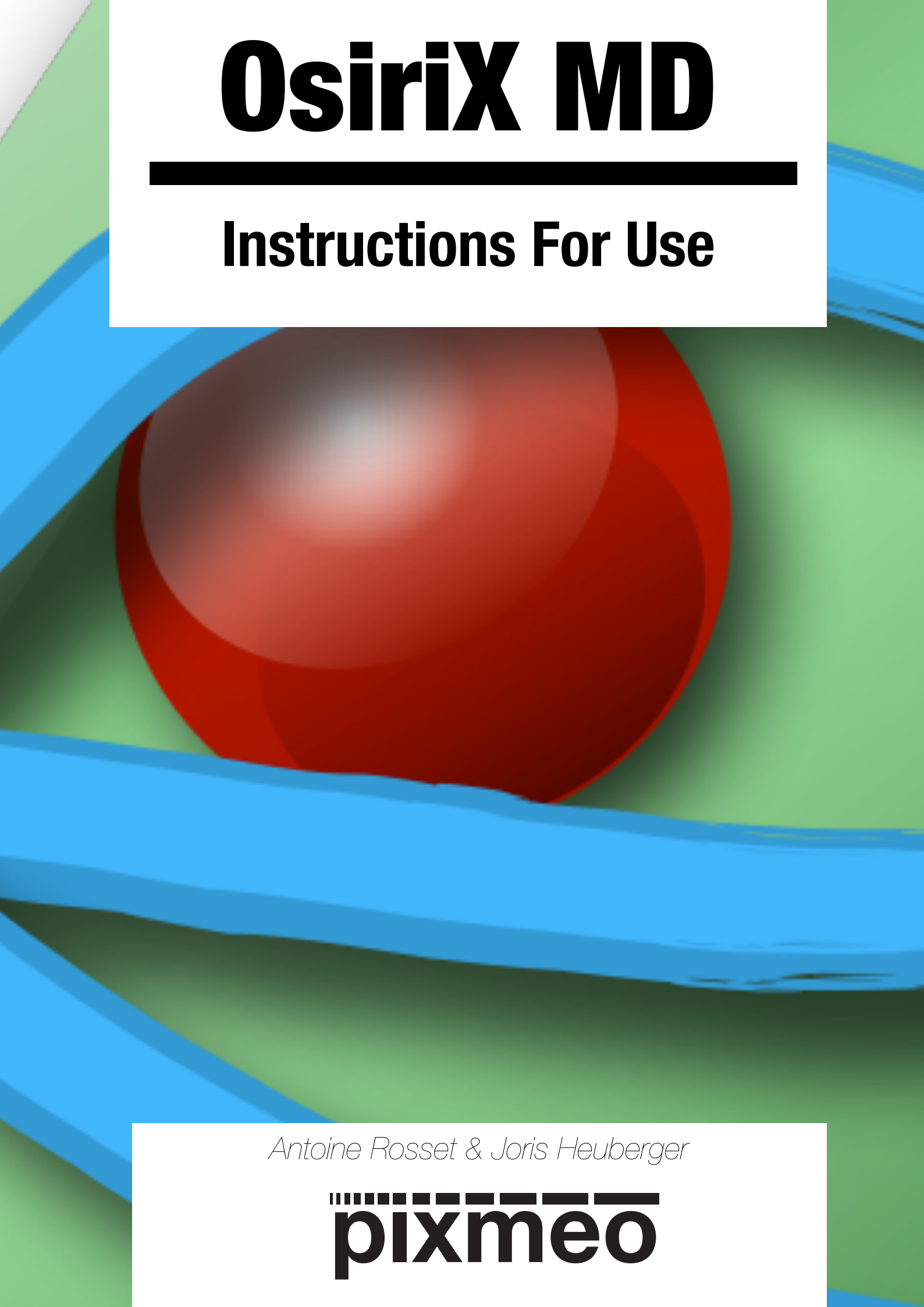


OsiriX MD



Instructions For Use

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|||||
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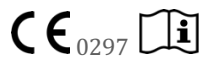
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The user is granted to receive a printable version of this manual. Contact the editor by email or mail for this.

The U.S. Federal Law restricts this device to sale by or on the order of a physician. OsiriX complies with European Directive 93/42/EEC concerning medical devices. Under this directive, it is regarded as a class IIa product.

OsiriX is an FDA cleared 510k class II medical device, according to US Food And Drug Regulation CFR21 part 820.



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INTRODUCTION

DEVICE DESCRIPTION

OsiriX provides services for review and post processing of diagnostic medical images and information. It conforms to the «DICOM» standard to allow the sharing of medical information with other digital imaging systems. OsiriX runs on Apple macOS systems and provides high performance review, navigation, and post processing functionality for multidimensional and multimodality images.

INDICATION FOR USE

OsiriX is a software device intended for the viewing of images acquired from CT, MR, CR, DR, US and other «DICOM» compliant medical imaging systems when installed on suitable commercial standard hardware. Images and data can be captured, stored, communicated, processed, and displayed within the system and/or across computer networks at distributed locations.

RESTRICTIONS

Lossy compressed Mammography images and digitized film screen images must not be reviewed for primary diagnosis or image interpretation. Mammography images should only be viewed with a monitor approved for viewing Mammography images. It is the user's responsibility to ensure monitor quality, ambient light conditions and that image compression ratios are consistent with clinical application.

CONTRAINDICATIONS

None

RESIDUAL RISKS

Risks linked with OsiriX software are acceptable in balance with its performance. Risks are the same with OsiriX than with any other marketed diagnosis software. There is no unpredictable or exceptional risk linked with the use of OsiriX software.

MEDICAL DEVICE

The Software is a Medical Device and may only be operated by an authorized medical doctor, or by a professional trained, under the control and responsibility of a medical doctor. The medical doctor must be fully trained in medical imaging to use this software as a diagnosis tool. The label of this software is available in the OsiriX MD menu, in the "About OsiriX MD" menu item.

