation time and may only be useful for objects with high frequent, high contrast colors.

Fill holes

Refers only to missing color information, not the geometry of the model. In areas where no color information is available, the software can calculate intermediate values to conceal these areas optically.

“All holes” completely interpolates all areas without color information, but doesn’t look good in very large areas.

“Small holes” interpolates only small areas.

“No filling” only calculates textures where actually color information is available.

Default texturing settings

Resets all texturing parameters either to the calculated values if you have chosen “use estimated settings” from the “Settings” tab or to the last saved values if you have chosen “use current settings” from the “Settings” tab.

6.2.2 Compute Textures - Dialog

3D Model → Compute Textures

“Texture size” specifies the maximum size of the calculated texture images. Reducing the size of the texture images is only useful for quick testing purposes.

“Supersampling” optimizes the visualization of very fine structures in distant areas. Supersampling takes up a lot of computation time and may only be useful for objects with high frequent, high contrast colors.

“Fill holes with texture” refers only to missing color information, not the geometry of the model. In areas where no color information is available, the software can calculate intermediate values to conceal these areas optically. “-1” will fill all missing areas. “0” does no filling. Any other number will interpolate one row of triangles for each iteration step. The preset of “8” will fill medium size holes.

“Generate texture atlas” will combine the information from all textured areas into a single texture image.

“Fast preview mode” will calculate a fast preview of the texturing. No smooth interpolation between differing color values will be calculated

6.3 Segmenting Color Images

If you scan faces or use external photos for texturing, the color information may not exactly fit the geometry. This will cause slightly moved or double color details or even the use of background information for texturing. The overlaid edge information, that is displayed in the color images after calculation the textures, can be used as an indicator where color and geometry information do not match. Please use the segmentation tools (see section “Segmentation”) to mask out such areas. Re-calculate the texture after optimizing the color scans.

6.4 Importing Geometry for Texturing into an Existing Project

You can add exported meshes to an existing project using “Import Images → Geometry”. Always choose a project in which the model calculation is already done, because otherwise the orientation between the color and the 3D information does not match. If you are editing meshes outside QTSculptor and plan to do texturing in QTSculptor after editing, assure that the orientation of the model is not changed in relation to the world coordinate system.

7 Data Export

File → Export Geometry

You can export your models in the common triangular mesh formats. Please note that only OBJ and VRML can store additional high resolution color information. If you want to export a textured model you will have to calculate textures in advance (see section “Texturing”).

For more information about exporting your 3D model see chapter “Export Geometry”

Thank you for using QTSculptor.

Note: If you move your mouse over a button or entry field in QTSculptor there will usually be a short description that gives you some additional information.

If you encounter problems while using QTSculptor or if you have any suggestions how to improve QTSculptor feel free to contact us.

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