iQ-3D

USER MANUAL

Version 3.1.0 Release INT EN 003R

CE 0482

IMAGE Information Systems Ltd.

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CE CONFORMANCE STATEMENT

IMAGE Information Systems Ltd. does not accept liability for the wrong or unprofessional use of the described software (see the End User License Agreement).

iQ-3D is certified as a medical device for 3D image post-processing, according to Council Directive 93/42/EEC concerning medical devices and according to FDA 510(k). Nevertheless, diagnosis can only be made using special high-resolution monitors.

Please note the current regulations and prescriptions for secondary capture images.

All patient names used in this manual are completely fictitious.

Throughout this booklet trademark names are used. Rather than put in a trademark symbol at every occurrence of the trademark name, we state that we are using the names only in an editorial fashion and to the benefit of the trademark owner with no intention of infringing of the trademark.

We assume no responsibility for inaccurate information or description of third-party products.

We are dedicated to improving and enhancing the software of our medical imaging and communication system. Consequently, the information in this manual is subject to change without notice. Current information about product improving can be received from the iQ-3D homepage: http://www.image-systems.biz/en/products/iq-system-pacs/workstation-software/iq-view-3d.html or IMAGE Information Systems homepage www.image-systems.biz.

Further inquiries can be addressed to: info@image-systems.biz.

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November 2011

0 INTRODUCTION

Thank you for using iQ-3D!

iQ-3D turns every iQ-VIEW / PRO viewing station into a full-featured 3D Workstation for all kinds of 3D image processing, e.g. vascular, neuro-radiological, traumatological, orthopedic and cardiac imaging. iQ-3D is an optional module for the iQ-VIEW and iQ-VIEW PRO viewing software and can therefore only be used in conjunction with an iQ-VIEW / PRO license.

The iQ-3D module includes:

- Orthogonal and Oblique Multiplanar Reconstructions (MPR),
- Maximum Intensity Projections (MIP),
- Surface Shaded Display (SSD),
- Volume Rendering (VRT),
- Image filters (sharpen, soften, edge preserving, etc.),
- Cropping and Clipping functions,
- Export functionality.

1.1 ABOUT THIS DOCUMENT

This document provides help regarding all comprised functions and control elements. Additionally, step-by-step guidance to specific task is provided.

NOTE:

Most chapters refer to other sections in the document since it is divided into a descriptive and a functional part. You can easily navigate to the corresponding chapter by ***simply clicking on the chapter number****.*

1.2 SYSTEM REQUIREMENTS

MINIMUM SYSTEM REQUIREMENTS:

SPECIFICATION	REMARKS
Processor	Pentium IV CPU ≥ 1,5 GHz or comparable AMD processor
Main memory	Min. 1 GB RAM (depending on the 3D datasets)
Hard disk	Min. 20 GB hard disk (DMA33 capable), depending on the volume of the data to be saved temporarily
Network	TCP/IP Network connection with 10 Mbits/s with UDP support
Graphics card	Any OpenGL 1.5 capable graphics card from Nvidia or ATI with 64 MB RAM
Display	Any color monitor with resolution of 1024 x 768 or more, ≥17" for demonstration, high resolution displays for diagnostic purposes
Operating system	Windows XP Pro 32 bit SP3 or Windows 7 Pro 64bit SP1

RECOMMENDED SYSTEM REQUIREMNENTS:

SPECIFICATION	REMARKS
Processor	Modern Intel Quad Core CPU ≥ 2GHZ
Main memory	Min. 3 GB RAM
Hard disk	Min. 500 hard disk capable (DMA33 capable)
Network	TCP/IP Network connection with 100 Mbits/s with UDP support
Graphics card	High end 3D graphics card from latest Nvidia GeForce series (e.g. GeForce 280, 380, 480 etc.), but at least a GeForce 8800. With 1 GB RAM and 256 bit bus width.
Display	High resolution medical color display with ≥ 22" for diagnosis
Operating system	Windows 7 Pro 64bit SP1

Furthermore, we recommend the use of up-to-date anti-virus software on the computer on which iQ-3D is run together with iQ-VIEW or iQ-VIEW PRO. The virus definitions must be updated regularly (they should not be older than 2 weeks). Due to known issues / incompatibilities (e.g. regarding the blocking of system files and ports), we do not recommend using AntiVir as an anti-virus software.

To keep constant the power supply voltage we recommend the use of an uninterruptible power supply (UPS). The interposition of such a device prevents data losses and data inconsistencies that can be produced at the occurrence of fluctuations in the power supply voltage.

In case of slowdowns we strongly advise you to try out the internal benchmark process and to read the separate document “iQ-3D – Administration guide”.

2 INSTALLATION AND LICENSING

iQ-3D as a module is already included in the iQ-VIEW software package. Thus, you need to install iQ-VIEW on your computer. The installation procedure of iQ-VIEW, as well as the license activation of iQ-3D, is described in "iQ-3D 3.1.0 Administration guide" document. Please consult that document for more information about this topic.

3 USAGE OF THE SOFTWARE APPLICATION

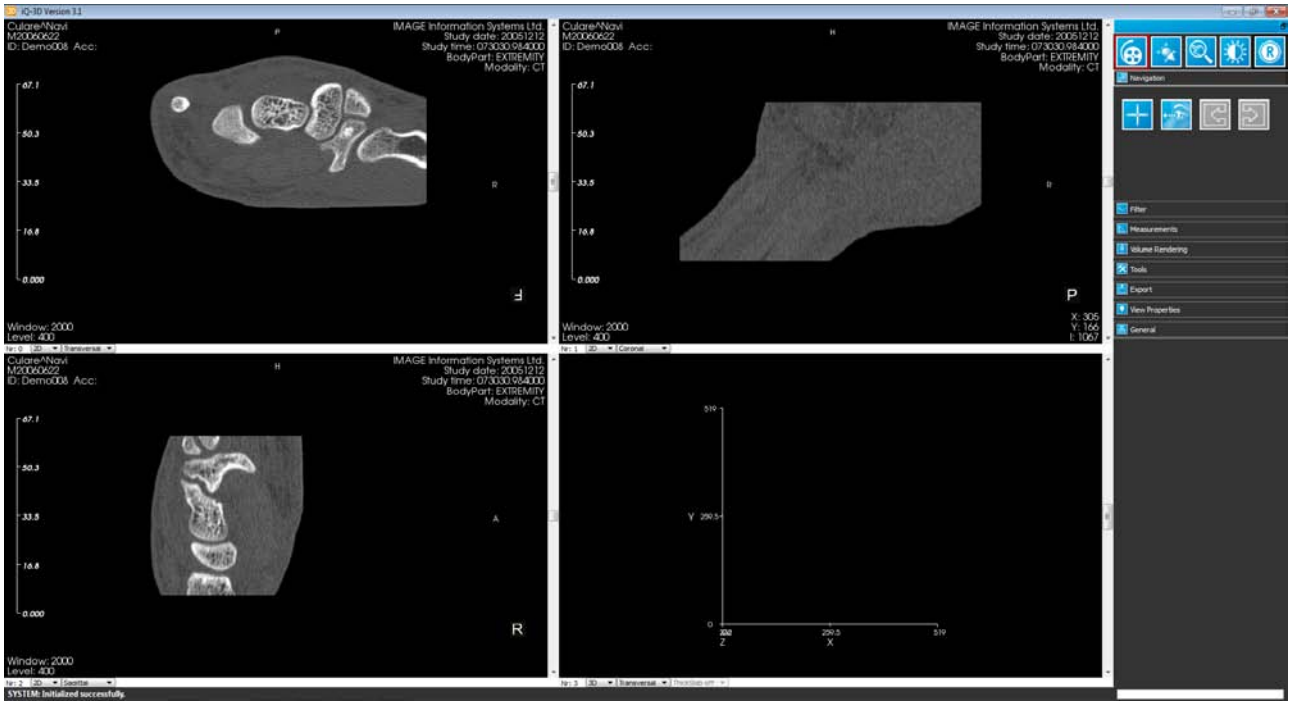
3.1 STARTING THE iQ-3D APPLICATION

To create a 3D volume of an image data set, you need to open the appropriate study in the iQ-VIEW image viewer and select the series you want to use for 3D post-processing. To select a series just click on the appropriate image on the viewer, a blue frame will indicate the correct selection.

iQ-VIEW image viewer

To start iQ-3D select the “3D” – “MPR + Volume Rendering” button in the toolbox of the viewer application.

After you clicked the button the volume will be calculated and iQ-3D starts by showing its main frame. It consists of an image processing area that is tiled into 2x2 views by default (can be tiled into max 6x6 views). A toolbox on the right side gives access to all functions. A status bar indicates running processes and informs you about errors. Please consult chapter 4 for problems with starting the application.



iQ-3D application

An orthogonal and oblique multiplanar reconstruction (MPR) is created out of the selected image series and displayed in three tiles of the image processing area. The fourth tile is reserved for 3D reconstructions. These user-defined reslice planes let you interactively explore a dataset by changing their position and orientation in space. MPR is applicable for all cross sectional volumetric data.

WARNING:

Medical findings should always be made only on the basis of the original image data and never from 3D post-processed images.