REQUIREMENTS

- **Type:** *Apple Mac computer*
- **Operating System:** *OS X 10.15 to macOS 14*
- **CPU:** *Intel or Apple Silicon*
- **Memory:** *6GB of RAM, or more*
- **Monitor:** *1280 x 1024 pixels or higher monitor certified for medical imaging*
- **Network:** *An active Internet connection for license validation process*
- **Files compatibility:** *files stored in «DICOM» format.*

INSTALLATION

You need Administrator privileges to be able to install this program. The installation wizard will walk you through the installation process step-by-step. The default setting will install OsiriX in the */Applications* folder of the selected hard disk.

You can download your software installer from your Pixmeo account at this address: <https://www.osirix-viewer.com/my-account/>

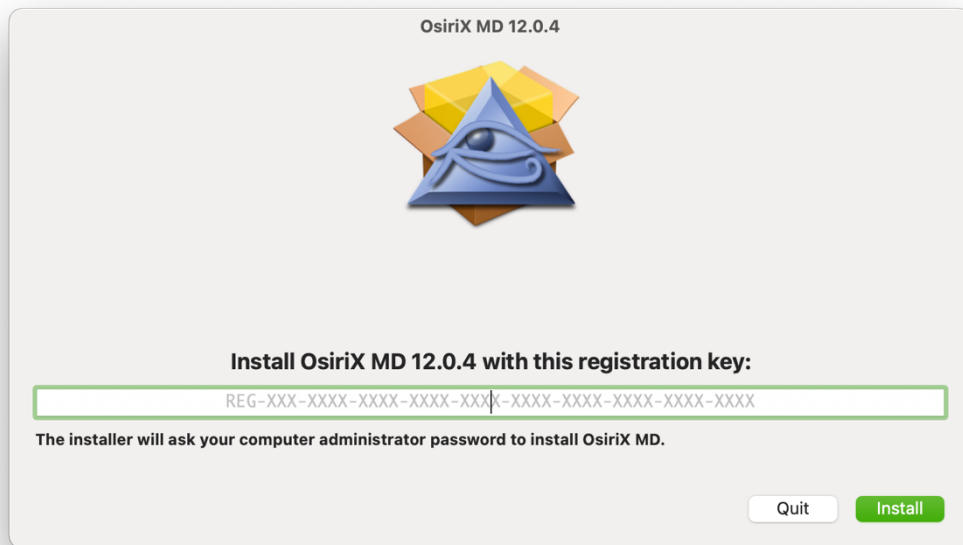


Figure 1: installer software

PREFERENCES

Options and settings of numerous functions of OsiriX can be changed at will using the preferences settings.

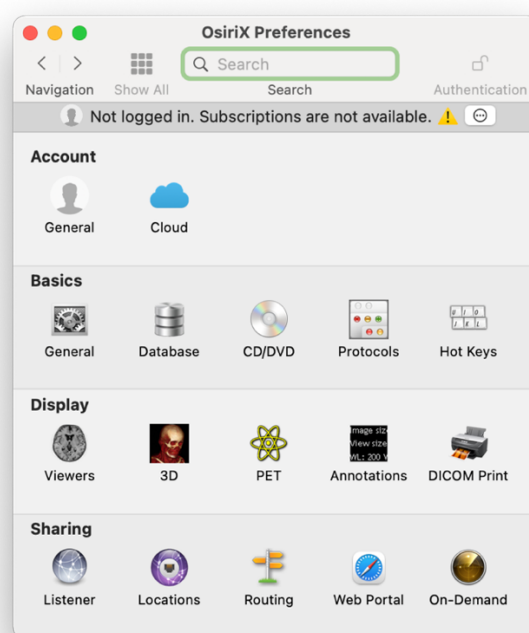


Figure 2: Preferences window

GENERAL

This set of preferences represents some basic preferences of the program.

