



OBJECT MANIPULATION

Version 1.0

**Software User Guide
Revision 1.1**

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1 GENERAL INFORMATION

1.1 Contact Data and Legal Information

1.1.1 Contact Data

Support

If you cannot find information you need in this guide, or if you have questions or problems, contact Brainlab support:

Region	Telephone and Fax	Email
United States, Canada, Central and South America	Tel: +1 800 597 5911 Fax: +1 708 409 1619	us.support@brainlab.com
Brazil	Tel: (0800) 892 1217	
UK	Tel: +44 1223 755 333	support@brainlab.com
Spain	Tel: +34 900 649 115	
France and French-speaking regions	Tel: +33 800 676 030	
Africa, Asia, Australia, Europe	Tel: +49 89 991568 44 Fax: +49 89 991568 811	
Japan	Tel: +81 3 3769 6900 Fax: +81 3 3769 6901	

Expected Service Life

Brainlab provides five years of service for software. During this period of time, software updates as well as field support are offered.

Feedback

Despite careful review, this user guide may contain errors.

Please contact us at igs.manuals@brainlab.com if you have suggestions as to how we can improve this user guide.

Manufacturer

Brainlab AG
Kapellenstr. 12
85622 Feldkirchen
Germany

1.1.2 Legal Information

Copyright

This guide contains proprietary information protected by copyright. No part of this guide may be reproduced or translated without express written permission of Brainlab.

Non-Brainlab Trademarks

Microsoft® and Windows® are registered trademarks of Microsoft Corporation in the United States and other countries.

Integrated 3rd-Party Software

This software is based in part on the work of the Independent JPEG Group.

This software is based in part on OpenJPEG. The full license and copyright notice can be found here: <https://github.com/uclouvain/openjpeg/blob/master/LICENSE>.

This software is based in part on libjpeg-turbo. The full license and copyright notice can be found here: <https://github.com/libjpeg-turbo/libjpeg-turbo/blob/master/LICENSE.md>.

This software is based in part on libtiff. The full license and copyright notice can be found here: <http://www.libtiff.org/misc.html>.

This software is based in part on Xerces-C++ made available under the Apache Software License: <https://xerces.apache.org/xerces-c/>.

CE Label

-  • The CE label indicates that the Brainlab product complies with the essential requirements of European Council Directive 93/42/EEC, the Medical Device Directive (“MDD”).
- According to the rules established by the MDD, **Object Manipulation** is a Class IIb product.

NOTE: The validity of the CE label can only be confirmed for products manufactured by Brainlab.

Disposal Instructions

	Only dispose of electrical and electronic equipment in accordance with statutory regulations. For information regarding the WEEE (Waste Electrical and Electronic Equipment) directive, visit: www.brainlab.com/en/sustainability
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Sales in the US



US federal law restricts this device to sale by or on the order of a physician.

1.2 Symbols

1.2.1 Symbols Used in This Guide

Warnings



Warnings are indicated by triangular warning symbols. They contain safety-critical information regarding possible injury, death or other serious consequences associated with equipment misuse.

Cautions



Cautions are indicated by circular caution symbols. They contain safety-critical information regarding possible problems with the device. Such problems include device malfunctions, device failure, damage to device or damage to property.

Notes

NOTE: Notes are formatted in italic type and indicate additional useful hints.

1.3 Intended Use

1.3.1 Using the System

Indications for Use

Object Manipulation is part of Elements Object Management 1.0. Elements Object Management 1.0 can be used in all clinical workflows that require the creation or manipulation of segmentation objects. The device itself does not have specific clinical indications.

Intended User Profile

The application is intended to be used by medical professionals and their assistants working in the field of neurosurgery and radiotherapy planning.

Intended Use Environment

The application shall be used:

- In a hospital office environment or at any other location offering a computer
 - In an operating room / suite or in rooms appropriate for surgical interventions
-

Plausibility Review



Before patient treatment, review the plausibility of all information input to and output from the system.

Responsibility



This application solely provides additional assistance to the surgeon or user and does not by any means substitute or replace the surgeon's or user's experience and/or responsibility during its use.

