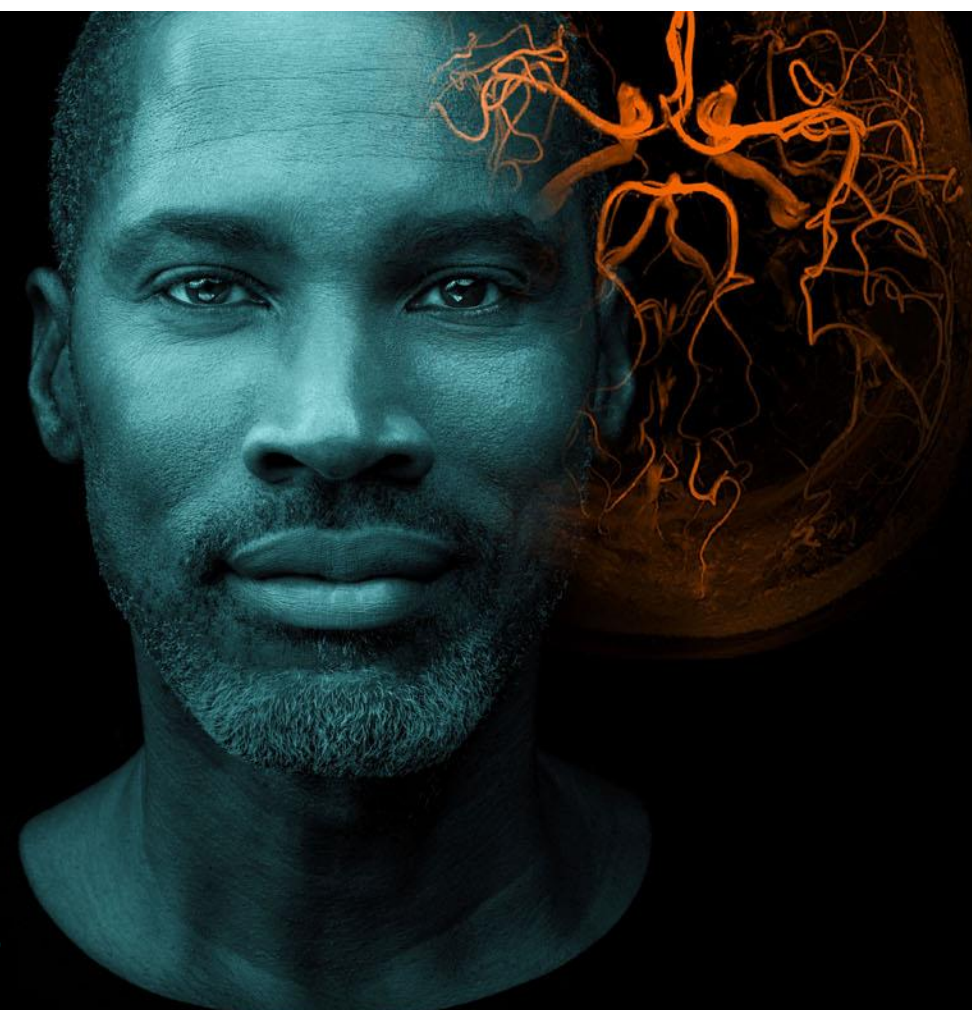
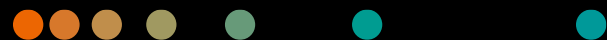


syngo.MR

Robust Quantitative Tool

v2.0-2



syngo.MR Robust Quantitative Tool (RoQT) Restrictions for Use

The *syngo*.MR Robust Quantitative Tool (RoQT) application is a demonstrator application and runs in the *syngo*.via OpenApp framework.

The *syngo*.MR RoQT application is for research use only. The software and any generated results must not be used for diagnostic or therapeutic purposes.



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syngo.MR RoQT

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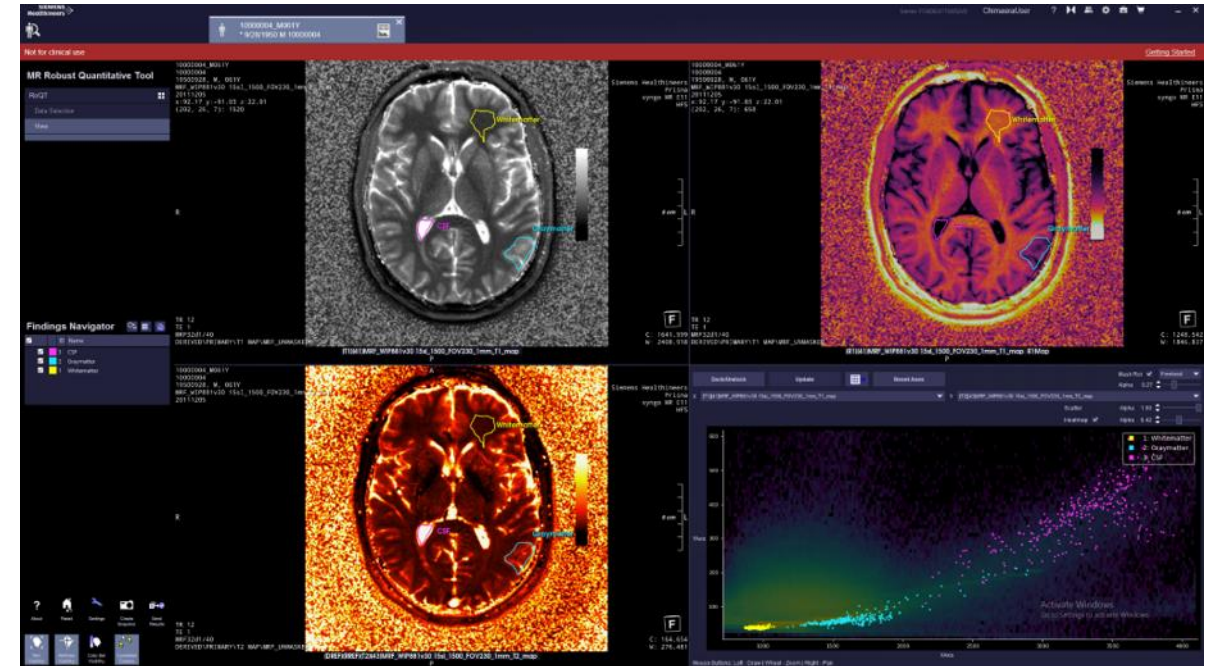


syngo.MR RoQT Overview

The syngo.MR Robust Quantitative Tool (RoQT) allows the simultaneous visualization and quantitative evaluation of multiple contrasts. Currently, T1-, T2-, and ADC-maps are supported, and additional contrasts labelled as "Other".