3.2 GENERAL CONCEPT

iQ-3D is state driven and context depended. The first means, buttons do not always correspond directly to functions and clicking them will not always result in starting a process. Some buttons just define a state. A state is something that tells the application how to behave in certain situations. Some buttons do both, setting a state and processing data. Buttons that set states will be framed red when clicked:

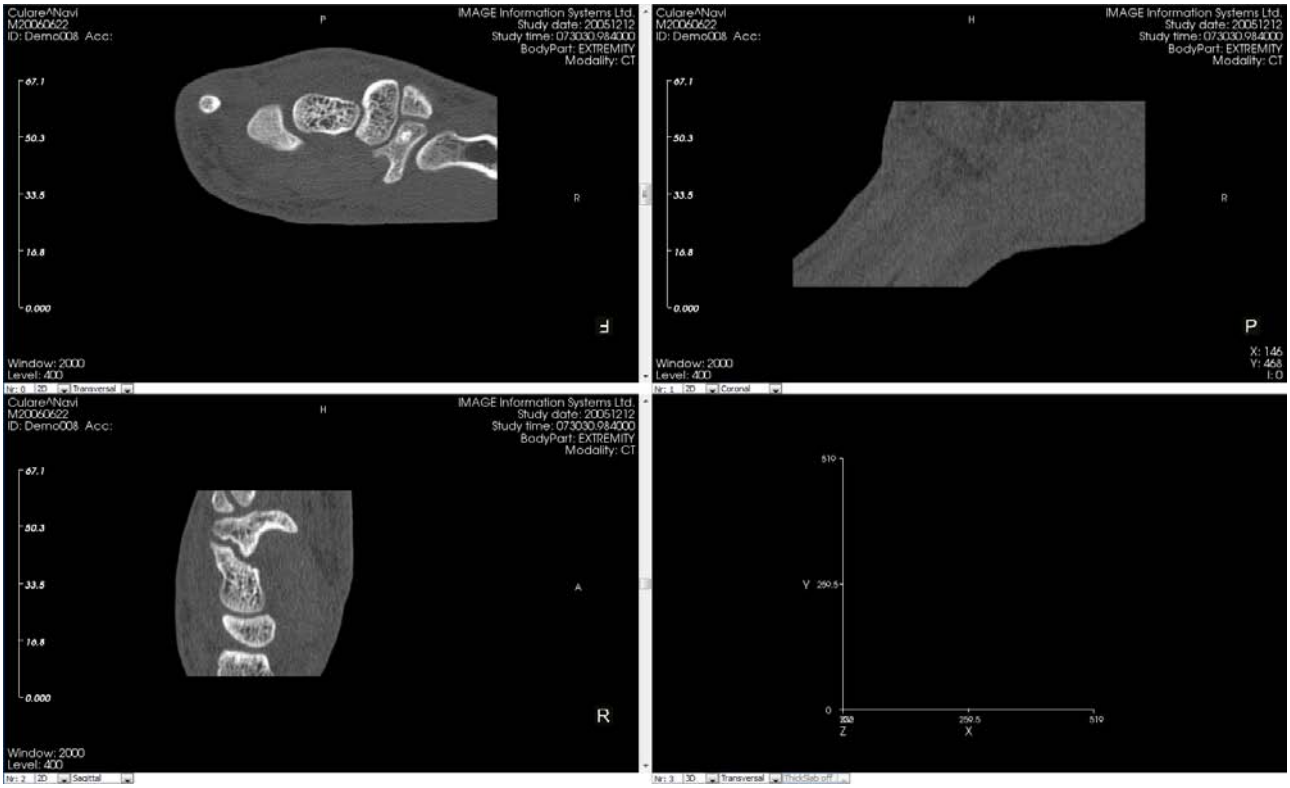
The navigation tab showing tilt as active state

In the picture above, the tilt button is active; therefore the state “tilt” is active too. Now for example mouse motion has a different meaning than in another state.

iQ-3D always tries to use the same buttons for functions that are similar to each other, to keep the program lucid. In order to achieve this, sometimes the meaning of a button is depending on the active context. In this case handling can vary, so you should be aware of that.

3.3 THE IMAGE PROCESSING AREA

The image processing area is used to render any visual results and for direct user input. It is divided into different views. The number of views can be defined by the user. The standard appearance is the following: The upper left and right windows as well as the lower left window are reserved for multiplanar reconstruction, the lower right window for representing the volume using different volume rendering methods. However you can redefine views and create new ones as you need.



The image processing area

3.3.1 2D VIEWS

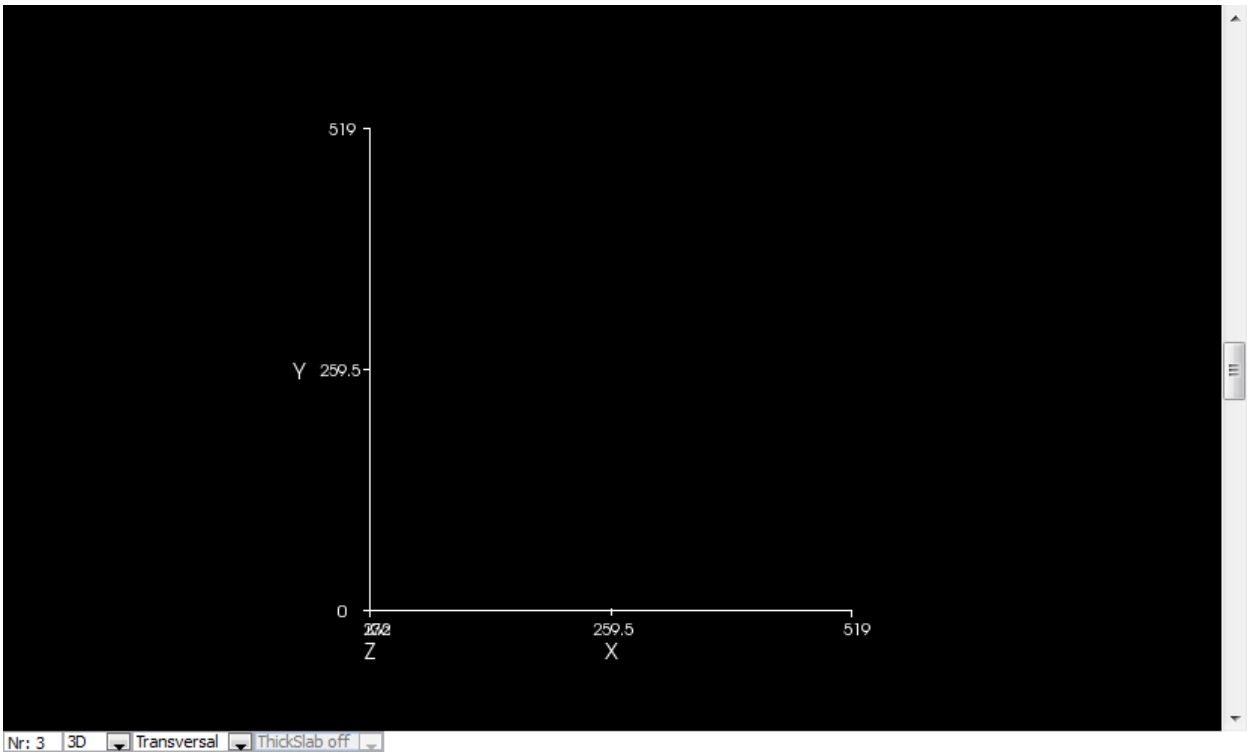
When starting the application, the created volume will be resliced (MPR) in the three orthogonal views: transversal, coronal and sagittal. The reslice orientation can be changed to any oblique angle.

3.3.2 3D VIEWS

3D views let you examine the space the volume resides in. At startup it will only show a three-dimensional axis to give you information about position and orientation in space.
Besides helping the user to navigate in space the main usage of this window is to show a rendered volume. To render a volume out of the loaded dataset you can choose between three different methods:

- VRT – Volume Rendering Technique
- MIP – Maximum Intensity Projection
- SSD – Surface Shaded Display

Chapters 3.4.5 and 3.5.3 - 3.5.7 explain how to do that.



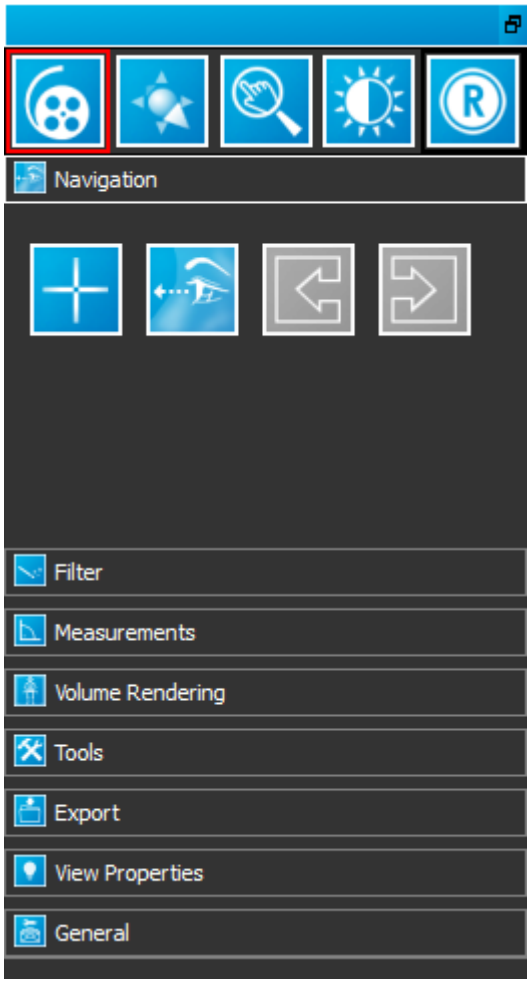
3D view

NOTE:

A double-click with the left mouse button into one of the images enlarges this image to fill the entire image processing area. Another double-click returns to the originally set tiling with the image fit into the available space.

3.4 THE TOOLBOX

The toolbox gives you instant access to all functions:



The toolbox

The panel is grouped into eight different categories (tabs):

- Navigation
- Filter
- Measurements
- Volume Rendering
- Tools
- Export
- View Properties
- General

The toolbox also contains **speed buttons** for frequently used functions.

NOTE:

You can detach the toolbox and drag it to another place on the desktop, e.g. a second monitor. Move the mouse cursor over the blue stripe at the top of the toolbox, click and hold the left mouse button and move the toolbox to another position.

3.4.1 SPEEDBUTTONS

The “Speedbuttons” group contains buttons that define the active navigation state you are currently working in.

The Speedbuttons group

Stack

On a 2D view it can be used to quickly browse through a series of images (e.g. CT, MRI, PET-CT) in any view by moving your mouse up and down within the MPR views while holding the left mouse-button pressed. Alternatively, you can use your mouse-wheel or Key up and Key down to browse through the series. Both methods will still work while another tool (e.g. Window/Level) is selected. Using the sliders on the right side of each view gives you another possibility to quickly stack through a dataset.

On a 3D view the stacking tool can be used to rotate the 3D object.

Tilt

On a 2D view an image can be flipped and tilted in all 3D levels by moving the mouse accordingly while holding the left mouse button pressed.

Moving the mouse button:

left	→	tilts the image to the left
right	→	tilts the image to the right
up	→	tilts the image to the front
down	→	tilts the image to the back

The upper and lower areas of each view act as “rotate zones” where you can spin the image.

On a 3D view the tilting can be used to rotate the 3D object (same functionality as stacking tool).