1.4 Compatibility with Medical Devices

1.4.1 Brainlab Medical Software

Compatible Brainlab Medical Software

Object Manipulation is compatible with:

- Content Manager 2.2
 - Patient Selection 4.1
 - Dicom Proxy 3.3.6
 - Image Fusion 2.0
 - SmartBrush 2.1
 - Brain Metastases 1.0
 - Adaptive Hybrid Surgery Analysis 1.0
-

Other Brainlab Software

Other compatible Brainlab software may become available after the release of this user guide. If you have questions regarding compatibility of the software contact Brainlab support.

If you are currently running software versions other than those specified above, contact Brainlab support for clarification regarding compatibility.

1.4.2 Non-Brainlab Software

Authorization



Only authorized Brainlab employees may install software on the Brainlab system. Do not install or remove any software applications.

Compatible Non-Brainlab Software

Object Manipulation is compatible with:

- Microsoft Windows 7
- Microsoft Windows 8.1
- Microsoft Windows 10
- Windows Server 2008
- Windows Server 2012

For information regarding compatible service packs, please contact Brainlab support.

Other Non-Brainlab Software



Only software specified by Brainlab may be installed and used with Object Manipulation.

1.5 Training and Documentation

Brainlab Training

To ensure safe and appropriate use, before using the system Brainlab recommends that all users participate in a training program held by a Brainlab representative.

Documentation

This guide describes complex medical software that must be used with care. It is therefore important that all users of the system:

- Read this guide carefully before handling the equipment
- Have access to this guide at all times

2 SOFTWARE OVERVIEW

2.1 Image Viewing Functions

Basic Viewing Options

Options		
To pan the slices,	 Pan	click this button and drag a slice with the mouse pointer.
To browse through the slices,	 Scroll	click this button and drag the mouse pointer through a slice, up or down. You can also use the mouse wheel.
To zoom in or out,	 Zoom	click the zoom button and drag the mouse pointer up/down (or press CTRL + mouse wheel).
To rotate a 3D view (where available)		click inside the 3D view and drag the mouse pointer.

How to Change Slice Windowing

You can change windowing settings to improve the visibility or structure contrast.

Options
<p>To change basic windowing, click this button:</p> <div style="text-align: center;"> Windowing</div> <p>Click in one of the slices, hold down the mouse button, and drag the mouse pointer to adjust the windowing histogram:</p> <ul style="list-style-type: none"> • Drag down (up) to increase (decrease) the brightness. • Drag left (right) to increase (decrease) the contrast level.

Available Image Layouts

Click **Data** and choose a button under **Layouts** to change how image slices are displayed.

Options	
 Slice Review	Slice Review provides a 3 x 3 grid with 3D view in the top left corner and a sequence of slices.

Options	
 <p>ACS</p>	<p>ACS provides a 3D view in the top left corner and an axial, coronal and sagittal view.</p>
 <p>Single</p>	<p>Single provides a single slice.</p>

2.2 Getting Started

General Information

Object Manipulation enables you to review and modify objects. Objects of interest can be copied and combined using logical operations. The application also provides the functionality to extend or shrink objects using margins.

Starting Object Manipulation

Choose a patient dataset using **Content Manager** and start **Object Manipulation**.



The application window displays a list of objects contained in the image set under **Objects**:



Figure 1

You can show/hide an object by clicking on the eye icon beside the object name.

Viewing Object Details

Click on **Objects** under **Data** to see more details about each object including its volume and creation date.