Features

- Support simultaneous evaluation of
 - Multiple quantitative MR maps (e.g. T1 map, T2 map, ADC)
 - Anatomical reference images (e.g. T2w TSE)
- Generate R1, R2 image from T1, T2 maps
- Synchronized side-by-side viewing
- Simultaneous measurements on all loaded contrasts
- Report table of statistical values
- Scatter plot and heat map visualization
- Interactive scatter plot back projection
- Image based co-registration
- Persistent handling of co-registrations and measurements
- Support of multiple sessions/profiles for the same image data



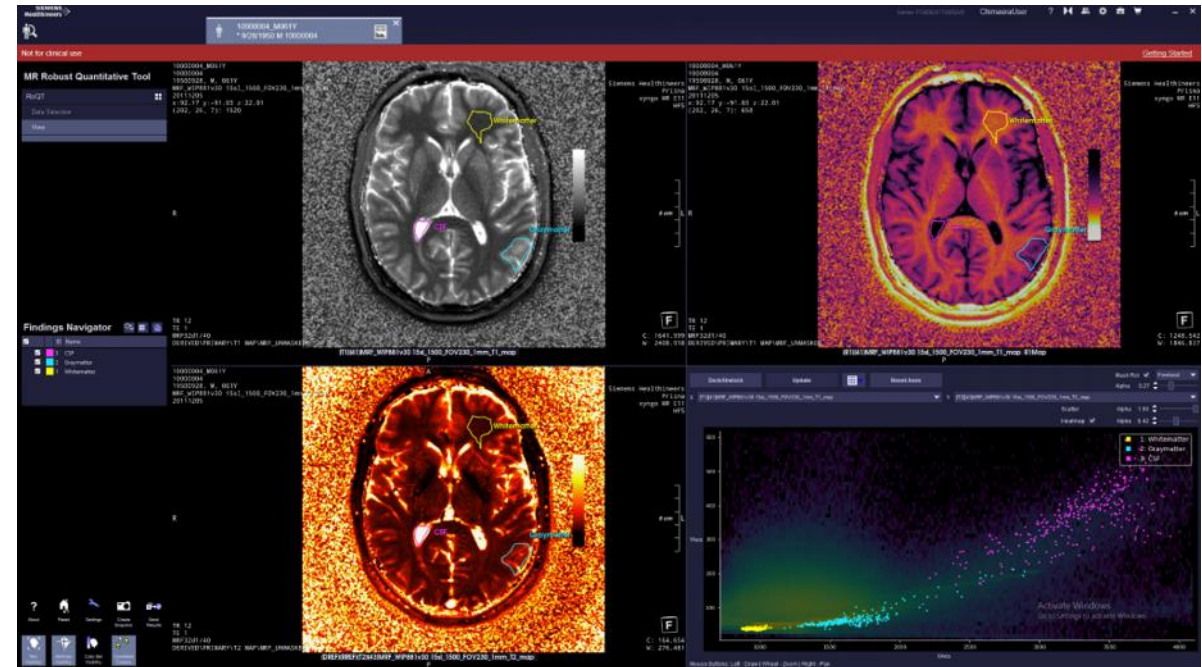
syngo.MR RoQT Overview

Input:

- T1 maps, T2 maps, ADC, other anatomical reference images
- Restrictions:
 - Only 3D image stacks
 - Currently no phases / timepoints per series supported

Output:

- Snapshots DICOM (Secondary Capture)
- Statistics Measurement Table as .csv or PDF Document (DICOM embedded PDF)
- Scatterpoints as .csv or PDF Document (DICOM embedded PDF)
- R1 and R2 maps (DICOM)



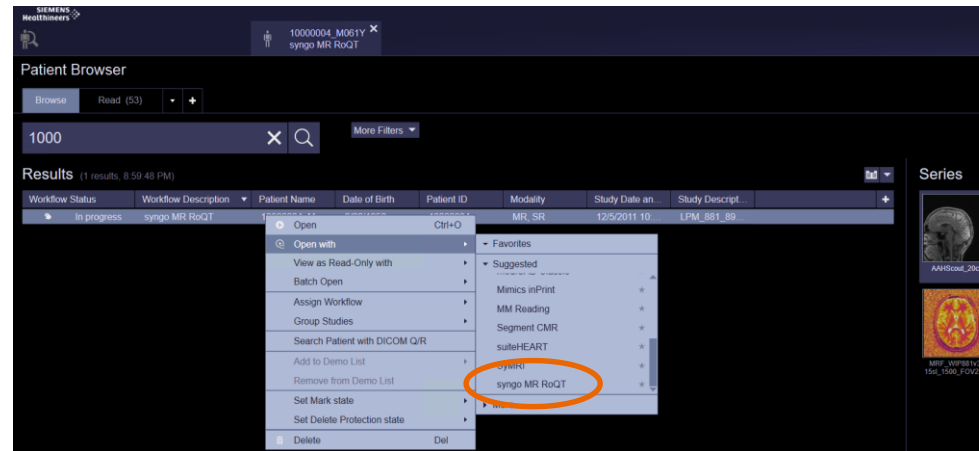
syngo.MR RoQT

How to Use it: Step-By-Step

How To Use it

Load and Prepare Images

- 1) Select a study from the Patient Browser and open with *syngo.MR RoQT*.



- 2) Select the data roles required for the evaluation in the Data Selection.

Note that only one dataset for T1, T2 and ADC can be selected.

Idx	T1	T2	ADC	Other	Series	SeriesDescription	ImgExt	AcquisitionTime	PatName	AcquisitionDate	Stu
1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1	AAHScout_20cx	160 x 160 x 128	100059.340000	10000004_M061Y	12/5/2011	LPM
2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	5	t2_map_0.7x0.7x3_44_LPM_20ch_T2map	600 x 640 x 44	100144.197500	10000004_M061Y	12/5/2011	LPM
3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	8	t2_map_0.7x0.7x3_44_LPM_20ch_M0	600 x 640 x 44	100144.197500	10000004_M061Y	12/5/2011	LPM
4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	9	t2_map_0.7x0.7x3_44_LPM_20ch_R2map	600 x 640 x 44	100144.197500	10000004_M061Y	12/5/2011	LPM
5	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	11	t1_map_0.7x0.7x3_44_LPM_20ch_T1_Images	300 x 320 x 44	100527.145000	10000004_M061Y	12/5/2011	LPM
6	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	37	Axial T2-FLAIR	256 x 256 x 35	103326.652500	10000004_M061Y	12/5/2011	LPM
7	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	41	MRF_WIP881v30_15sl_1500_FOV230_1mm_T1_map	224 x 224 x 15	101951.332500	10000004_M061Y	12/5/2011	LPM
8	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	43	MRF_WIP881v30_15sl_1500_FOV230_1mm_T2_map	224 x 224 x 15	101951.332500	10000004_M061Y	12/5/2011	LPM
9	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	45	MRF_WIP881v30_15sl_1500_FOV230_1mm_B1_Map_B1...	224 x 224 x 15	101951.332500	10000004_M061Y	12/5/2011	LPM
10	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	39	MRF_WIP881v30_15sl_1500_FOV230_1mm_M0_map	224 x 224 x 15	101951.332500	10000004_M061Y	12/5/2011	LPM
11	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	47	ep2d_diff_mddw_20_p2_ADC	128 x 128 x 27	103742.925000	10000004_M061Y	12/5/2011	LPM
12	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	48	ep2d_diff_mddw_20_p2_TRACEW	128 x 128 x 27	103742.925000	10000004_M061Y	12/5/2011	LPM
13	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	49	ep2d_diff_mddw_20_p2_FA	128 x 128 x 27	103742.925000	10000004_M061Y	12/5/2011	LPM