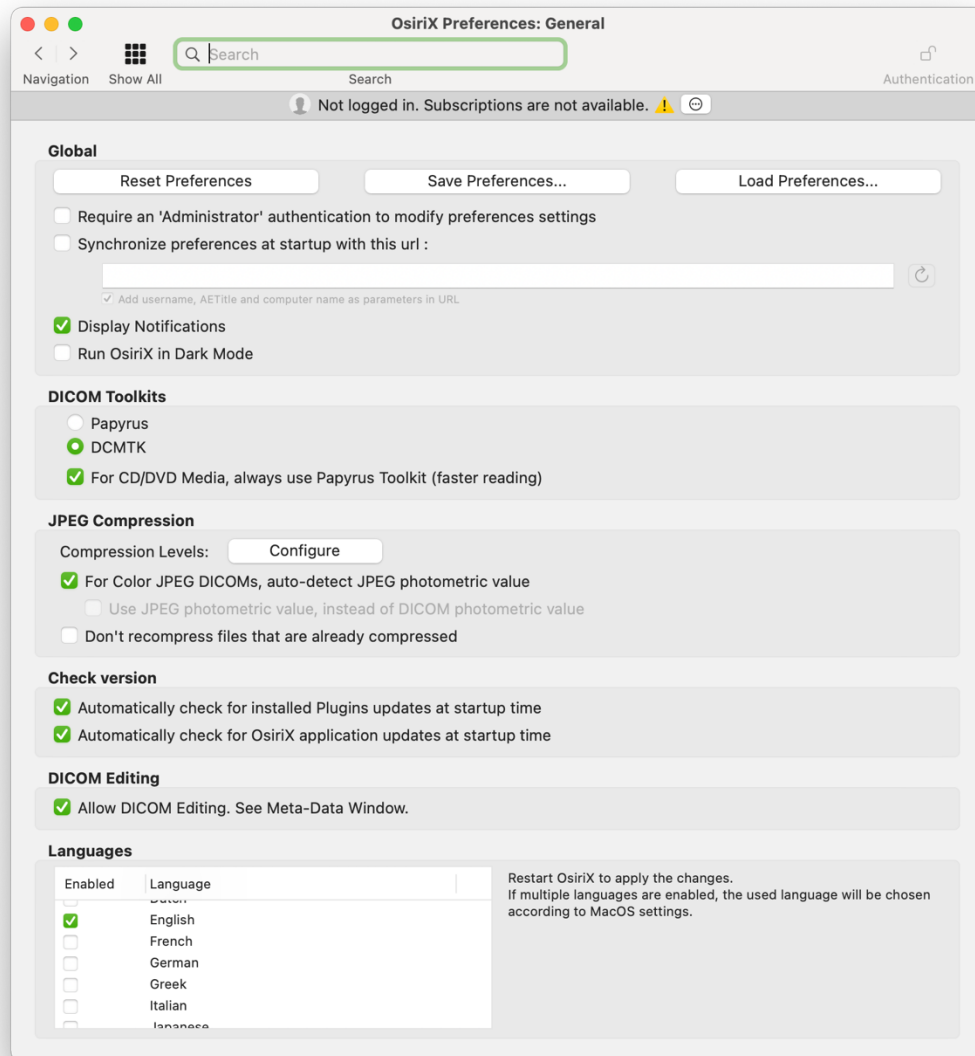


Figure 3: General Preferences

The three buttons allow you to reset, save or load all preferences of OsiriX. The preferences file is an XML file, you can edit it with a text editor.

The *Require an administrator authentication* option allows you to block preferences changes. You should check this option if you want only a user with an administrator account to be able to change the settings found in the Preferences. This option will prevent unexperienced users from inadvertently modifying critical parameters, such as the «DICOM» Listener settings or the OsiriX Database options.

The *Synchronize with URL* option allows you to store a preference file (saved with the *Save Preferences* button) on a distant computer. You can use a web server, such as Apache, to store the file. This file will be loaded by OsiriX at startup, and then each hour. All the preferences stored in this URL will replace the current preferences of OsiriX.

The «DICOM» Toolkits options allows the user to choose from different «DICOM» software libraries in order to parse «DICOM» files and to read «DICOM» files images. Changing these options allows you to evaluate differences in the performance of different software libraries and to test some alternatives in case of difficulty importing some particular sets of «DICOM» images that may not be fully compliant with standard «DICOM» import routines.

Several «DICOM» Toolkits are embedded in OsiriX and can be used for either reading the «DICOM» header or the image data of a «DICOM» file. When handling «DICOM» files coming from different vendors, it can be useful to be able to switch these toolkits allowing you to find the best settings for the types of images that you use most frequently. The recommended setting is to use «DCMTK» for parsing the files. «DCMTK» is robust enough and quick enough to read any «DICOM» files.

DATABASE

This set of preferences allows the user to set up an images database location (containing the SQL index, the actual «DICOM» files and more) and behavior, like «DICOM» files parsing, database fields settings and database auto-cleaning.

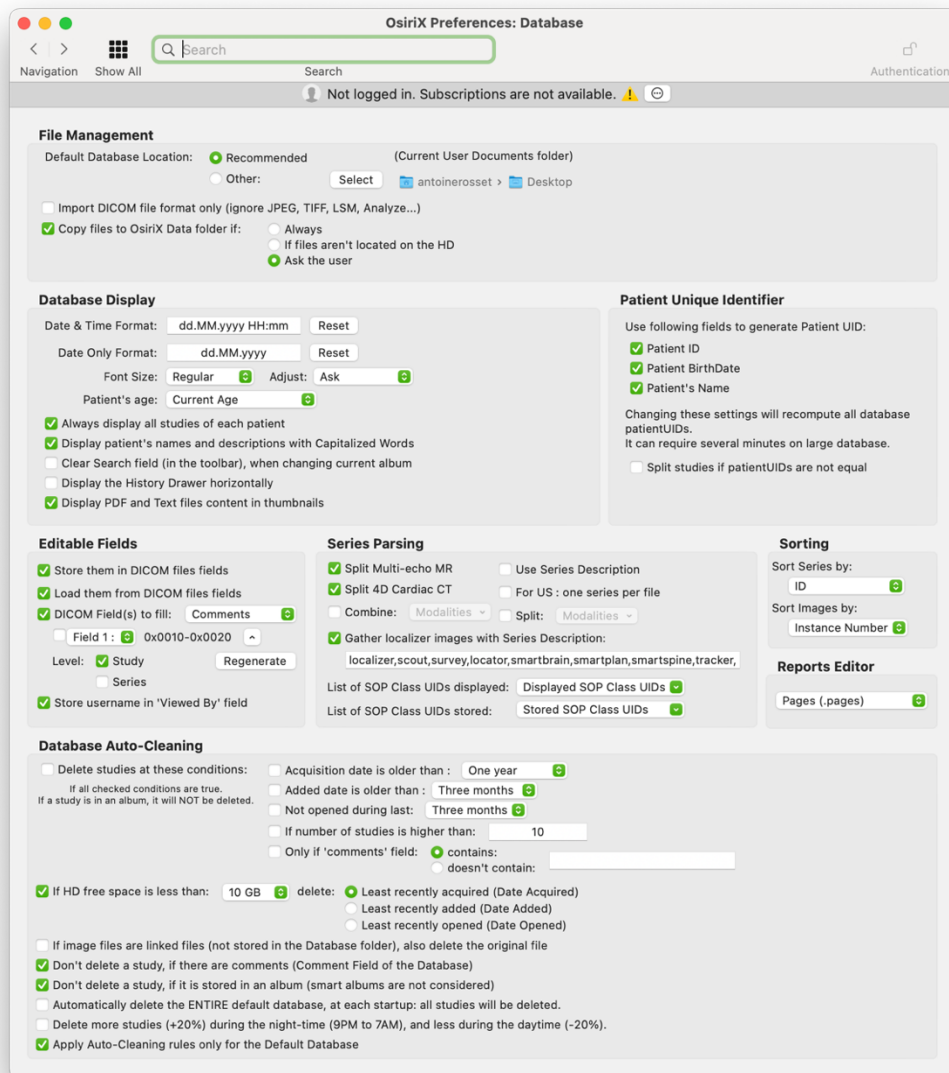


Figure 4: Database preferences

By default, OsiriX creates a folder called «OsiriX Data» in the user's Documents folder. This folder contains the images database and associated files used by the software program to store settings, preferences, overlay, 3D settings data and so on.