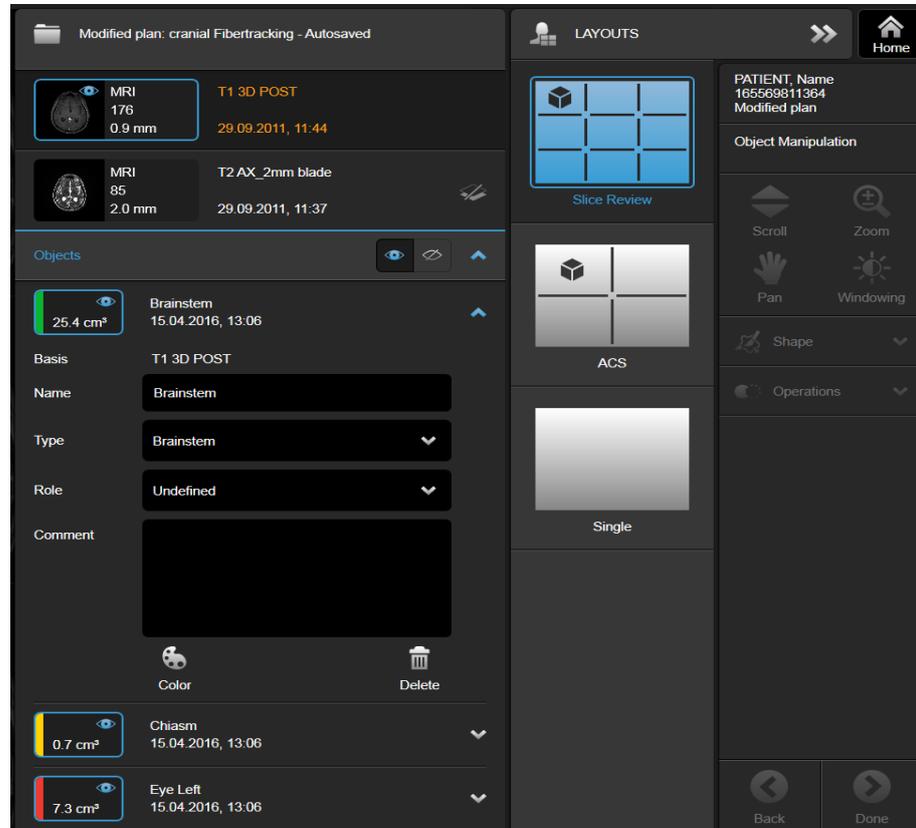


Figure 2



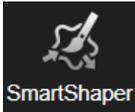
Not all Elements can evaluate the value that is set in Role and solely rely on the value that is set in Type. Refer to the software user guide of the Element that uses the object after creation and ensure that the correct properties are set.

2.3 Refining Objects

General Information

Once you have selected an object for review, you can adjust its shape for correctness.

Smartshaper Options

Option	Description
 SmartShaper	Extend an object.
 Brush	Simple brush (available in Single view layout).
 Erase	Remove part of an object.
	Adjust brush size.
 Undo	Undo last change or multiple changes.

How to Use SmartShaper

Steps
1. Select an object in the list.
2. Center and zoom to the region of interest using the Zoom , Scroll and Pan functions.
3. Select SmartShaper .
4. Adjust the brush size if necessary.
5. Move SmartShaper over the contour. The part of the contour that will change will be highlighted. You can now drag the contour to the desired location. You can bend, bulge or drag contours depending based on the initial position of the mouse cursor.
6. Scroll to next slice.
7. Repeat steps 4-6 until the object has been created in all relevant slices.
8. Verify the object.



The **SmartShaper** algorithm modifies the object in a local three-dimensional neighborhood around the modified contour. Hence, not all changes might be visible in the displayed slices. Objects that are modified using **SmartShaper** must be verified by the user in all 2D slices before leaving the application.

How to Use Brush

Steps	
1.	Select an object in the list.
2.	In the single slice view, center and zoom to the region of interest using the Zoom , Scroll and Pan functions.
3.	Select Brush .
4.	Adjust the brush size if necessary.
5.	Add to the object outline with a brush stroke.
6.	If edges of the segmented area are not correctly separated from the surrounding area, use Erase to define these borders more accurately. If a mouse is used, use the right mouse button to erase when Brush is active.
7.	The change is only applied in 2D to the current slice. Scroll to next slice.
8.	Repeat steps 4-7 until the object has been created in all relevant slices.
9.	Verify the object.