How To Use it

Load and Prepare Images

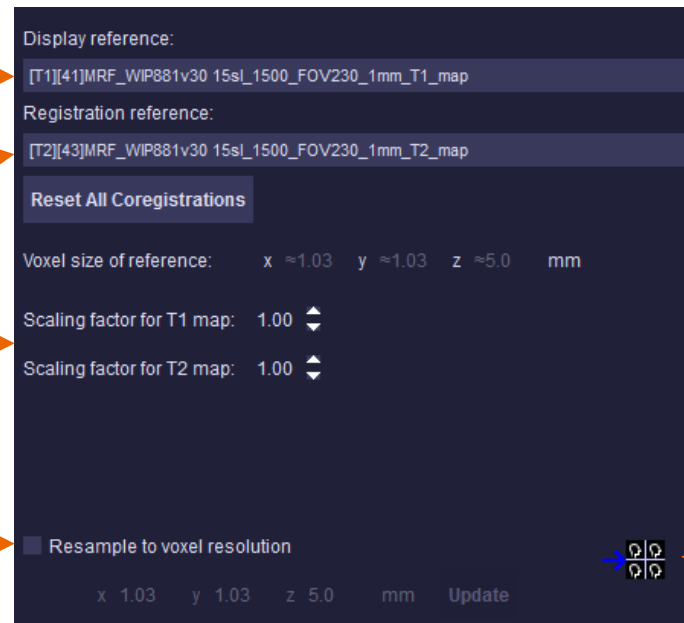
- 3) Prepare the data by selecting the display and registration reference series.

Display reference: show all images reformatted to display reference's slice orientation

Registration reference: use this image as the anchor for the image alignment. Better results are achieved when choosing a high-resolution data set

- 4) Intensity rescaling might be required for some sequences to generate T1 and T2 maps. The scale factor is used to turn image intensity values into relaxation times in milliseconds.

- 5) The voxel resolution of all selected data roles can be adapted for viewing.

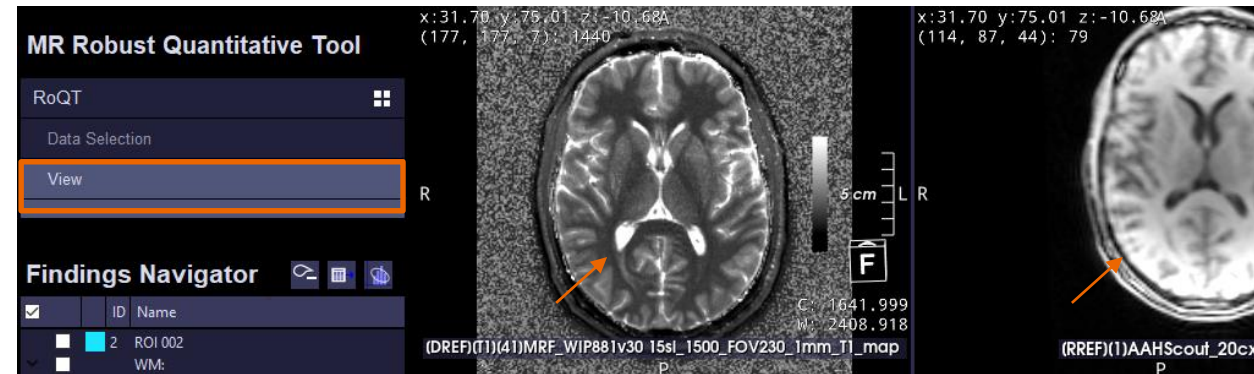


- 6) Send the selected data to View, which will load the series into the application.

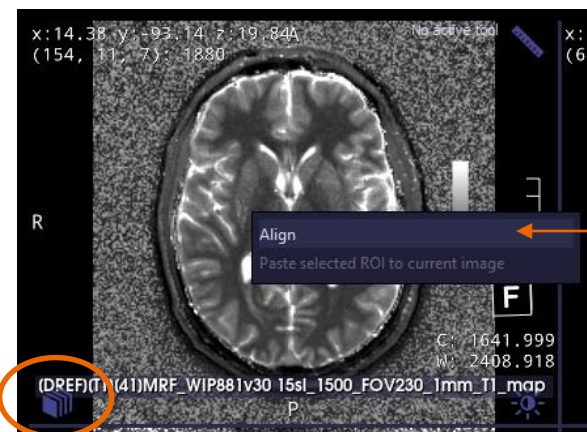
How To Use it

Display and Alignment of Images

Make sure that each contrast that will be part of the table or scatterplot is well aligned with the registration reference image (marked as RREF).



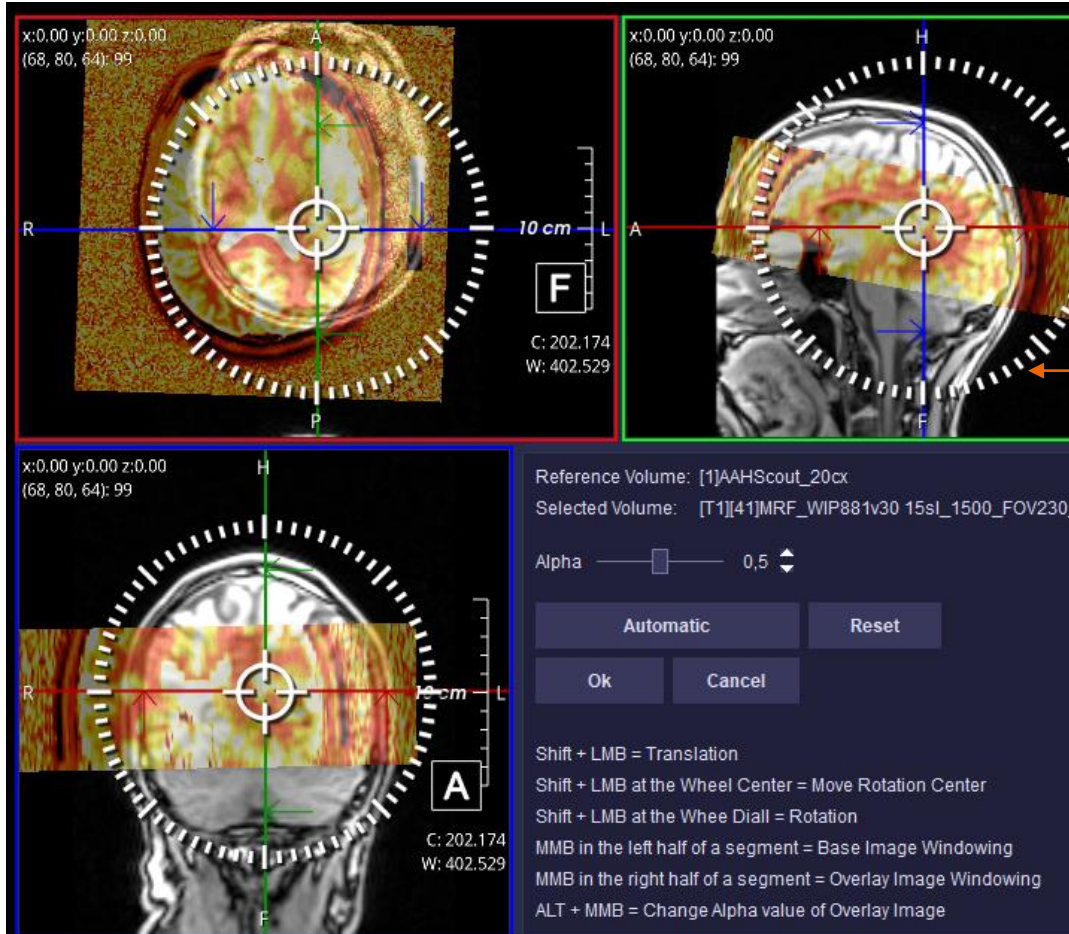
- 1) Select the different contrasts within the image view segments (lower left corner) and check with the correlated cursor the alignment to the registration reference.