You can choose to store these data files in a different location. To do so, select Other and enter the new location where you wish to store the «OsiriX Data» folder.

By selecting the «Import DICOM file only» option, OsiriX will parse, import and display only files that are stored in DICOM format. All other types of images, such as TIFF or JPEG, will be ignored. This option is activated by default.

As the DICOM format is quite a complex format, some DICOM files can be modified and corrupted when files are produced by very specific modalities or software. Usually, OsiriX can automatically detect these corrupted files and will not try to read or open them. However, these corrupted files can sometimes cause OsiriX to crash, or they can corrupt the database. By activating the Validate files before importing option, OsiriX will test each «DICOM» file with an independent process. This independent process can crash, without corrupting OsiriX or causing it to crash. If this independent process crashes, OsiriX can detect it and delete the corrupted «DICOM» files. Therefore, this option is useful when importing files from an unknown or untrusted source. It will increase importing time however, when importing many images.

OsiriX usually copies «DICOM» images into its local database, for example when receiving new images through the «DICOM» Listener. When importing images directly from «DICOM» files, rather than from a «DICOM» communication, the user may choose to copy the image files into his local folder if the images are on a CD, DVD, or an external disk. The user may also choose to be prompted every time a new set of studies or images is imported to decide if these images should be copied to the hard disk.

If the images are not copied, OsiriX will retain a link to the images in their original location thereby avoiding unnecessary usage of storage space on the local disk.

Copying all files into the database folder is easier in terms of file management because the user will always know that all files are in this location. If the user keeps just links to the files, he can inadvertently delete or loose these links, for example by moving or renaming the files.

For «DICOM» CD or DVD, this option can be useful, if the user wants to automatically archive these images in the database (copy files) or if the

user just wants to temporarily look at these images. In this case, the links will be automatically deleted when the user ejects the CD or DVD and no files will be stored in the Database folder.

Database Auto-Cleaning: This section provides the parameters used to clean up the database and delete old files when the size of the database exceeds a certain limit. This allows the user to avoid filling the hard disk and running into situations of not being able to import more images because the hard drive is full. When this option is activated, OsiriX automatically deletes old images that match the criteria listed in the preferences panel. You can also prevent some images from being deleted if the comments field contains a certain text. Studies that have been locked or added to an album will also not be affected.

PROTOCOLS

This section provides options regarding the layout of 2D Viewers windows on the screen. OsiriX can be set to arrange the windows in different ways depending on the study modality and description. For each modality, one can define multiple layouts for any number of study description. When opening a study, if a layout is set for the modality and the description, OsiriX will arrange the series accordingly to the layout.

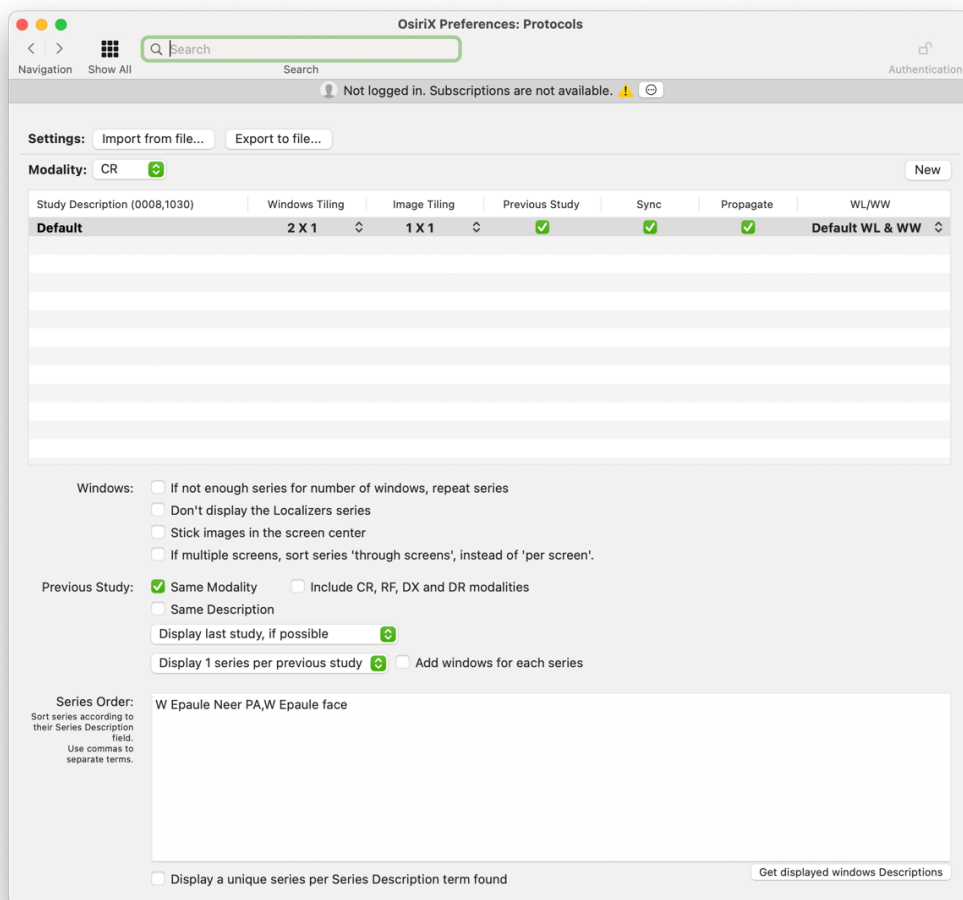


Figure 5: Protocols Preferences

To apply a specific layout to brain CT studies, for example, one will have to add a new protocol for the CT modality and type "CT Brain" in the study description column. This implies however that the study needs to have the exact "CT Brain" string in the Study Description.