Pan/Zoom/Rotate

On a 2D view it is used to change the size of an image, to move it into another position or to rotate it. The center area of the view-windows acts as a “pan zone”. If you click into the center and move the mouse up/down/right/left, the image will be moved. The periphery of the individual windows acts as “zoom zone”. If you click into the periphery and move the mouse up and down you can steplessly zoom the image. The upper and lower areas of each view act as “rotate zones” where you can spin the camera that looks onto the image.

On a 3D view this tool is used to change the position of the 3D object.

Window/Level

On a 2D view an image can be windowed by moving the mouse left/right and up/down, holding the left mouse button pressed while in one of the MPR views.

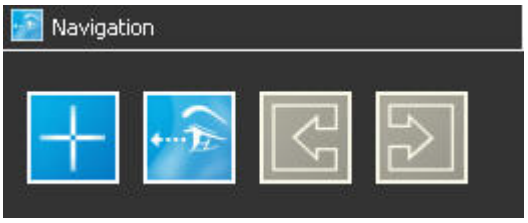
On a 3D view this tool gives the user the possibility to scroll thru the tissue of the 3D volume. Hold the left mouse presses and move the mouse horizontally or vertically.

Reset

Resets the oblique projections of all 2D views and returns the viewing positions to the starting positions. This tool does not affect the 3D view.

3.4.2 NAVIGATION

The Navigation tab contains buttons that provide tools to help you with navigation in 2D or 3D space.



The Navigation tab

3D-Cursor - is used to find the position of a selected point in all 2D views. Drag the cursor cross with your left mouse button in one of the MPR views and locate the position you want to analyze. The positions of all other MPR views will be updated automatically.

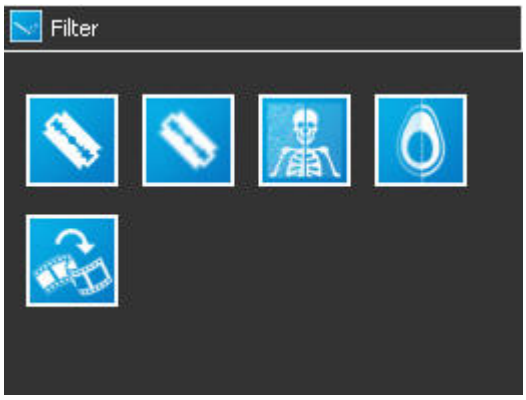
Crosswidget - can also be used to find the position of a selected point in all 2D views. You need a minimum of three 2D views open to use that widget. Like the 3D-Cursor you can drag the cross to locate a position, but you can also rotate the widget. To do that, click one of the arms of the cross with the left mouse button, hold the mouse button and drag the mouse.

Undo - an undo function that lets you revert an unlimited number of user interactions step by step. All navigation changes (Stack, Tilt) are supported.

Redo - a redo function that lets you redo all previous undo operations on a step-by-step basis.

3.4.3 FILTER

The Filter tab contains buttons that provide sets of image filter. These sets are grouped into image filter types: sharpen, soften, noise removal, edge preserving and invert.



The Filter tab

Sharpen filter – this group contains methods to enhance the clarity of the images.

Soften filter - this group contains methods to soften images (blur effect).

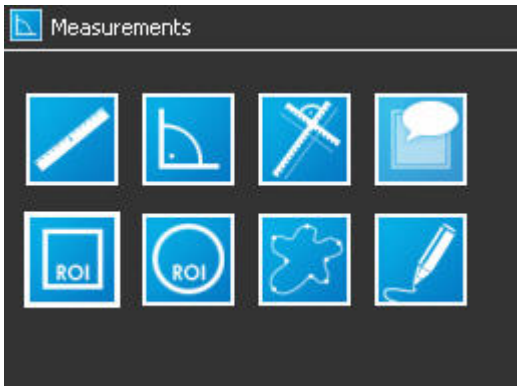
Noise reduction filter - methods to remove noise (e.g. white noise produced by capturing devices).

Edge enhancing filter – methods to find edges in the images and improve their strength. This gives similar results as a sharpen filter, but changes only edge information.

Invert filter – invert all voxel values. This results in an inverted image where low values are white and high values black.

3.4.4 MEASUREMENTS

The measurement tab provides access to often used measurement tools.



The Measurement tab

Distance measurement - is used to measure distances in an MPR image. To measure a distance, first press on the distance measure button, and then simply click with your mouse on one end of the distance you want to measure, hold the left mouse button pressed until you reach the end point and click again to confirm. You can also adjust the position of the handles afterwards by selecting and dragging them to the desired location. The result is given in millimeters.

Angle measurement - is used to measure angles in an MPR image. To measure angles, first press on the angle button, then draw the first ray like drawing a distance measuring line. Confirm with a click and start the second ray from that point. All three points constituting the angle may be moved to other positions afterwards.

Orthogonal distance measurement - similar to the distance measure tool, this lets you measure two distances that are always orthogonal onto each other.

Annotation - add a labeled annotation. Click on the point of interest you want to annotate. Input your annotation into the dialog that appears afterwards.

Rectangle ROI - a tool for measuring the density in a region of interest (ROI). Several properties will be shown: the minimum, maximum and mean density values of the selected area as well as the standard derivation. Hold the left mouse button and draw the region of interest in one of the MPR views.

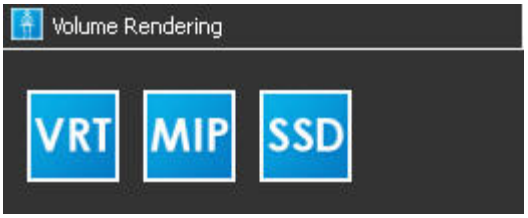
Circle ROI - a tool for measuring the density of a region of interest (ROI). Similar to rectangle ROI but drawing a circle.

Polygonal ROI - a tool for measuring the density of a region of interest (ROI). Similar to rectangle ROI but you can define all kinds of shapes with this tool. Adding points to the view will define a closed surface that is used for ROI measurement.

Pen based ROI - a tool for measuring the density of a region of interest (ROI). Similar to point based ROI. With this tool you do not add single points but draw continuously a user defined shape.

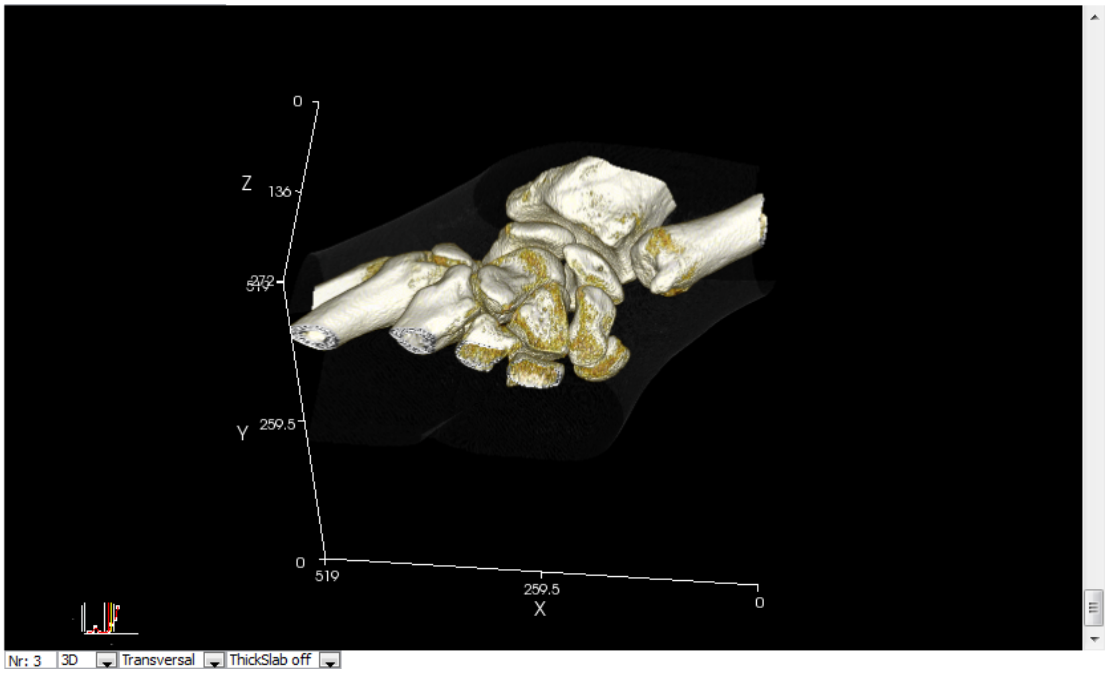
3.4.5 VOLUME RENDERING

Volume Rendering creates volumetric representations using different techniques. This can be useful to better explore the image series.



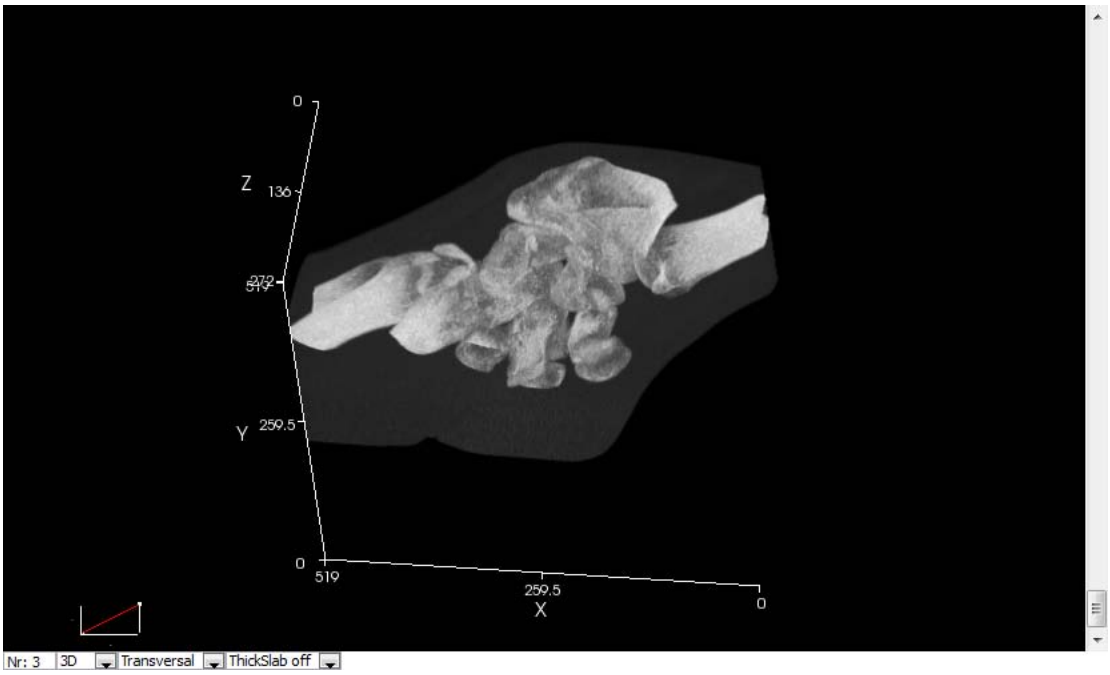
The Volume Rendering tab

VRT – VRT means "Volume Rendering Technique" and starts the volume rendering process using color mapping. The application comes with predefined mapping functions called presets. When clicked it will start with the standard preset that can be changed in the configuration page.