- 2) If an image is not well aligned, choose "Alignment" from the context menu by right-clicking within the according image view segment.

How To Use it

Display and Alignment of Images



3) The alignment dialog allows you to choose various options:

- Automatic: Can be called multiple times and uses an automatic registration algorithm to align the datasets
- Reset: Return to starting point of coregistration
- Ok: Accept the current status and use it in the application
- Cancel: Return to viewing without applying the changes

4) The coregistration may be modified manually within the alignment views by the operations described within the alignment dialog.

The registration compass center may be used to perform rotations, as its center defines the point around which the overlay image is rotated. By dragging the compass ring (SHIFT + Left Mouse Button (LMB)) the overlay is rotated.

How To Use it

Display and Alignment of Images

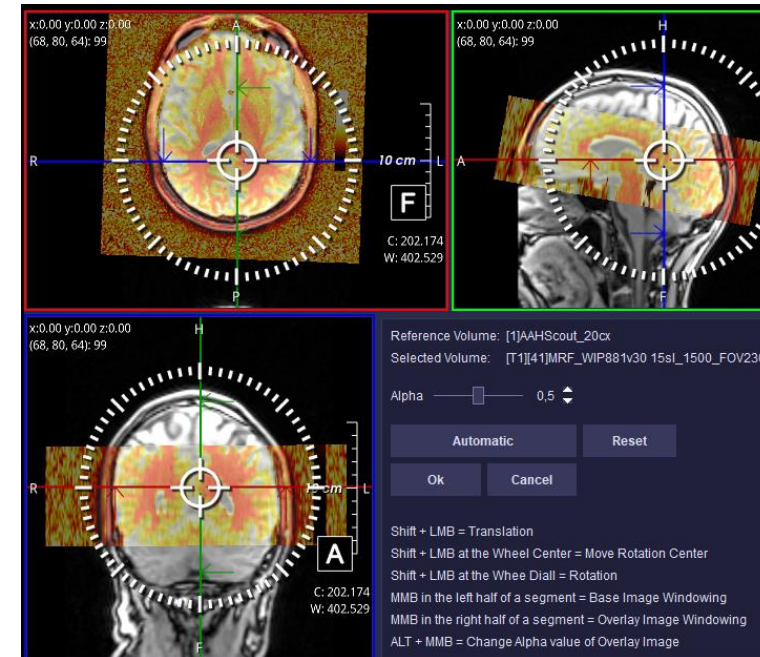
In order to reduce the number of required explicit coregistration operations, some heuristics will be used to propagate a coregistration to other data sets in the application:

The following coregistration will be picked for an image:

- an existing coregistration that is linked to the same Frame of Reference and Acquisition Date / Time
- an identical coregistration in all other cases

In case the propagation of coregistration matrices yields unfavorable results, the “Reset All Coregistration” function from the Data Selection step may be used to clear all coregistrations.

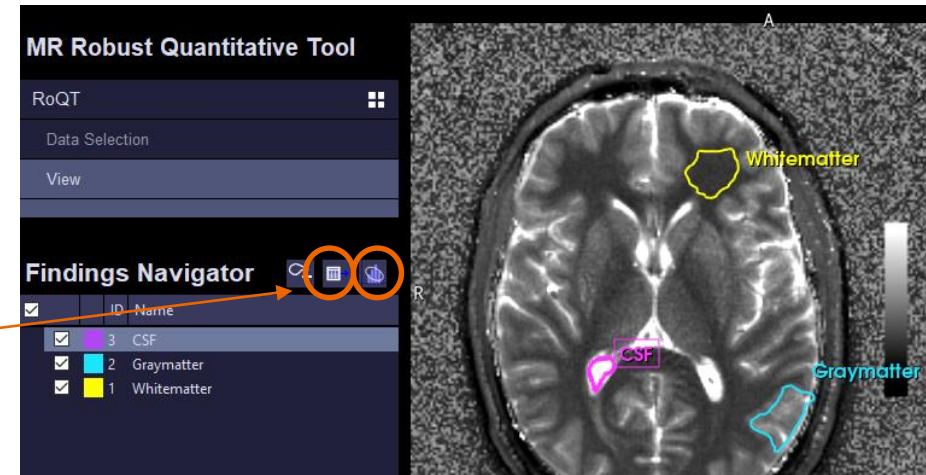
The coregistration information will be stored and retrieved if the application state is saved (or paused). This makes it possible to resume with existing coregistrations the next time the dataset is loaded into the application.



How To Use it

Scatter Plot and Statistics

- 1) Draw ROI objects into structures within the image you want to analyze. The ROI tools are located at the upper right corner menu within the view segments. ROIs may be manipulated using the SHIFT + Left Mouse Button (LMB), additional hints are displayed in the upper right corner for the selected tool.
- 2) The Scatter Plot and Statistics Table can be opened from the Findings Navigator section.
- 3) Select appropriate series for the X- and Y-axis in the Scatter Plot to fully utilize the data separation for different ROI regions.
- 4) Statistics Table values are displayed for all selected series. Displayed statistics values may be enabled / disabled within the application settings.

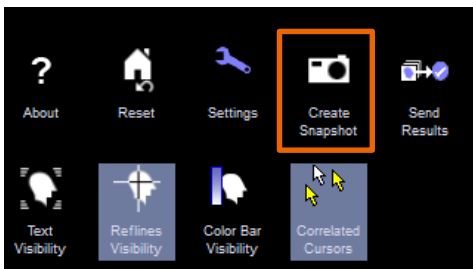
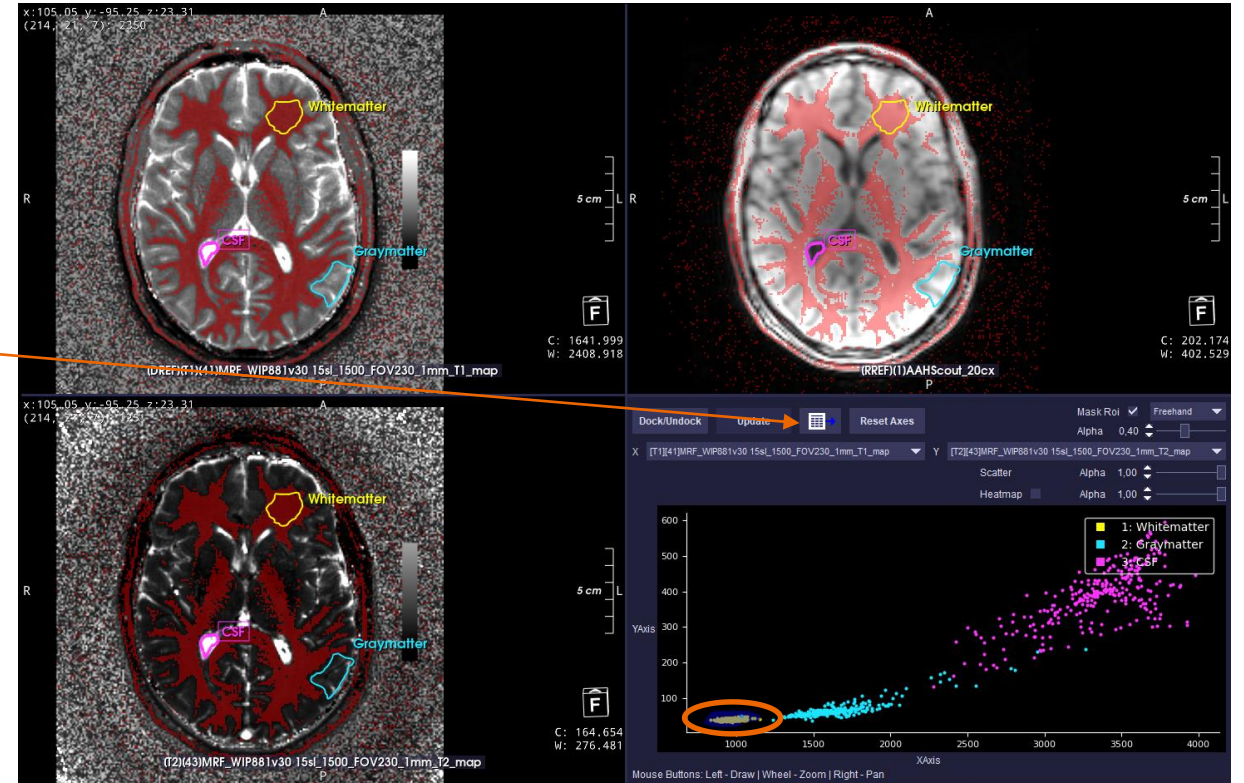