To apply the layout to all studies of a modality, regardless of the Study Description, use Default as the Study Description.

HOT KEYS

This preferences pane allows the user to modify some of the default shortcut keys to access certain tools, such as the mouse tools or the «WL/WW» presets. To modify the key associated with a tool/function, select the line corresponding to the tool and hit the desired key.

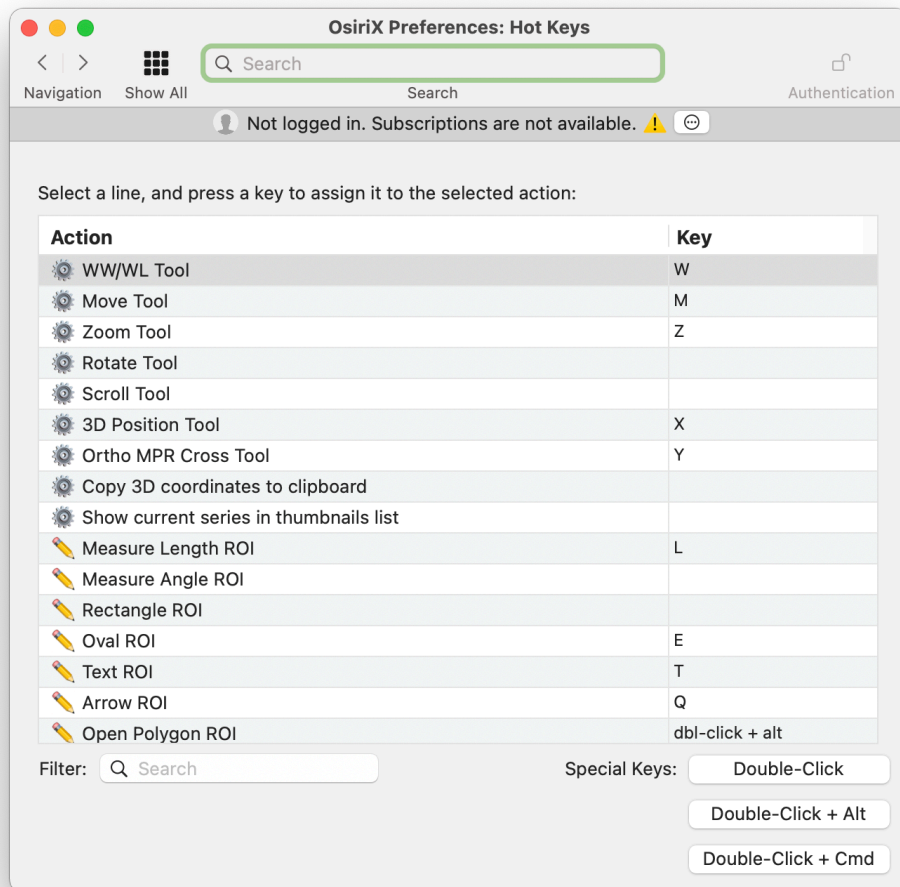


Figure 6: Hot Keys Preferences

VIEWS

This set of preferences allows the user to customize the behavior of the 2D Viewer window. Many of these settings will modify the display parameters of the views, such as interpolation, mouse behavior, «ROI» display, etc. The behavior of multiple windows can also be modified using the following preferences: magnetic windows, windows tiling, workspaces, multiple monitors, etc.



Figure 7: Viewers Preferences

Screens & Windows: This group of options allows the user to set OsiriX functions when it comes to displaying windows.

When the computer has several screens, OsiriX can be set to open windows on all screens or on a sub-selection of screens. To activate or inactive a screen for 2D Viewers, simply click on it and activate or inactivate the Use this screen for viewers' item.

An option also allows you to always reserve the screen where the database window is located for the database: no windows are displayed on this screen. An option also allows you to use the database window screen in the last, only if all other screens are already used for 2D Viewers.

ANNOTATIONS

This preferences panel allows the user to edit the textual overlays (such as the patient's name, date of the study, etc.) that are displayed on the windows. It contains a large white region that represents the entire view and 8 placeholders. The placeholders are located in the 4 corners and in the middle of each of the 4 sides. They represent the areas where the textual overlays can be placed. Each placeholder can contain up to 6 lines of annotations.