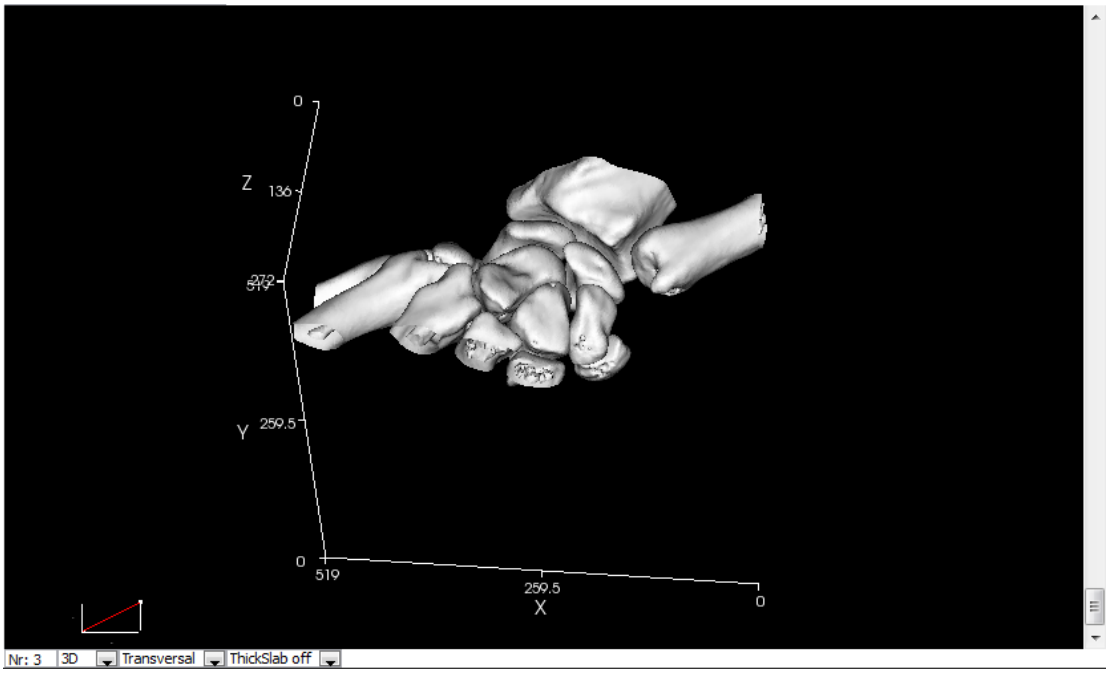
A VRT presentation in the 3D view

MIP – this button starts a Maximum Intensity Projection. It also provides additional function, e.g. Minimum Intensity Projection.



A MIP presentation in the 3D view

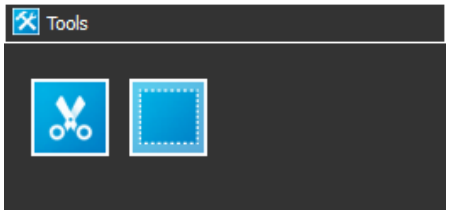
SSD - a surface shaded display calculation can be started by clicking on the SSD button. Additional buttons are revealed that let you change certain parameters.



A SSD presentation in the 3D view

3.4.6 TOOLS

Tools provide task-specific complex functions, e.g. removing a user defined shape out of the image stack. This comprises several interactive steps – placing the contour, building a shape, perform cropping.



The Tools tab

Crop volume – using this function, it is possible to permanently remove a volume of interest (VOI) in a 3D representation.

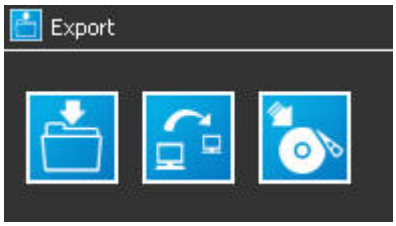
Clip volume - using this function, it is possible to define a temporary volume of interest in a 3D representation and to clip (temporarily hide) the rest.

NOTE:

This software will under no circumstances change the original DICOM images. It always works with a copy of the dataset. You can safely use cropping and clipping and also undo all changes.

3.4.7 EXPORT

This category provides several methods to export views or series to several targets. You can select from a range of common data types how you would like your images to be stored.



The Export tab

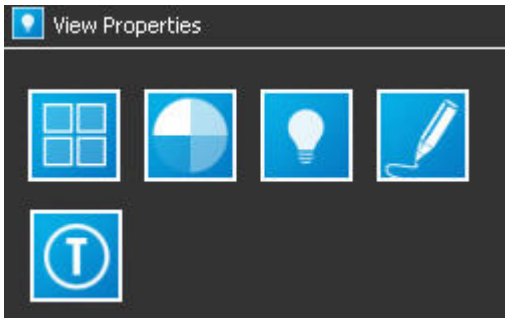
Export to image box – This will create images from the selected view and export them to the local imagebox of iQ-VIEW. Only DICOM images can be exported here. The created snapshots are appended as a separate series to the study that is stored in the local imagebox. This series will then be displayed regularly in the viewer and can be further processed (windowing, measurements, printing, etc.).

Export to remote node – This will create images from the selected view and export them to any remote DICOM node that is already configured in the main application (iQ-VIEW). This makes it possible to directly transfer the exported views to a DICOM modality or archive. Only DICOM images can be exported here.

Export to file system – This will create images from the selected view and export them to the local file system. All supported file formats can be used here (e.g. DICOM, JPG, BMP...)

3.4.8 VIEW PROPERTIES

View Properties includes functions that let you configure certain properties of 2D and 3D views.



The View Properties tab

Tiling – Here you can define the number of views in the image processing area and their respective type (2D/3D/Off).

Color remapping– provides a collection of window level presets and some color remapping presets. Just select the desired item from the dropdown box.

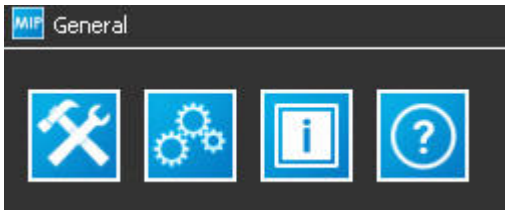
Light management– enables better control over the lighting in any 3D view. This will provide better rendering results. You can define back lights, top and head lights and a variety of parameters.

Camera control – Moving in 3D space can be a daunting task. This gives you fine control over a 3D camera.

Toggle overlay– Turn overlay on/off. Besides the better vision on the images, turning overlays off, might result in better performance (orientation computation is disabled).

3.4.9 GENERAL

This section gives access to all kinds of general functions like system configuration or licensing information.



The General tab

Analyze system – a useful tool to check if your computer meets the high requirements that are common in the field of 3D computation. Specific benchmarks give you a clear overview of possible bottlenecks. The scoring-based results are varying from 1(worst) to 11(best).

Configuration – here, a lot of parameters can be changed to tailor the application to your needs. The startup section lets you define if certain events are automatically triggered on startup (e.g. Create 3D Visualization or enable 3D Cursor).

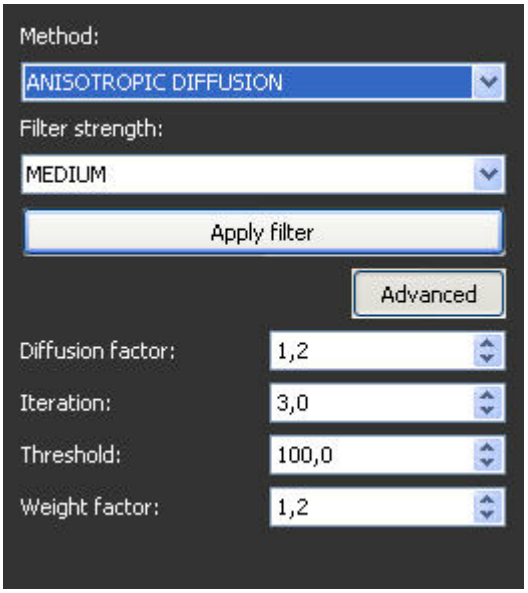
System information – detailed info on the current installed license with options to reset to default (e.g. when migration to another system). Also the installed version and vendor contacts are provided.

Help – Opens this user manual in any PDF reading tool (e.g. Adobe Acrobat Reader).

3.5 DYNAMIC DIALOGS

Dynamic dialogs are context-dependent and provide more options to some of the buttons described in the former chapters. They only appear when the button is selected.