ROI Id	ROI Label	Voxels	Mean	Std	Me
[T1][41]MRF_WIP881v30 15sl_1500_FOV230_1mm_T1_map					
3	CSF	1920	3339.6	328.27	339
2	Graymatter	7656	1666.82	267.05	160
1	Whitematter	7234	955.96	45.48	950
[R1][41]MRF_WIP881v30 15sl_1500_FOV230_1mm_T1_map R1Map					
3	CSF	1920	304.56	35.15	298
2	Graymatter	7656	616.79	83.51	624
1	Whitematter	7234	1049.68	48.52	105
[T2][43]MRF_WIP881v30 15sl_1500_FOV230_1mm_T2_map					
3	CSF	1920	383.81	81.17	390
2	Graymatter	7656	69.21	26.87	61.5
1	Whitematter	7234	39.35	2.41	39.2

How To Use it

Scatter Plot and Statistics

- 5) Draw an ROI inside the Scatter Plot to project the mask ROI back into the data (red overlay). The opacity of the mask ROI may be adapted from the Scatter Plot dialog.
- 6) The Scatter Plot values, as well as the Statistics Table measures may be exported to file (CSV, PDF, DICOM).
- 7) The entire screen content may be saved as a DICOM snapshot.



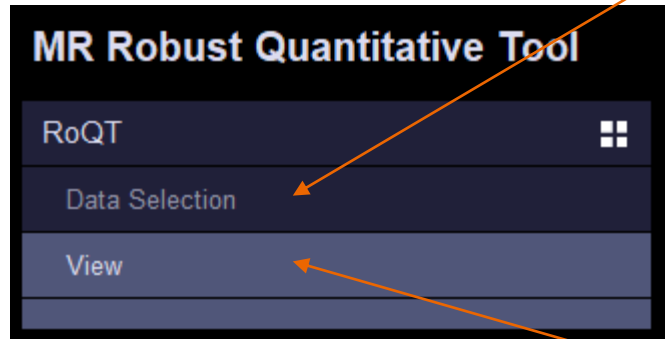
syngo.MR RoQT

Feature Overview

Feature Overview

General Task Switches

Click “Data Selection” or “View” to navigate to these steps:



Use **Data Selection** for the loading and preparation of data:

- Select the data roles T1 map, T2 map, ADC and “Other”.
You can pick one series for the data roles T1 map, T2 map and ADC.
You can pick multiple series for the data role “Other”.
- After loading the data: Choose the reference data set for image alignment.
- Choose whether all data should be reformatted to the image matrix and coordinate system of the reference image.
- Choose whether a resampling of all data sets to a common resolution should be carried out.
- Automatic alignment of all data sets with respect to the reference image.
- Manage the user profiles for findings measurements.

Use **View** for the reading of the data loaded:

- Synchronized side-by-side navigation with series selection
- Interactive ROI measurement tools (Rectangle, Circle, Ellipse, Polygon, Freehand)
- Color Look-up-table (LUT) selection
- Statistics Table
- Scatter Plot with support for Mask ROI backprojection

Feature Overview

Data Selection – Import Data

The application consists of the following workflow steps: Data Selection and View.

In the Data Selection step you can select the input datasets for further processing. For each of the input data contrasts (T1, T2, ADC) an automatic role selection will be performed initially:

Presets will be used based on DICOM Tag “ImageType” (0008,0008). Strings containing T1_Map, T2_Map, ADC will be assigned respectively. As only one quantitative map per contrast is supported, the most recently acquired scan based on the acquisition date and time will be selected. The user can change the automatic selection.

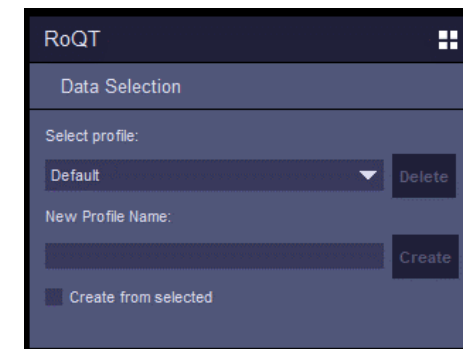
The data role “Other” can be enabled to load additional data sets into the application. Multiple items can be selected for “Other”.

You can create new profiles to store the current data role selection and all subsequent measurements. The profiles will be accessible again, if the dataset will be reopened in the app after suspend or save mode.

The “Default” profile is used for storing the current state until a new profile is created. Type in a name for the profile and hit the “Create” button.

If the current data selection and measurements should be copied into the new profile, make sure to check “Create from selected” before creating the new profile.

Idx	T1	T2	ADC	Other	Series	SeriesDescription	ImgExt	AcquisitionTime	PatName	AcquisitionDate	Stu
1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1	AAHScout_20cx	160 x 160 x 128	100059.340000	10000004_M061Y	12/5/2011	LPM
2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	5	t2_map_0.7x0.7x3_44_LPM_20ch_T2map	600 x 640 x 44	100144.197500	10000004_M061Y	12/5/2011	LPM
3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	8	t2_map_0.7x0.7x3_44_LPM_20ch_M0	600 x 640 x 44	100144.197500	10000004_M061Y	12/5/2011	LPM
4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	9	t2_map_0.7x0.7x3_44_LPM_20ch_R2map	600 x 640 x 44	100144.197500	10000004_M061Y	12/5/2011	LPM
5	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	11	t1_map_0.7x0.7x3_44_LPM_20ch_T1_Images	300 x 320 x 44	100527.145000	10000004_M061Y	12/5/2011	LPM
6	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	37	Axial T2-FLAIR	256 x 256 x 35	103326.652500	10000004_M061Y	12/5/2011	LPM
7	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	41	MRF_WIP881v30 15sl_1500_FOV230_1mm_T1_map	224 x 224 x 15	101951.332500	10000004_M061Y	12/5/2011	LPM
8	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	43	MRF_WIP881v30 15sl_1500_FOV230_1mm_T2_map	224 x 224 x 15	101951.332500	10000004_M061Y	12/5/2011	LPM
9	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	45	MRF_WIP881v30 15sl_1500_FOV230_1mm_B1_Map_B1...	224 x 224 x 15	101951.332500	10000004_M061Y	12/5/2011	LPM
10	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	39	MRF_WIP881v30 15sl_1500_FOV230_1mm_M0_map	224 x 224 x 15	101951.332500	10000004_M061Y	12/5/2011	LPM
11	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	47	ep2d_diff_mddw_20_p2_ADC	128 x 128 x 27	103742.925000	10000004_M061Y	12/5/2011	LPM
12	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	48	ep2d_diff_mddw_20_p2_TRACEW	128 x 128 x 27	103742.925000	10000004_M061Y	12/5/2011	LPM
13	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	49	ep2d_diff_mddw_20_p2_FA	128 x 128 x 27	103742.925000	10000004_M061Y	12/5/2011	LPM