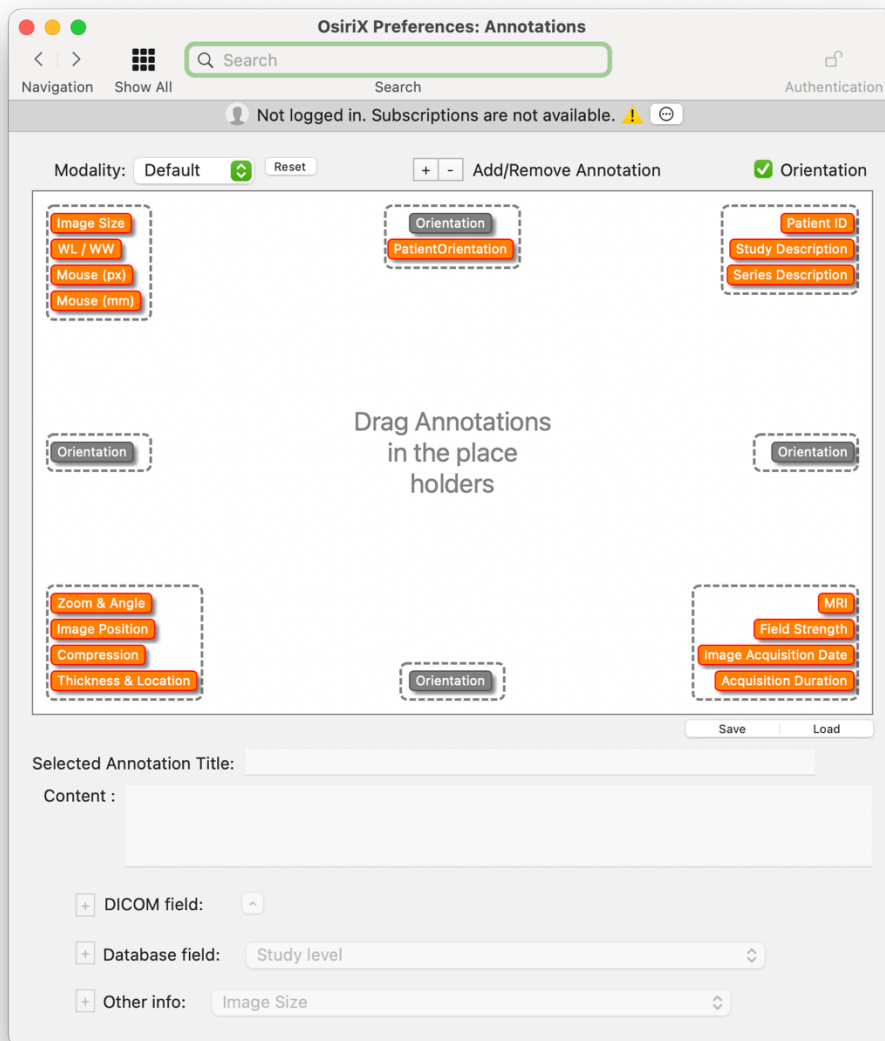


Figure 8: Annotations Preferences

LISTENER

This preferences panel allows the user to modify settings for the «DICOM» Listener («C-STORE SCP»), such as the «AE Title» and the port number. It also allows the user to modify some other networking settings, such as «DICOM TLS», file compression handling and XML-RPC.

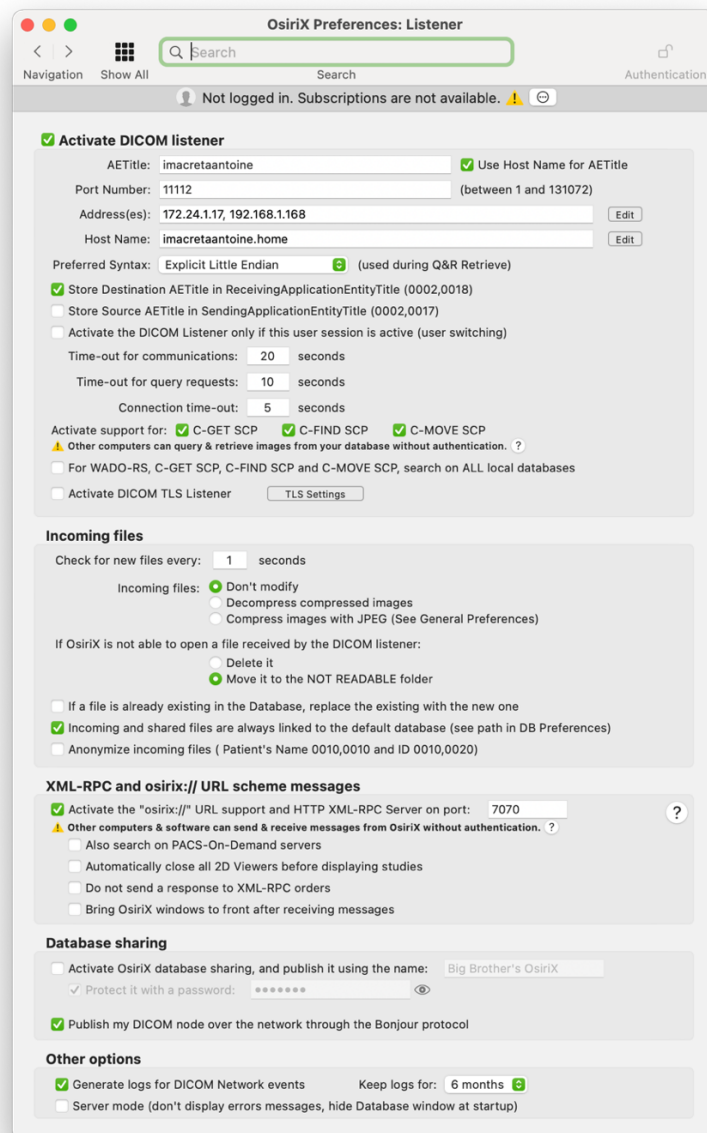


Figure 9: Listener Preferences

The identification settings of the listener contain the following parameters:

«**AETitle**»: The «AETitle» is a unique string used on a «DICOM» network to identify a «DICOM» entity. According to the «DICOM» standard, it can

be composed of up to 16 characters. A convenient checkbox allows the user to automatically use the computer's hostname as «AETitle».

Port Number: This is the TCP/IP port number that will be used by the listener to receive «DICOM» communications.

Address(es): This parameter contains the entire list of the computer's IP addresses which depends on the computer's settings located in macOS System Preferences.

Preferred Syntax: The transmission syntax used for incoming DICOM communications.

LOCATIONS

This set of preferences allows the user to edit the settings for the «DICOM» nodes management. Here you can add nodes to your «DICOM» network, such as other workstations, modalities, «PACS», etc.