3.5.1 FILTERS



Smooth filter dialog showing anisotopic diffusion settings

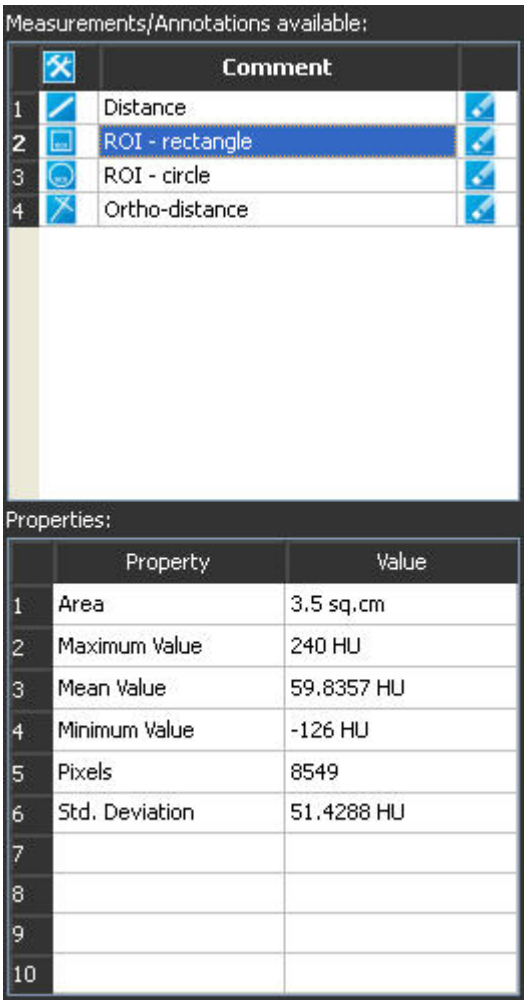
All image filters use dialogs similar in structure to add more options:

Filter method: Here you can choose the algorithm that is used to achieve the task. You can try out which work best for your dataset.

Filter strength: Choose between weak, medium and strong filtering or just turn the filter off.

Advanced button: When pressed the dialog shows additional parameters to fine-tune each method.

3.5.2 MEASUREMENTS



Measurements table showing all present measurements and the property of ROI-rectangle (selected)

All measurements are stored in a global measurement table, ordered according to their creation time. If you click on an entry the property table will be populated with values specific to this tool. Measurements are created on the slice and will be invisible when moving to another slice (e.g. when stacking or tilting the image). A click on the tool (on the table) will jump to the corresponding slice and highlight the tool. You can easily remove tools by clicking the rubber button.

3.5.3 VRT

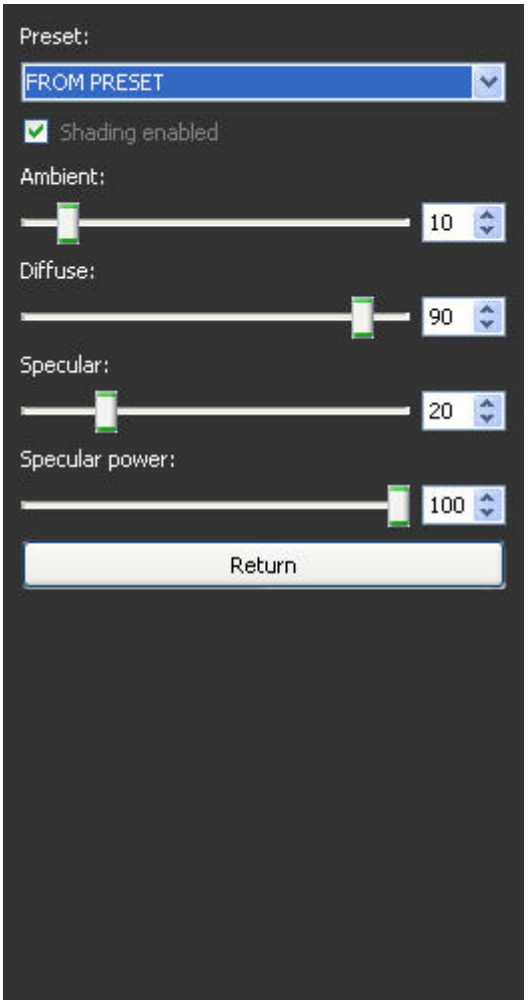
Main VRT Dialog

The color group shows the selected color line with RGB values and scalar value. You can add new colors, remove colors and change the RGB color and/or scalar value.

The Opacity group shows the selected opacity point, scalar value and opacity in percent. You can add new points, remove points and change a point's value and/or opacity.

The shading button opens the shading dialog (see below).

The save button lets you save a created preset to disk. Just provide a name and confirm. The preset can be found in the custom folder (see preset selection dialog).



Shading dialog

Shading dialog – Change the ambient, specular and diffuse parameter or disable shading and lighting at all.

Preset selection box: Select one of the presets (Glossy, Pale, Normal) to automatically adjust the sliders. “From preset” will read the values stored in the active preset.

Ambient: Is the amount of light that comes from no particular spot in the scene but rather from the surrounding environment. This determines the overall visibility of the volume.

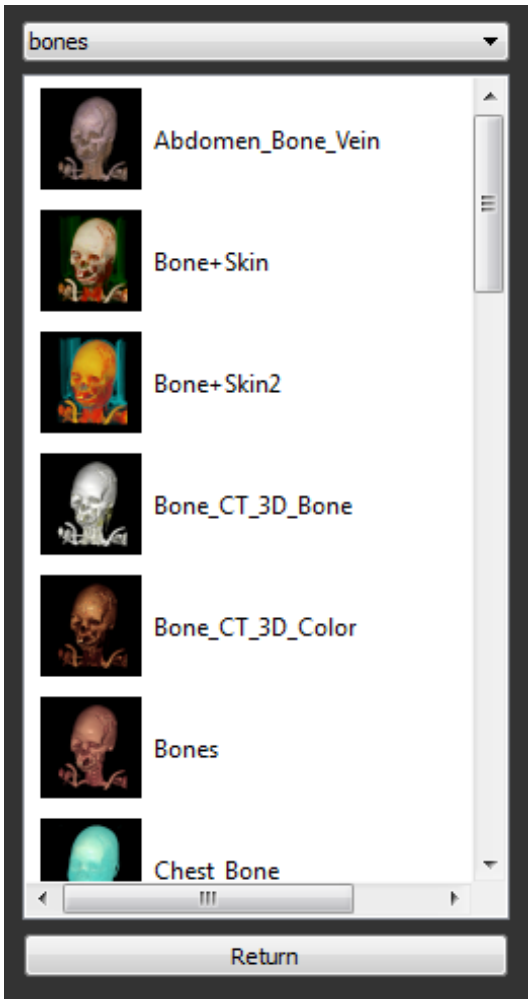
Diffuse: Diffuse light appears to emanate from one direction, but it does not reflect sharply. It appears brighter on a surface perpendicular to its direction and much less bright on a surface that lies at an oblique angle to the diffuse source.

Specular: Is the amount of light that that comes from a well-defined direction and reflects well in a particular direction. It will change the reflective characters of your volume. So adjusting the level will change the glossiness of the material.

Specular power: A modulating parameter that influences the effect of the specular term.

NOTE:

Objects with too much specular power will look more plastic, so be sure to keep that level low. When "Use lighting and shades" is turned off, none of the sliders will have an effect on the rendering. Turning it off will decrease realism but significantly increase rendering speed for volume rendering.



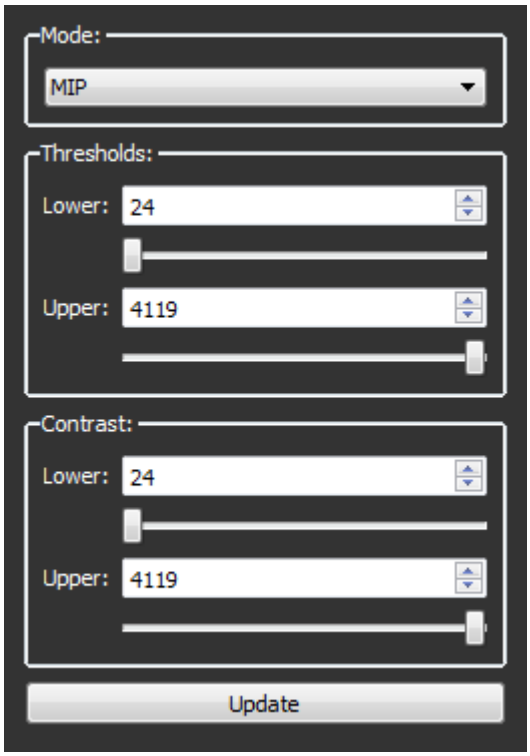
Preset selection dialog

Preset location box: Select one of the folders where presets are stored. The standard location gives access to most needed presets. The custom folder contains all self-created presets while all other locations are presets similar to presets in other applications.

Just click one of the visual representation images to auto apply the preset.

To return to the main VRT dialog, either double click on the desired preset or press the return button.

3.5.4 MIP



Main MIP dialog

Mode: Select Maximum Intensity Projection (MIP) or Minimum Intensity Projection (MinIP). The former will show the highest voxels white while the latter will whiten the lowest intensity voxels.

Lower and upper threshold: This defines the scalar range that is taken into account when creating the visualization. You can avoid showing parts of the volume that have very high or low values but are not of interest for the diagnostic findings (e.g. metal plates).

Lower and upper contrast: This defines the range of brightness. The upper contrast threshold lights up the tissue with the defined values, while the lower contrast thresholds black it out.

3.5.5 SSD

Main SSD dialog

Quality – This selection will affect the rendering quality by reducing the amount of polygons that are needed to draw one single image. Medium quality gives good visual results and interactive speed. High quality results in a high amount of polygons that can slow down your computer. Since high quality can be quite expensive computationally, it is recommended to choose the quality level depending on the speed of your computer.

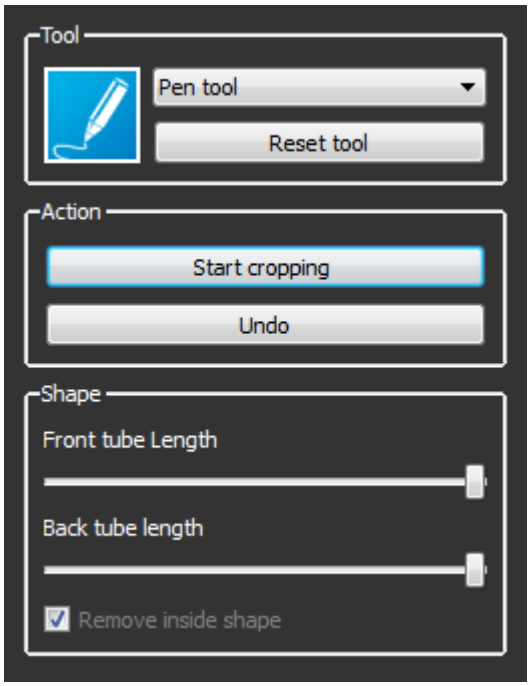
Noise filter strength – Can be applied to reduce artifacts (noise) that disturb the visual quality of the rendering. You can choose the intensity of this filter. Strong filtering will reduce more artifacts than lower settings.