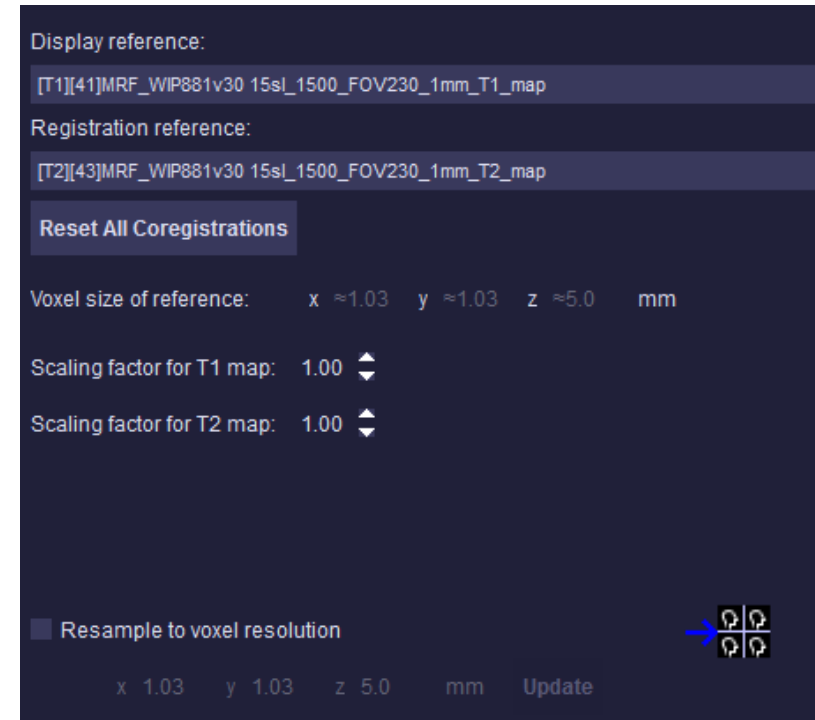


Feature Overview

Data Selection – Data preparation

After importing the data, you may choose from various options to optimize the data for the application:

- **Choose a “Display reference” image.** This image defines the viewing characteristics in the application. All images will be reformatted to the given slice orientation of the display reference. E.g. choosing a sagittal image as display reference will yield all other images being displayed in sagittal orientation, as well.
- **Choose a “Registration reference” image.** This reference may be different from the display reference. It will be used as reference image for all coregistration processes. It is usually a good choice to select an image with nearly isotropic voxel resolution and good frame of interest coverage, for example MPAGE.
If you change the registration reference after some coregistrations have been carried out, existing coregistrations will be propagated to the new reference image. However in some cases, it might be necessary to reset all internally stored coregistration matrices. Use the “Reset All Coregistrations” function for this purpose.
- By default, a scaling factor of 1.0 will be used to convert voxel values from T1 map and T2 map to physical units [ms]. If you use data with different scaling factors you can adapt the scaling here.
- Resample to voxel resolution: Images can be resampled to a given voxel size. If the z-size is not changed, the interpolation will only be carried out in plane.
After changing the values you have to press “Update” and send the data to viewing using the “Send to Viewing” button.

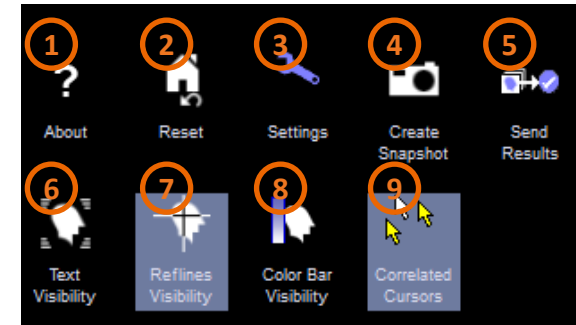


Feature Overview View

Image Segments

- Corner Menu
 - lower left: Select contrast for display
 - lower right: Color LUT
 - upper right: Measurement Tools
- Context Menus
 - Set this contrast as reference image
 - Open Alignment UI to align the contrast with the reference image
 - Paste the selected measurement from findings navigator to this slice
- Windowing/Zoom/Pan
 - Windowing: Middle mouse button (MMB) + Drag
 - Zoom: Left mouse button (LMB) Drag starting at the edge of the segment
 - Pan: LMB Drag starting in the middle of the segment
- Blow up segment: LMB Double click
- Measurement Tools: SHIFT+ LMB

Communal Tools



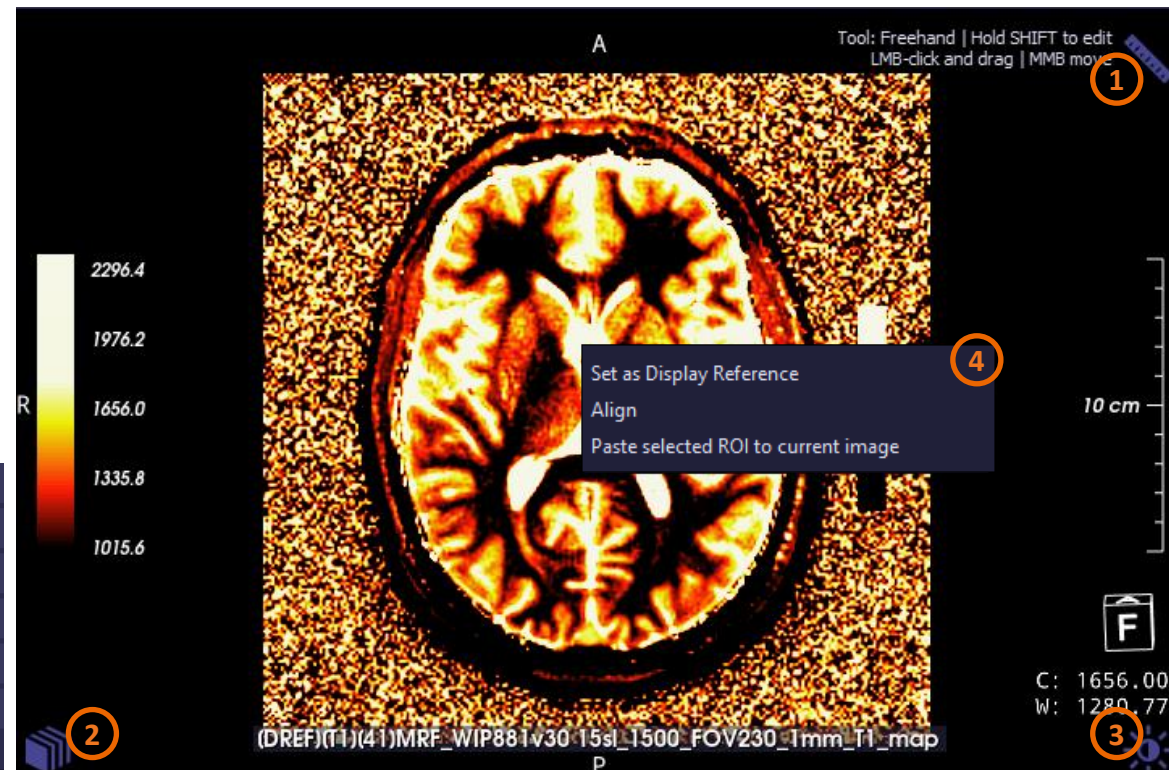
- | | |
|--|--|
| (1) Display About dialog | (5) Export R1/R2 images to DICOM |
| (2) Reset View settings to default (zoom, pan, windowing, positions) | (6) Toggle image text visibility |
| (3) Open application configuration | (7) Toggle reference lines in alignment mode |
| (4) Create snapshot and store as DICOM secondary captured | (8) Toggle color bar visibility |
| | (9) Toggle correlated cursors |