2.4 Object Operations

General Information

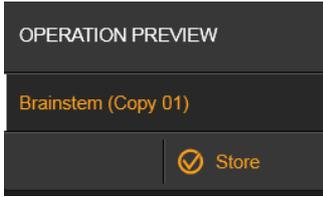
The following operations are available:

Operation	Description
Copy	Creates a copy of an existing object.
Union	Creates a new object from two or more merged objects.
Subtraction	Creates a new object from the subtraction of the one or more objects from another.
Intersection	Creates a new object from the intersection of two or more objects.
Margin	Shrink or enlarge the operation result.



Union, Intersection, and Subtraction results could differ from the object's original shape when the operands are segmented in different slice sets and/or with different resolutions. Objects created using one of the logical operations must be verified by the user.

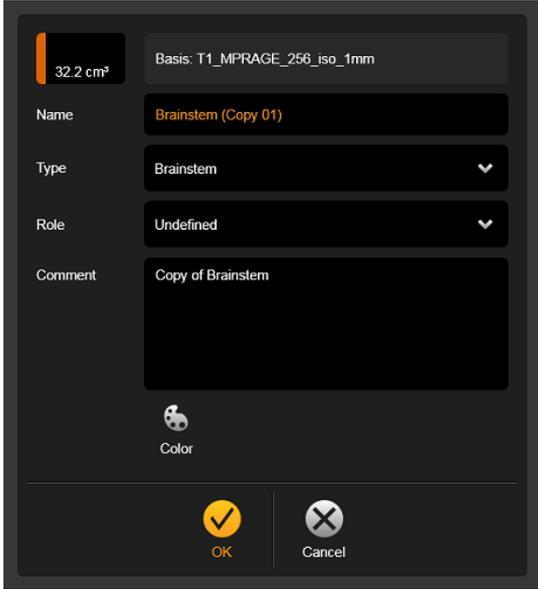
How to Copy an Object

Steps	
1.	 Click Copy .
2.	Choose the object to copy from the list under Objects .
3.	<p>A preview of the new object is displayed in the slice view and listed under Operation Preview.</p> 
4.	You can choose to add a margin (see page 22).

Steps

If you are satisfied with the operation, click **Store** to save the object. This dialog is displayed:

5.



The system provides a default name and other values which you can change. You can change the color of the object by clicking **Color**.

6. Click **OK** to save the object.

How to Perform a Union of Objects

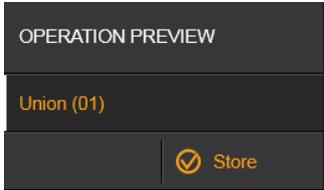
Union enables you to create a new object from two merged objects.

Steps

1.  Click **Union**.

2. Choose two or more objects from the list under **Objects**.

3. A preview of the new object is displayed in the slice view and listed under **Operation Preview**.



4. You can choose to add a margin (see page 22).

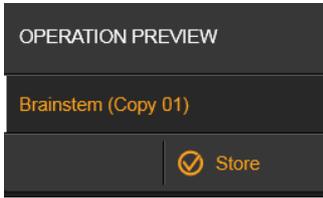
If you are satisfied with the operation, click **Store** to save the object.

5. A dialog is displayed providing a default name and other values which you can change. You can change the color of the object by clicking **Color**.

6. Click **OK** to save the object.

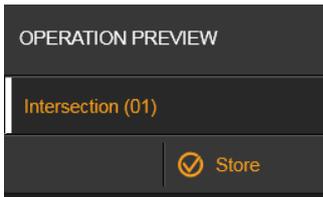
How to Perform Subtraction on Two Objects

Subtraction enables you to create a new object from the subtraction of the one object from another.

Steps	
1.	Choose the first object from the list under Objects .
2.	 Click Subtraction .
3.	Choose the objects that you want to subtract from the target object from the list under Objects .
4.	A preview of the new object is displayed in the slice view and listed under Operation Preview . 
5.	You can choose to add a margin (see page 22).
	If you are satisfied with the operation, click Store to save the object.
6.	A dialog is displayed providing a default name and other values which you can change. You can change the color of the object by clicking Color .
7.	Click OK to save the object.