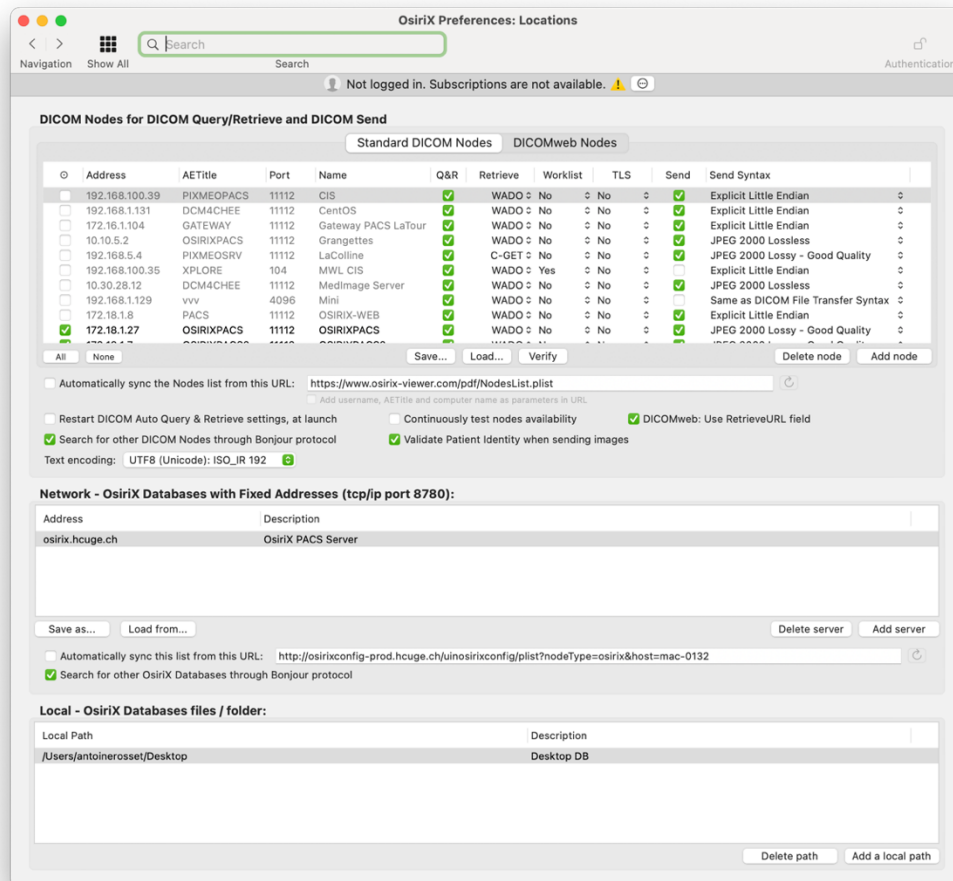


Figure 10: Locations Preferences

DICOM Nodes: The «DICOM» nodes list order can be changed: you can drag and drop a line to the top of the list. This can be useful if you frequently use a specific node.

Shared OsiriX Databases: You can manage a list of other OsiriX databases, either manually or automatically.

Local OsiriX Databases: You can also manage a list of local databases.

ROUTING

This preferences panel allows the user to change the settings for the Auto-routing feature. Auto-routing allows the user to automatically send images to another DICOM node based on a rule.

A route has a destination node and a rule. Each time images correspond with the route's rule they will be sent to the destination.

The destination of a route can be chosen from the list of locations managed by the Locations preferences.

The rule can be composed of an SQL filter, or one can choose to route all data generated by OsiriX (such as Status, Comments, Reports, etc.). One can also choose to send the previous studies associated to the routed images.

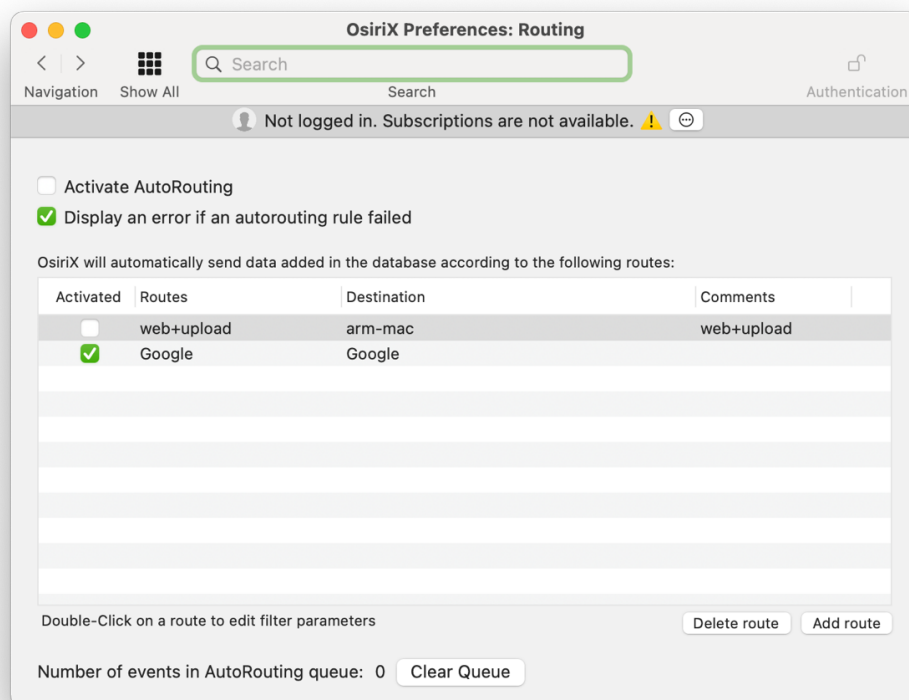


Figure 11: Routing Preferences

WEB PORTAL

This set of preferences allows the user to edit the settings for the Web Portal.