Feature Overview

View – In Segment Options

- (1) Tools menu
- (2) Contrast selection
- (3) LUT
- (4) Context menu

```
[RREF][1]AAHScout_20cx
[R2][43]MRF_WIP881v30 15sl_1500_FOV230_1mm_T2_map R2Map
[T2][43]MRF_WIP881v30 15sl_1500_FOV230_1mm_T2_map
[R1][41]MRF_WIP881v30 15sl_1500_FOV230_1mm_T1_map R1Map
[DREF][T1][41]MRF_WIP881v30 15sl_1500_FOV230_1mm_T1_map
[37]Axial T2-FLAIR
[ADC][47]ep2d_diff_mddw_20_p2_ADC
```



- No Tool
- Rectangle
- Circle
- Ellipse
- Freehand
- Polygon

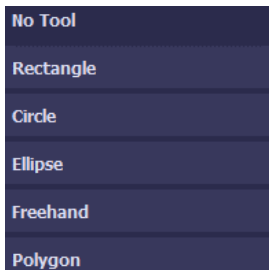
- Grayscale
- Hot Metal
- Inv Grayscale
- MRF T1
- MRF T2
- Rainbow

Feature Overview

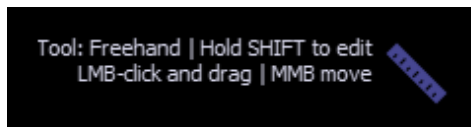
View – Findings Management

Each Measurement (ROI) will be collected in the Findings Navigator.

The following ROI Types are available:



After selecting a Tool some help is displayed in the upper right part of the image segment:



The Findings Navigator shows the currently drawn ROI findings. By adding a prefix and a colon to the name, e.g. “WM:”, findings may be grouped together.



- Remove Highlighted Finding
- Open / Close Statistics Table
- Open / Close Scatter Plot

- Checkbox: Toggle visibility of finding
- Color Box: Click to change color
- ID: Double click to position images to the Center of Gravity of the finding
- Label: Double click to edit label name
- The highlighted measurement can be copied to another slice: Navigate an image segment to the target slice and then select “Paste selected ROI to current image” from the context menu or via copy-paste shortcut keys (CTRL-C for copy, CTRL-V for paste).

Feature Overview

View – Statistics Table

The screenshot displays a software interface with a statistics table. The table is docked in the lower right corner of the image segment. It contains four data series, each with a table of ROI statistics. The columns are ROI Id, ROI Label, Voxels, Mean, Std, Median, and Min. The rows represent different tissue types: CSF, Graymatter, WM, WM:Whitematt..., and WM:Whitematt... (repeated for different series).

ROI Id	ROI Label	Voxels	Mean	Std	Median	Min
2	CSF	2596	2971.2	594.42	3184.3	1097.14
3	Graymatter	14233	1488.25	221.28	1462.72	973.46
0	WM:	14919	1199.71	155.58	1193.7	885.5
1	WM:Whitematt...	8387	1168.64	162.2	1146.52	885.5
4	WM:Whitematt...	6532	1239.61	136.64	1242.69	966.67

ROI Id	ROI Label	Voxels	Mean	Std	Median	Min
2	CSF	2596	373.01	108.95	326.98	260.98
3	Graymatter	14233	692.38	80.04	689.65	307.88
0	WM:	14919	868.95	102.08	862.68	611.18
1	WM:Whitematt...	8387	893.86	102.05	892.97	659.29
4	WM:Whitematt...	6532	836.97	92.8	825.76	611.18

ROI Id	ROI Label	Voxels	Mean	Std	Median	Min
2	CSF	2596	317.61	117.7	347.73	52.77
3	Graymatter	14233	61.79	26.96	55.43	37.23
0	WM:	14919	49.05	9.5	46.46	36.39
1	WM:Whitematt...	8387	46.7	6.58	44.55	36.86
4	WM:Whitematt...	6532	52.07	11.59	48.2	36.39

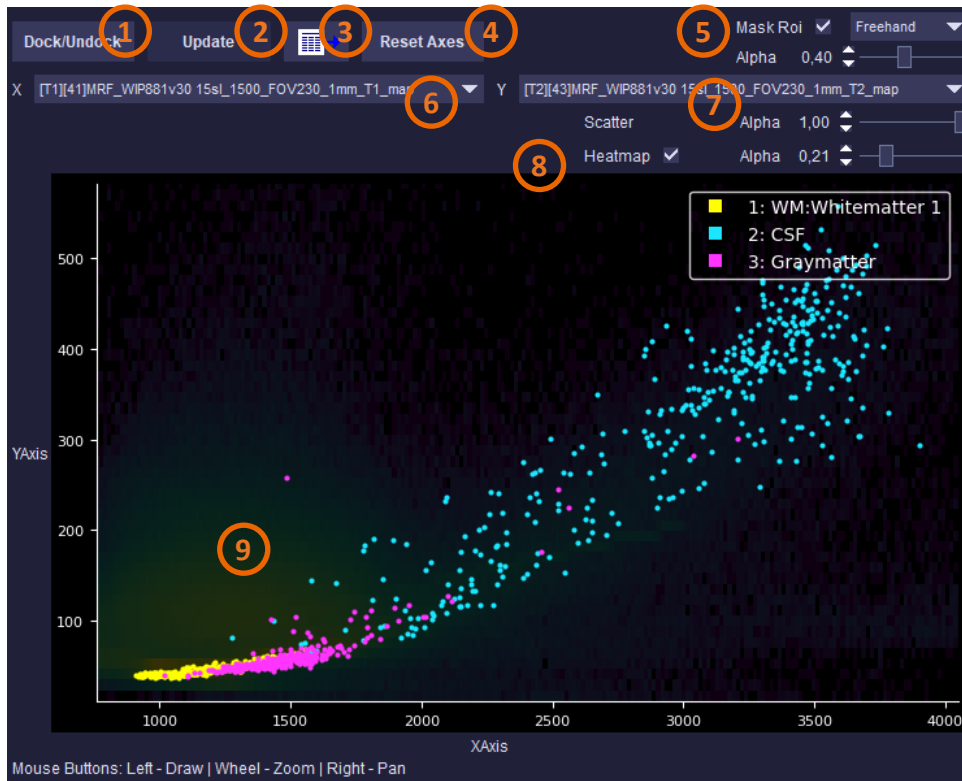
ROI Id	ROI Label	Voxels	Mean	Std	Median	Min
--------	-----------	--------	------	-----	--------	-----