How to Perform an Intersection of Two Objects

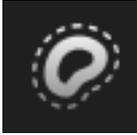
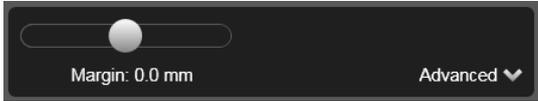
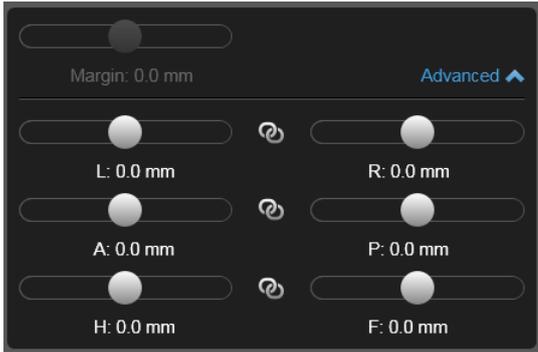
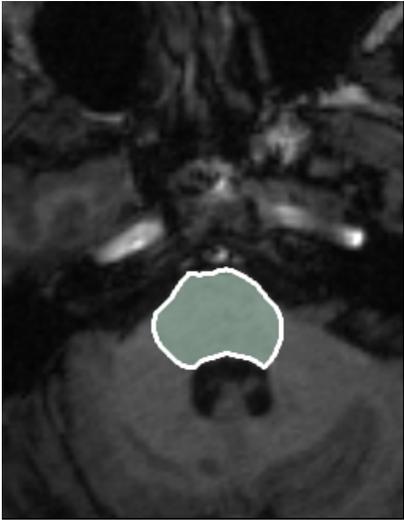
Intersection creates a new object from the intersection of two objects.

Steps	
1.	Choose the first object from the list under Objects .
2.	 Click Intersection .
3.	Choose the objects that you want to intersect with the target object from the list under Objects .
4.	A preview of the new object is displayed in the slice view and listed under Operation Preview . 
5.	You can choose to add a margin (see page 22).
	If you are satisfied with the operation, click Store to save the object.
6.	A dialog is displayed providing a default name and other values which you can change. You can change the color of the object by clicking Color .

Steps	
7.	Click OK to save the object.

How to Add a Margin to an Object

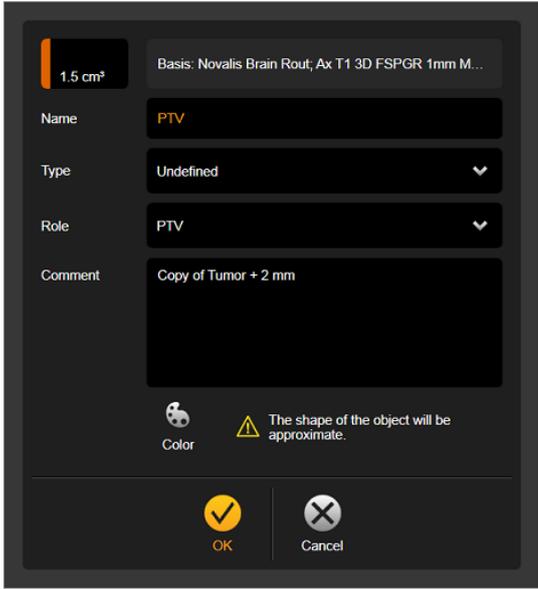
When you create an object using one of these operations you can shrink or enlarge the operation result to create your target volume.

Steps	
1.	Start one of the operations Copy , Union , Subtraction or Intersection .
2.	 <p>Click Margin.</p>
	<p>Choose the width of the margin using the slider displayed.</p>  <p>You can customize the margin further with parameters available under Advanced:</p>  <p>3.</p> <p>Move the slides to adjust the margin in the directions:</p> <ul style="list-style-type: none"> • L - R: left-right • A - P: anterior-posterior • H - F: head-foot
4.	<p>A preview is displayed in the slice views.</p> 

Steps

The margin is added to the new object if you choose to store it.