Smooth filter strength – This selection will try to smooth all polygons in order to increase the visual appearance, however smoothing too much will result in information loss.

NOTE:

The filtering does only affect SSD and is not permanent, meaning it will not be applied to the original dataset.

3.5.6 CROPPING



Main cropping dialog

Tool selection box: Several tools can be chosen to create a shape that will later be used to define a tube. The tube acts similar to a stencil. You can choose between a rectangle, a circle, a poly tool and a pen tool. The handling of those tools is identical to their corresponding ROI measurement tools.

Reset button: Remove all created shapes and reset the active tool to its initial stage.

Start cropping: Performs the actual cropping.

Undo button: Undo all croppings.

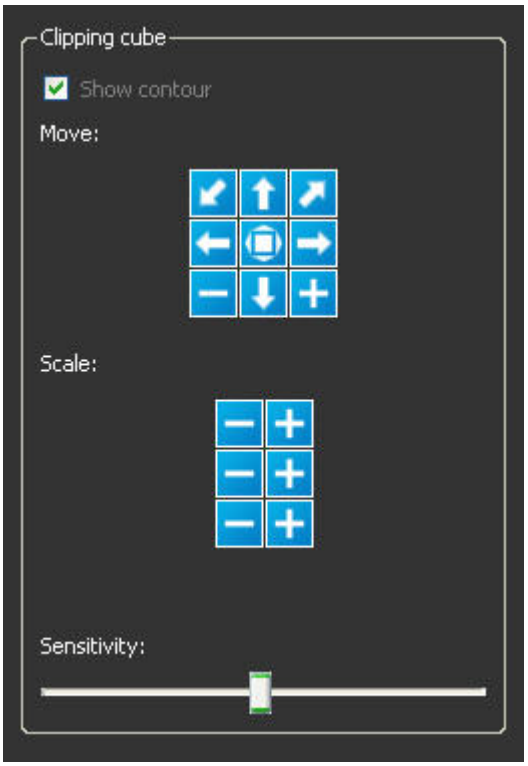
Front/Back tube length: Moving this slider will change the extent of the stencil tube in the desired direction. If both sliders are on the right side a 100% extension is chosen and results in a tube that completely intersects the volume.

Remove inside shape checkbox: If selected, everything inside the created stencil will be removed otherwise everything outside of it leaving only the inside.

NOTE:

You can perform as many cropping steps as you wish, since it can be easier to draw a complex shape in several steps.

3.5.7 CLIPPING



Main clipping dialog

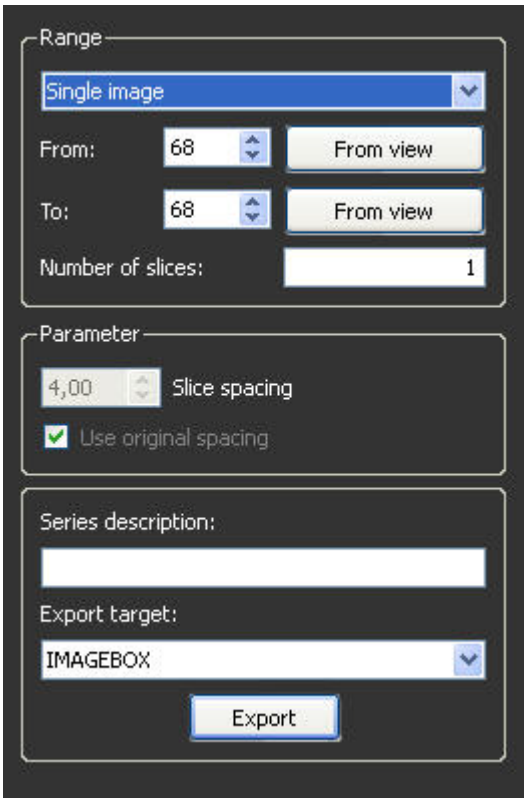
Show contour checkbox: If selected, all available views will show a contour representation of the clipping box. 2D views will show the contour as cross sections in the image while 3D views show opaque cubes.

Move widget: Gives you fine control over the clipping box and lets you move the box.

Scale widget: Gives you fine control over the clipping box and lets you scale the box.

Sensitivity: Defines how much the above-mentioned widgets will move/scale with on click.

3.5.8 EXPORT



2D view export dialog

Range selection box: Choose between single image, full range or custom. Single image will use the current slice position, while full range will stack iteratively through the volume and export all images.

From/To spin box: Slice to begin/end export.

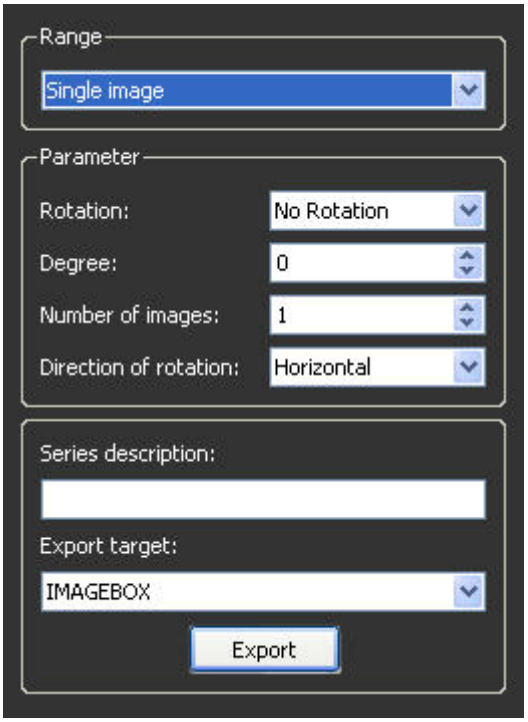
From/To view button: A click on this button will add the current image number to the From/To spin box. Select the respective images (the starting one and the final one) by scrolling to these images in the actual view.

Slice spacing spin box: Change the desired spacing, smaller numbers will result in more images. If the checkbox "Use original spacing" is activated this option is disabled.

Use original spacing: Use the spacing from the dataset.

Series description edit box: Is used to apply aa description to the series that will be created (optional).

Export target: Choose a target. You can choose between IMAGEBOX (iQ-VIEW local imagebox) and all defined remote nodes. If this selection box is empty you didn't setup any DICOM AETs in iQ-VIEW. Consult the administration guide that comes with iQ-VIEW on how to set up a connection to another DICOM node.



3D view export dialog

Range selection box: Choose between single image and custom. Single image will use only the current position and orientation of the volume and produce only one image.

Rotation: Choose FULL, HALF, QUARTER and NO ROTATION. It will automatically set the degree spinbox.

Degree spin box: Defines the degree of rotation starting from 0 degree where 0 is the current image.

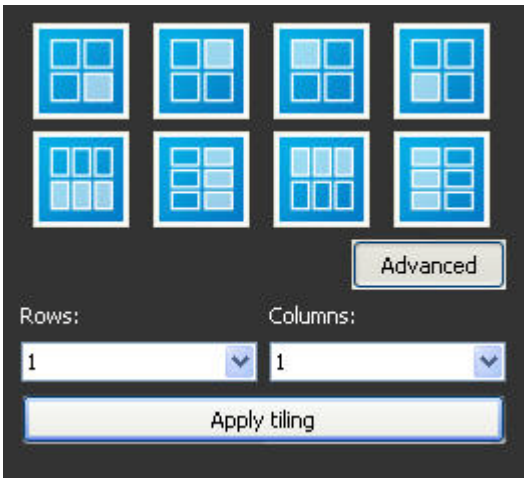
Number of images: The number of images that will be exported.

Direction of rotation: You can choose between horizontal and vertical rotation.

Series description edit box: Is used to apply aa description to the series that will be created (optional).

Export target: Choose a target. You can choose between IMAGEBOX (iQ-VIEW local imagebox) and all defined remote nodes. If this selection box is empty you didn't setup any DICOM AETs in iQ-VIEW. Consult the administration guide that comes with iQ-VIEW on how to set up a connection to another DICOM node.

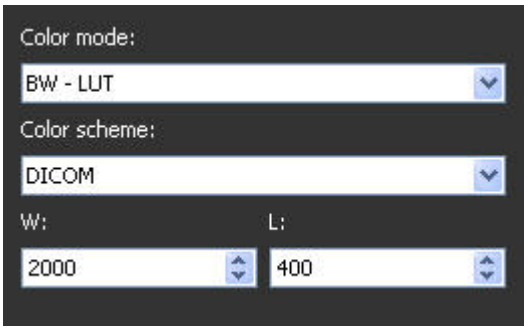
3.5.9 TILING



Tiling dialog

Tiling lets you change the current tiling of the image processing area. You can use the predefined buttons to quickly get the desired result or use the columns and rows boxes to create a tiled area with up to 6x6 views.

3.5.10 COLOR REMAPPING



Color remapping dialog

Color remapping changes either the current window and level of the image to one of the predefined values or you can apply custom values for it. You can also change the mapping to represent colors ranging from blue to red.

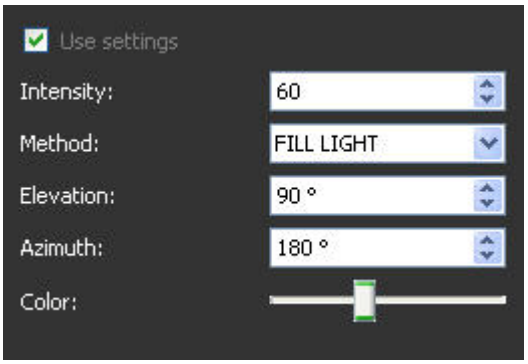
Color mode: Select black and white or color. This will automatically adapt the presets that can be found under color scheme.

Color scheme: Presets defining window and level. The preset "DICOM" uses the values found in the current DICOM files.

Window box: Change the window value.

Level box: Change the level value.

3.5.11 3D LIGHTS



Light dialog

This dialog lets you change the default lighting of a 3D scene. You can only see the difference when a volume rendering is present in the view.

Use settings checkbox: Turn on/off the widget.