Statistics Table

- (1) Dock/Undock statistics table into/from the lower right image segment
- (2) Export table in csv format or PDF, DICOM as configured within the settings
- (3) Toggle series
- (4) Measurements may be adapted in the application configuration settings

Feature Overview

View – Scatter Plot



Scatter Plot

- (1) Dock/Undock scatter plot into/from the lower right image segment
- (2) Update Button must be pressed to reflect changes of the ROIs in the scatter plot
- (3) Export table in csv format or PDF, DICOM as configured within the settings
- (4) Reset axes to visible content region
- (5) Switch on the back projection of the masked voxels and choose ROI type to draw in scatter plot region
- (6) Select contrasts for X- and Y-axes of the scatter plot
- (7) Select transparency of scatter points
- (8) Toggle heat map and control transparency
- (9) Scatter plot region to visualize contrast intensities along X- and Y-series

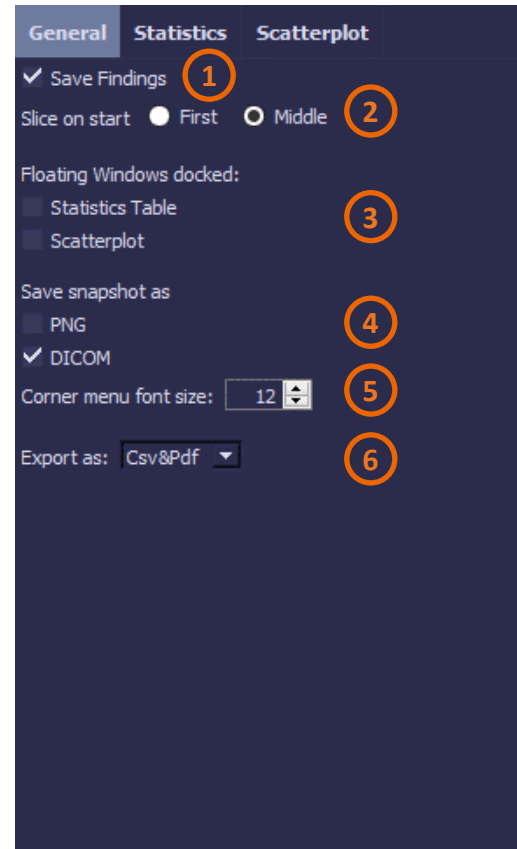
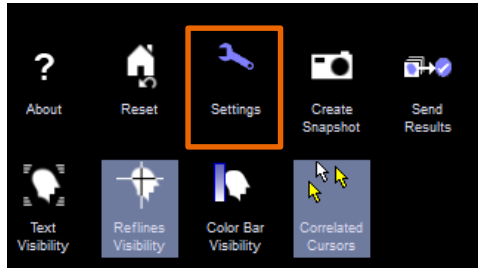
LMB: Draw Rectangle or Freehand ROI into scatter plot region to mask all voxels in which the pixel values of contrast X and Y fall into the ROI.

Navigation in the scatter plot region:

- Drag RMB: Pan
- Mouse wheel close to center: Zoom both axes
- Mouse wheel close to an axis: Zoom single axis

Feature Overview

Settings

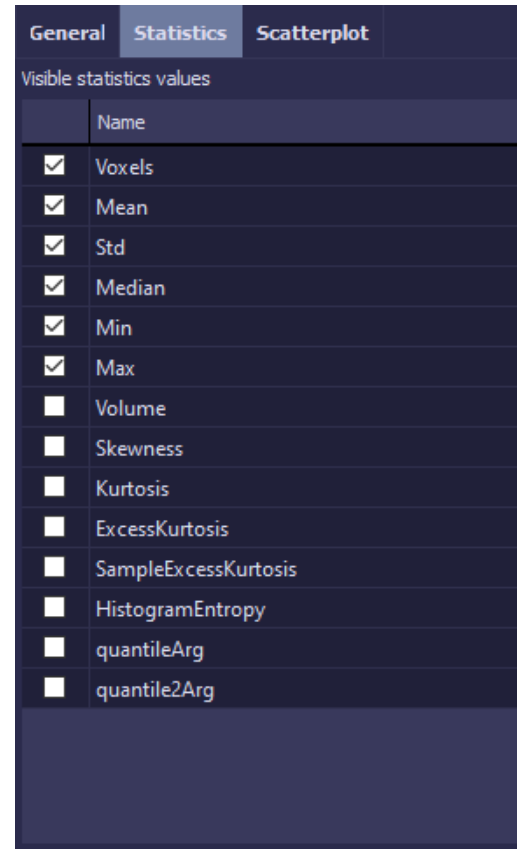
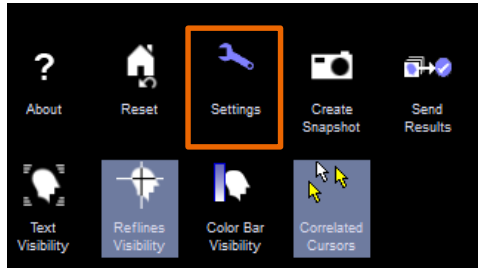


General Settings

- (1) Specify whether findings are saved automatically.
- (2) Set the initial slice position for viewing either to the first or the middle slice.
- (3) Both the Statistics Table, as well as the Scatter Plot may be started either docked or floating.
- (4) Additional snapshot formats for export as PNG and DICOM.
- (5) Adjustment for the corner menu font size.
- (6) Specify formats for exported measurements and findings.

Feature Overview

Settings

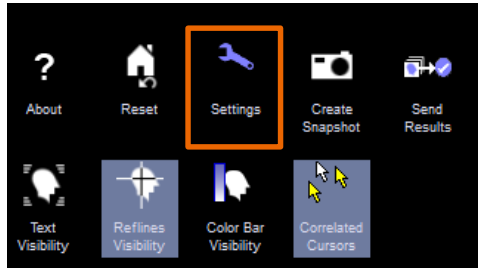


Statistics Settings

Choose from a list of available statistics values that will be shown in the Statistics Table and used for the export.

Feature Overview

Settings



Scatter Plot Settings

Change the visibility of the Scatter Plot legend.

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Common Controls / Key Bindings

Common Controls

Key Bindings

Image segments follow in most aspects the standard *syngo.via* style user interaction mechanisms.

Mouse:

- Left Mouse Button (LMB):
 - Drag while clicking: Center of an Image: Pan
 - Drag while clicking: Corner of an Image: Zoom
 - Double click: Blow up the segment to full-size or toggle back to original size
- Middle Mouse Button (MMB): Windowing
- Right Mouse Button (RMB): Navigation through slices
- Mouse Wheel: Navigation through slices


Keyboard:

- "A" – Toggle Image Annotations
- "Del" – Delete currently selected findings ROI
- CTRL+Cursor-Left, CTRL+Cursor-Right: previous/next contrast
- CTRL+C, CTRL+V: Copy paste selected ROI to current segment

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