5.



The screenshot shows a dark-themed dialog box with the following fields and controls:

- Volume: 1.5 cm³
- Basis: Novalis Brain Rout; Ax T1 3D FSPGR 1mm M...
- Name: PTV
- Type: Undefined (dropdown menu)
- Role: PTV (dropdown menu)
- Comment: Copy of Tumor + 2 mm
- Color: (color selection icon)
- Warning: The shape of the object will be approximate.
- Buttons: OK (yellow checkmark) and Cancel (grey X)



Not all Elements can evaluate the value that is set in Role and solely rely on the value that is set in Type. Refer to the software user guide of the Element that uses the object after creation and ensure that the correct properties are set.

2.5 Adding Additional Objects

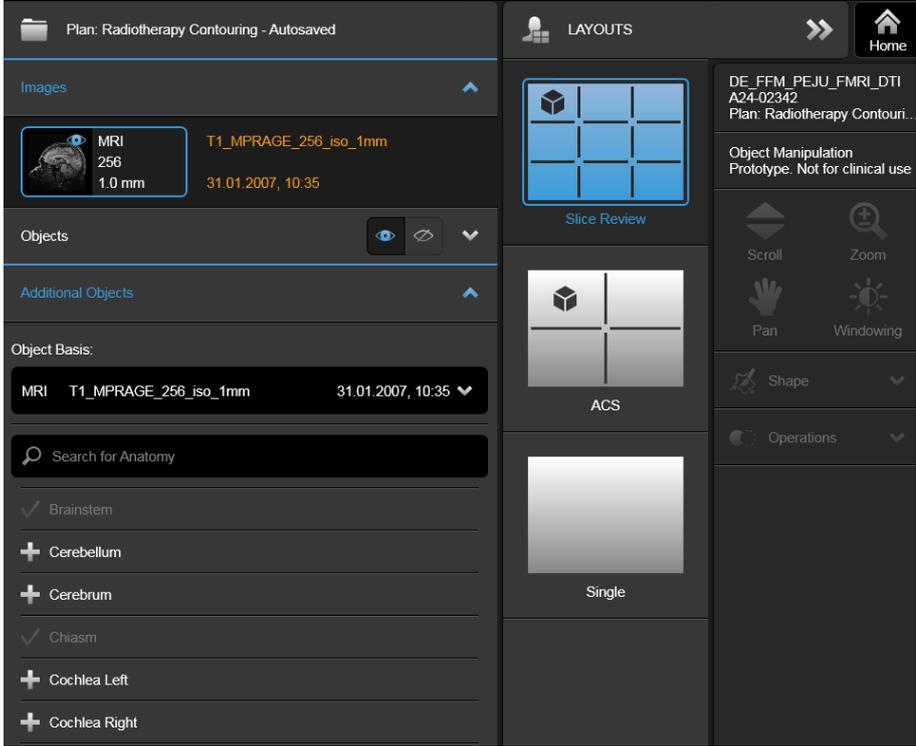
Adding Additional Objects

If an image set for this patient contains pre-existing defined objects, you can add them for **Object Manipulation**.

*NOTE: This feature is only available if **Elements Segmentation** is licensed.*

Steps

Click on **Additional Objects** under **Data** to see the list of available pre-existing objects.

- 

1. Chose the image set containing the additional objects under **Object Basis**. The objects available in that image set are displayed.

Some objects are only available by using the search function:

 - Click inside the search field.
 - Type the name of the object to be added.
 - The list is filtered to display matching objects.
- 

4. Click **+** to add an object to the views.

2.6 Exporting Data Sets

General Information

The 3D objects created by the application are stored on the whiteboard and can be used by other Elements within the workflow for further planning and processing. Those objects can also be exported for usage with third party applications.

The Brainlab Elements **DICOM RT Export** and **DICOM Burned-In Export** are always installed in addition to **Anatomical Mapping**. Both export functions are available in the **Content Manager**. (See the **Software User Guide, Content Manager Patient Selection**).