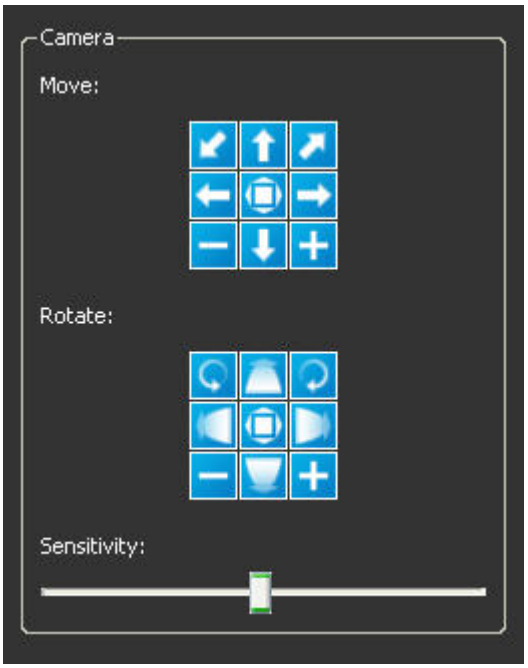
Intensity: This defines the overall intensity of all four light sources.

Method box: Choose between FILL, HEAD, KEY and BACKGROUND lights.

Elevation: Elevation angle of the current selected light source.

Azimuth: Azimuth angle of the current selected light source.

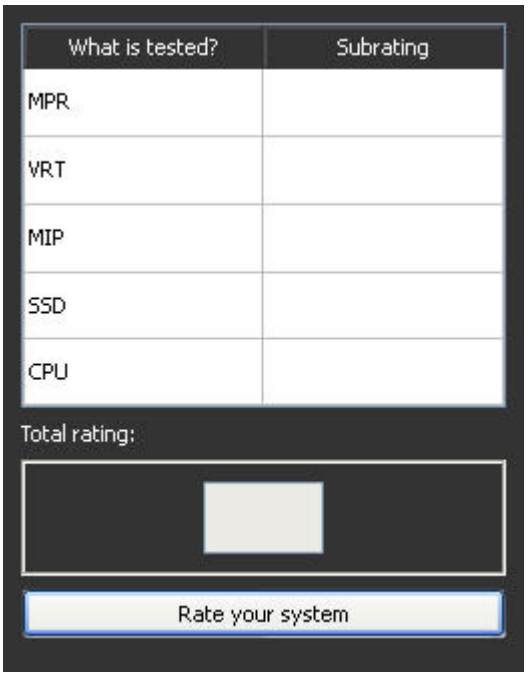
3.5.12 3D CAMERA CONTROL



Camera control dialog

This dialog lets you fine-tune any active 3D camera that is present in the image processing area. Just select the sensitivity you want and then click on the move or rotate button. The current selected camera will be modified.

3.5.13 SYSTEM ANALYSIS

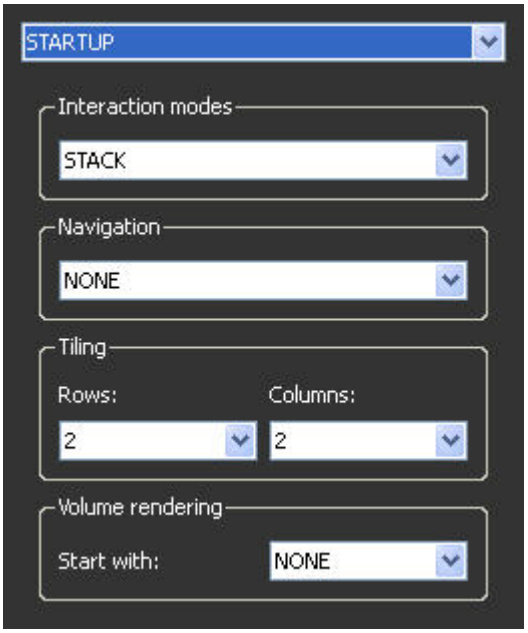


Main dialog for analyze system section

This dialog lets you analyze your system and test the performance of the processor and the graphics card and the whole system working together. It is score-based ranging from 1(low performance) to 11(very high performance). After the test has finished you can see the total rating of your system. The total rating uses the lowest result to express its bottleneck effect.

3.5.14 SYSTEM CONFIGURATION

The application comes with default values for all functions. The startup is defined so that four views are visible (3 x 2D and 1 x 3D). However, sometimes there is need for customization. With the following dialogs you can do two things: customize startup and customize default parameters for some functions.



Startup section of configure dialog

The top drop-down bar lets you select the page you are viewing. The first page is "startup". Here you can define the tiling, the use of cursors, the interactive state and the automatic creation of volume visualizations.

Interactive modes: Choose one of the interaction states: stack, tilt, zoom/pan/rotate or window leveling.

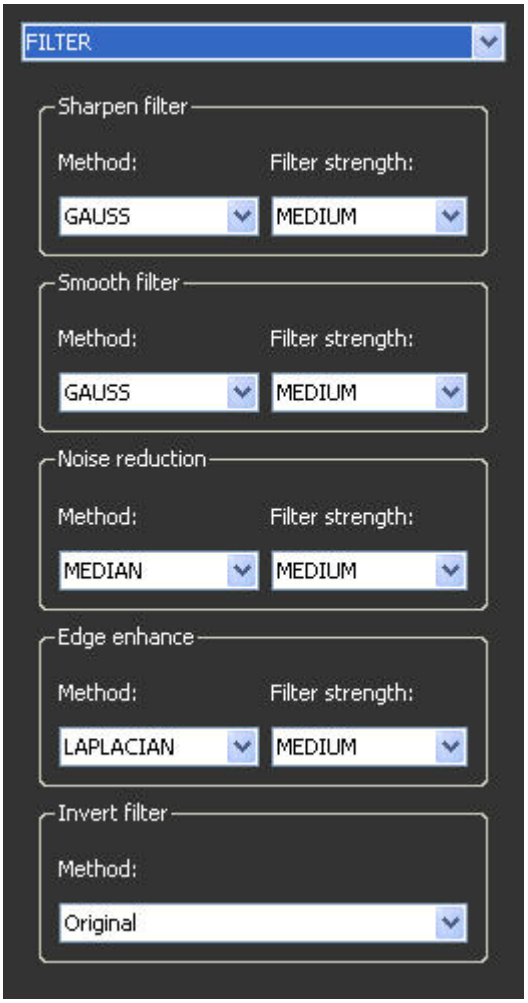
Navigation: Choose if you want to have the 3D cursor, the crosswidget or no cursor activated right after startup.

Tiling: Choose a different tiling that better fits your needs; however some tasks have requirements on the type and amount of views and might not be available in combination with the selected tiling.

Volume Rendering: Select between VRT, MIP and SSD if you want to activate Volume Rendering on startup, select NONE if you don't.

NOTE:

When "Start with: VRT" is selected you can also define which preset should be loaded. This can be done on the page "Volume Rendering".



Filter section of configure dialog

In the Filter page you define the method and strength of all filter groups. A filter group can contain several methods to perform the same task (with slightly different results).

Sharpen filter method: Choose between GAUSS (Gaussian smooth removal), ANIDIFFUSE (Anisotropic diffusion removal), LOWPASS (Lowpass smooth removal), HIGHPASS (Highpass filtering).

Sharpen filter strength: Choose between HIGH, MEDIUM, LOW and NONE.

Smooth filter method: Choose between GAUSS (Gaussian smooth), ANIDIFFUSE (Anisotropic diffusion) and LOWPASS (Lowpass filtering).

Smooth filter strength: Choose between HIGH, MEDIUM, LOW and NONE.

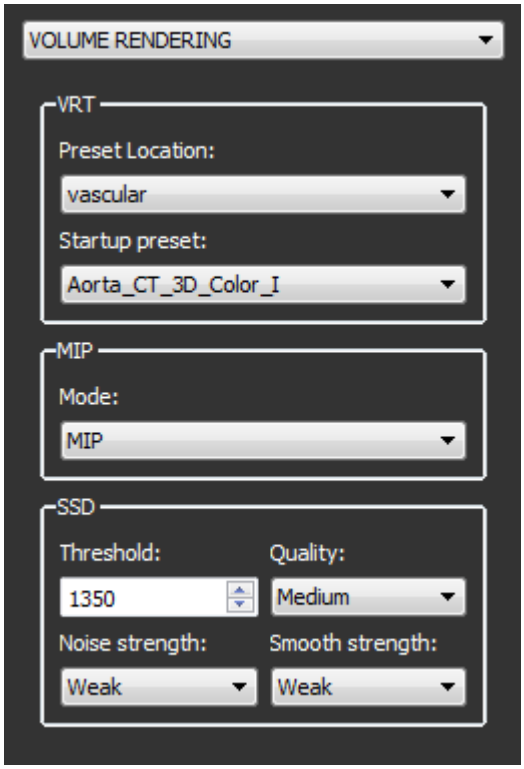
Noise reduction method: This version only contains one method, so you cannot choose anything else than MEDIAN (median filtering), but this might change in future versions.

Noise filter strength: Choose between HIGH, MEDIUM, LOW and NONE.

Edge enhance filter method: Choose between LAPLACE (Laplacian edge enhance) and GRADIENT (Gradient magnitude).

Edge enhance strength: Choose between HIGH, MEDIUM, LOW and NONE.

Invert Filter method: Here you can choose between original (pixel values from original files) and invert (pixel values inverted).



Volume Rendering section of configure dialog

This dialog defines the default parameters of all 3 volume rendering methods (VRT, MIP, SSD).

VRT preset location: Select the folder that should be your default preset folder when starting VRT.

VRT startup preset: Select the preset that should be loaded when starting VRT. You can only choose between presets that are residing in your active preset location.

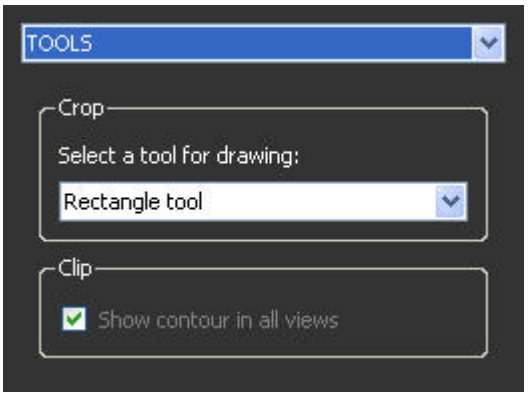
MIP mode: Choose if you want to start with a MIP (Maximum Intensity Projection) or MinIP (Minimum Intensity Projection).

SSD threshold: This value is the search criteria for SSD. Only voxels that have a value above the threshold will be used for computation.

SSD quality: Choose between high, medium and low.

SSD noise strength: The default values for SSD noise filtering: high, medium, low and none.

SSD smooth strength: The default values for SSD polygon smoothing: high, medium, low and none.

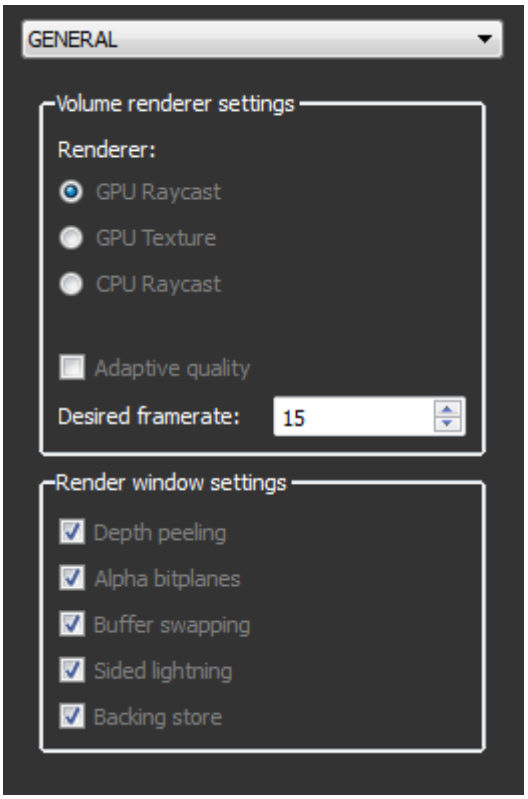


Tools section of configure dialog

The tools page shows all changeable parameters for cropping and clipping:

Crop – select a tool for drawing: Here you can select your preferred tool that you often use for drawing the stencil shape.

Clip – show contour in all views: If you have a rather slow computer turning this option off will result in better performance when using the clipping box.



General section of configure dialog

The general page contains application wide settings. Changing these options might result in performance and quality increase or decrease, so be sure to know what you are changing.

VR Renderer: Three different volume renderers are included in this software:

- GPU Raycast (best option) will be used when a supported graphics card is present in your computer. Otherwise it chooses GPU Texture (if available) or CPU Raycast. GPU Raycast performs a high quality raycasting algorithm on your graphics card which yields in high performance and high quality renderings. Keep in mind that you need an Nvidia GeForce graphics accelerator (at least a GeForce 8800) to use this renderer.
- GPU Texture is a hardware based renderer that has lower requirements on the graphics card, however its performance and quality are inferior to GPU Raycast and CPU Raycast.
- CPU Raycast, while producing renderings with the same quality as GPU Raycast, is much slower. It is only recommended if you have a modern processor with multiple cores and no supported graphics card.

Adaptive quality: Check this option, if you want the renderer to automatically adjust the quality when the current frame rate drops below the desired frame rate.

Desired frame rate: Works only in combination with adaptive quality. Interactive frame rates are between 6 and 30 frames.

Render window settings: These settings are provided for troubleshooting performance/quality issues. You should only try to deactivate these checkboxes if you encounter graphics card problems (quality or performance issues).

3.5.15 SYSTEM INFORMATION

System info dialog

This page provides information about the currently used version and the currently installed license. Also it allows you to install a new license and to reset your old license in case you need to migrate to another PC. For more information about the licensing process, please consult the "iQ-3D 3.1.0 Administration guide ".

Install license: Calls up a dialog which gives you the possibility to install a new license. You need a valid activation key and an adequate registration name – both depending on your hardware fingerprint – to do that. Please contact your local vendor to gain a license key.

License info: Opens a dialog which informs you about the current license state.

Reset license: Only proceed if you want your license to be reverted to a trial license, e.g. in case of migrating the existing license to another computer. This will produce a file called "uninstall_license_iQ-3D_3.1.0.ini" that holds the uninstall key. Send this key to your vendor to get a new license.

WARNING:

When migrating to another computer you should always check the conditions with your vendor BEFORE starting the migration process. Please keep in mind that there might be fees for obtaining new keys.

4 TROUBLE-SHOOTING AND FAQ

First of all, no software is 100% error free. Errors are always possible even after intense testing. Sometimes it seems like the application does not work as expected but the problem is not the software itself, rather a prerequisite that was not met. This section gives answers to frequently asked questions and gives advice on what to do if something goes wrong.

4.1 TROUBLE-SHOOTING

- **When trying to start iQ-3D with some series a popup appears stating: “Series does not meet requirements, unable to load the volume”.**

  This is no error message. It is just a note that the series you are trying to load is not appropriate for volume processing. Images need to meet the following requirements:

  - At least two images within a series are necessary to start the 3D module.
  - All images within the series need to have the same slice-thickness and spacing between slices.
  - All images within the series need to have the same orientation.

  If the above message appears, you may open the process log (“Jobs” button”) in iQ-VIEW (from the viewer directly with [CTRL]+[J]).. Activate the log on debug log level. Keep the jobs dialog open (it will stay on top) and try to open the same series again in iQ-3D. The log will give you details on why the series could not be loaded (e.g. image 73 has different slice spacing etc.)

- **Trying to start iQ-3D does not work. An error message appears with “Unknown software exception ... in the application addressed...”.**

  The series data will be exported from iQ-VIEW to iQ-3D via memory sharing. Sometimes when the data is very large (many hundred slices) it is possible that there is not enough coherent free memory. That causes the error message.
  Close iQ-3D and iQ-VIEW. Change the following iQ-VIEW.ini parameter from „3DCommunicationMode=0“ to „3DCommunicationMode=1“. That advises iQ-VIEW & iQ-3D to share the data as raw files instead of using memory sharing. Restart iQ-VIEW and iQ-3D afterwards. Importing will take longer now, but has lower memory constraints.

- **Sometimes the application hangs or crashes, but I cannot reproduce the error.**

  Locate the “3D_error_log.txt”, which you can find in your iQ-VIEW installation folder in the subfolder “3D”. (e.g. “C:\Program Files\iQ-VIEW\3D”). Send this file to your local vendor for technical support.

- **Cropping does not work in SSD mode.**

  Due to technical issues it is not possible to crop a volume directly in SSD mode. But you can crop the volume in VRT or MIP and then switch to SSD.

- **The application runs slow on my computer, what can I do?**

First just run the internal benchmark which will help you to identify the bottleneck of your system. Then you should read the "iQ-3D administration guide" that gives detailed advice of individual computer parts. If you have performance problems with VRT or MIP, then make sure to use a high end Nvidia GeForce graphics accelerator and to enable the GPU Raycast Renderer in the "General" settings.

4.2 FAQ

Q: What kind of images can be used with the module?
A: Basically any kind of DICOM images that meet the requirements; mostly these are CT and MRI series.

Q: Can I use this software as a standalone application?
A: No, you need to have iQ-VIEW installed as the main application in order to use it.

Q: What interpolation is used for MPR and Volume Rendering?
A: MPR uses bicubic interpolation (can be changed to bilinear); VR always uses bilinear interpolation.

Q: What is the quality of the volume renderer? Are there any limitations?
A: The software renderer will never reduce the volume size and comes with maximum quality when not interacting with the volume. The hardware renderer might reduce the size to fit onto your graphics card.

Q: What algorithm for volume rendering is used when "GPU-Texture" is selected?
A: 3D texture mapping.

5 RELEASE NOTES

New Features in Version 3.1.0:

- New license management. iQ-3D now provides new license dialogs and concurrent licensing.
- Graphical User Interface supports more languages: Russian, Japanese, Dutch, French (next to English, German, Spanish).
- Version info now contains build number.
- At program restart, iQ-3D remembers last display position.
- New GPU Raycast Renderer provides higher quality for 3D visualization of VRT and MIP
- Removed obsolete GPU Texture + CPU Raycast renderer.
- New render management: application chooses best renderer for current workstation automatically.
- The cropping dialog was redesigned.
- Cropping tool now resets automatically after the cropping process.
- Default length of cropping tube will be restored when copping dialog will be re-opened.
- Thresholding feature of MIP was enhanced.
- Presets are rearranged in new groups (bones, vascular, muscles, other).
- Changed the default preset (now vascular).
- Scrolling through tissue in 3D views is now possible by W/L tool + mouse moving.
- The thickslab feature was redesigned.
- Pan/Zoom/Rotate tool now available for 3D view.

Bugfixes in Version 3.1.0:

- Dialog "change op. point": updating opacity point via spin box did not work correctly.
- Some VRT-dialog objects did not support multilanguage capability.
- Exporting a series as DICOM files lead to several series with one image instead of one series with several images.
- VRT was not capable to show MRT data correctly.
- Resolved a cropping bug which caused inverted cropping when drawing a cropping polygon counterclockwise.
- The export of DICOM data to a DICOM node has only worked if the logical name in iQ-VIEW was specified with a valid AE-title.
- Exported JPGs, BMPs and DICOMs did not look like original view with changed Window/level values.
- iQ-3D now automatically performs windowing and levelling if a series contains no default values.
- Title of annotation dialog was wrong.
- Exported images (“secondary capture”) had wrong PixelSpacing.
- Switching from MIP to MinIP updated correctly only by moving mouse.
- The progress bar for MIP has not worked with CPU Raycast renderer.

6 LIST OF ABBREVIATIONS

3D	– three-dimensional
CR	– Computed Radiography
CT	– Computed Tomography
DICOM	– Digital Imaging and Communication in Medicine
DR	– Direct Radiography X-Ray Systems
DX	– Direct Radiography, e.g. Angiography or Fluoroscopy
GUI	– Graphical User Interface
HU	– Hounsfield Units
MIP	– Maximum Intensity Projection
MinIP	– Minimum Intensity Projection
MPR	– Multiplanar Reconstruction
MR	– Magnetic Resonance Imaging
NM	– Nuclear Medicine
OT	– other title (other DICOM storage class)
RF	– Radiographic Fluoroscopy
ROI	– Region of Interest
SSD	– Surface Shaded Display
UPS	– Uninterruptible Power Supply
US	– Ultrasound
VOI	– Volume of Interest
Voxel	– Volume Pixel, the smallest distinguishable box-shaped part of a three-dimensional image
VR	– Volume Rendered, Volume Rendering
VRT	– Volume Rendering Technique

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