2.6.1 DICOM RT Export

Exporting DICOM RT Data

The DICOM radiotherapy (RT) export function converts DICOM data into a DICOM RT-specific format and exports the data to a pre-configured DICOM network storage target for further processing with 3rd-party systems.

The DICOM RT export uses the DICOM merge library as the transfer protocol to 3rd-party systems. DICOM facilitates the general interoperability between different vendors' systems. DICOM RT export provides the most recent subset of DICOM objects to facilitate the transfer of specific digital image, graphical and non-image data between two or more systems.

For detailed information and the latest DICOM conformance statement, visit www.brainlab.com/DICOM.



The DICOM configuration provided by Brainlab cannot guarantee that interoperability is always correct. It is necessary to verify that your equipment is fully functional and produces accurate results.

DICOM stores a certain number of points in space that are used to reconstruct contours. Due to different algorithms used by different systems the actual representation of the contours may vary with a very high likelihood but only in small scale. Nevertheless, these different interpretations may result in slight deformations of the contours and differences in size of the volume. Therefore, carefully verify the structures after import on a third-party system.

Exporting 3D Objects and Annotation Points

During export, 3D objects and annotation points are converted to the so-called "DICOM RT structure set" format, during which objects are re-sampled according to the related image set or a fused image set contained in the current selection.

There are two possible configurations for the export of 3D objects and annotation points:

1. Default configuration: All objects are exported in the context of the original image set they were created in. If the original image set is not selected among the data for export, the latest CT image set that is fused to the original image set is chosen as base set for the export. If you selected MR image sets only, the set with the largest volume and smallest voxel size is chosen. If you did not select any fused image sets for export, the export process is aborted.
2. All objects are created in the latest CT data selected for export. If objects are selected that are not fused to this CT image set, these objects are not exported. To change the default configuration, contact Brainlab support.



When objects are re-sampled to the original or fused image set, there may be a loss of information. Therefore, carefully verify structures after import on a 3rd party system.

Contour Interpretation



Brainlab stores contours with a very high precision. Due to a limitation imposed by the DICOM standard the accuracy of contour point positioning may be reduced before the contour information is written to the DICOM RT structure set. Depending on the number of contour points, the precision may be reduced from 10E-9 m to 10E-5 m.



Contours in RT structure sets may be interpreted differently depending on the system. Therefore, an unwanted change to alignment or orientation, or a flipping or mirroring of the image contours may occur. In addition, depending on the system, the shape and volume of the structures may differ slightly due to the use of different algorithms to represent contours. Therefore, carefully verify structures after import on a 3rd-party system.

2.6.2 DICOM Burned-In Export

Export of Burned-In Datasets

The **DICOM Burned-In Dataset** export function permanently integrates the contours of a segmented object into a DICOM MR image series, thereby creating a new DICOM image series. This functionality is only available for exactly one segmented object combined with exactly one DICOM MR image series. DICOM compliant 3rd party applications can load these images and recreate the content using e.g., thresholding algorithms.

After the export has finished, the newly created DICOM image series will be easily recognized by its series comment "BURNED-IN" and located together with the original patient data.



The Burned-In export function creates a new DICOM image series containing a permanent change in pixel values. Structures underneath the Burned-In contour cannot be accessed later on. Use Burned-In image series only in conjunction with the original MR image series.



The size and shape of the exported object can appear differently in the resulting image series. Brainlab stores contours with a very high precision. Due to rasterization and re-sampling of the contours to images of a lower resolution, an information loss will arise. It is recommended to use a high resolution image series in order to retrieve the best possible output results. Please review the created images carefully and compare to the original image series before exporting to a 3rd party device.



DICOM facilitates the general interoperability between different vendors' systems. However, the DICOM configuration provided by Brainlab cannot guarantee that interoperability is always correct. It is necessary to verify that your equipment is fully functional and produces accurate results.



The created images can look differently when used on 3rd party systems. Depending on the interpretation of the image on the 3rd party system, the image intensities might be displayed differently. Please review the images carefully and compare to the original image series before further use.

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