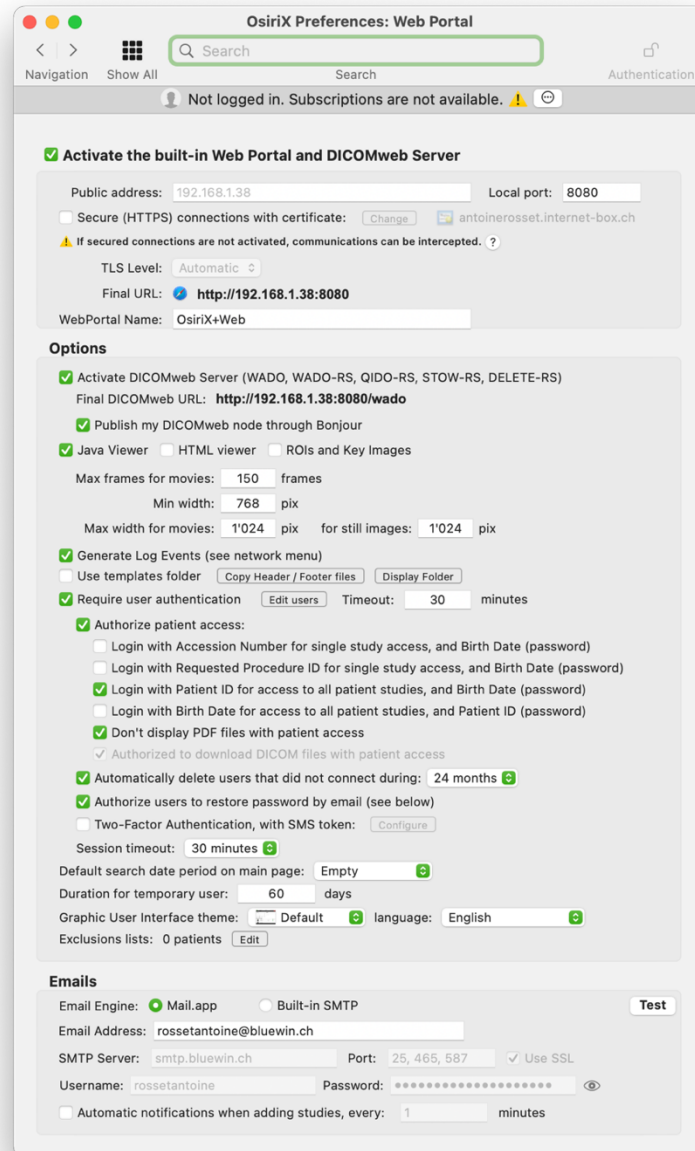


Figure 12: Web Portal Preferences

OsiriX contains a «Web Portal» module that allows the user to share data using a simple web browser that follows the standard and widely adopted HTTP protocol.

When the «Web Portal» is activated, OsiriX can display the content of its database on HTML pages produced on the fly. This feature allows the user to easily share images with users.

As an end-user perspective, the «Web Portal» allows any users to access the content of OsiriX using a simple web browser, just like surfing on any ordinary web site. The user begins by typing the address of the OsiriX «Web Portal» and goes through a login screen. The login can be anonymous or authenticated. The user is then redirected to the main screen that allows him/her to search and browse the database. The results of the search will be displayed as a list of studies. Selecting a study will display the contents on a detailed page.

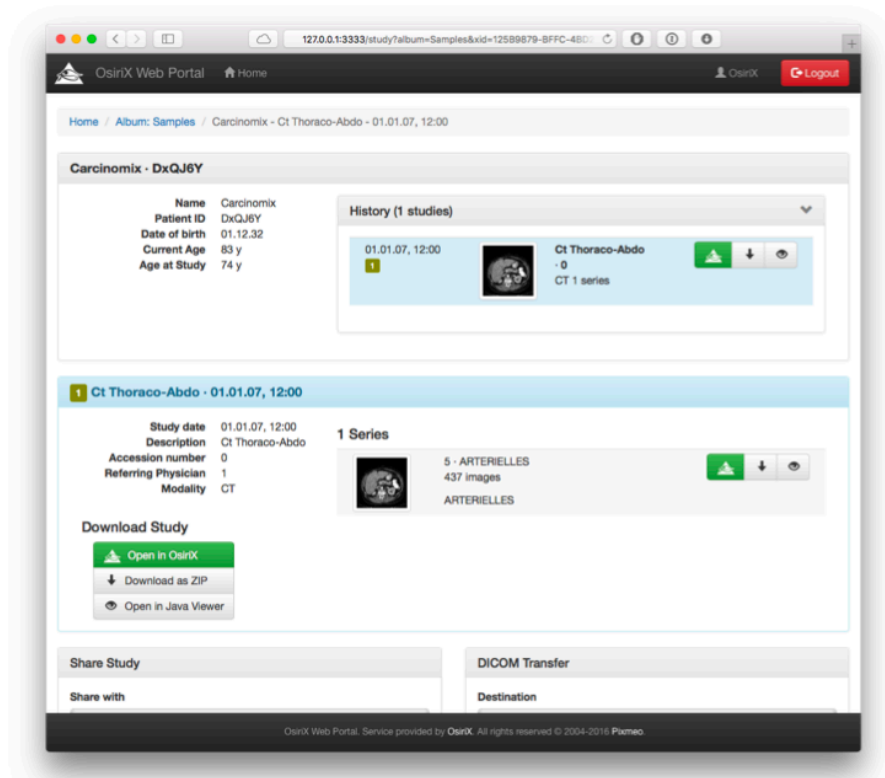


Figure 13: Web Portal Appearance

User Management

When choosing to authenticate the users, OsiriX allows you to manage a simple database of users (Figure 14: Web Portal User Preferences). The interface manages basic information such as names, addresses, passwords, ... but also clearance levels for the transfer of images, etc.

Osirix Preferences: Web Portal

Navigation Show All Search Authentication

Search: admin

Name
admin

Authorized to edit users through the Web interface (admin account)

Name: admin Password: *****

Email: pixmeo@pixmeo.com Phone: 123123123

Address: unknown

Comment:

Filter (Study Table Level):
The syntax is similar to smart albums. For example: (referringPhysician CONTAINS[cid] 'Prof. ROSSET') (YES == NO) for an empty list.

Osirix Tables SQL Syntax Test

List of specific studies:
Study Instance UIDs & Patient UIDs

Remove

☐ Authorized to access all studies of already partially accessible patients

☒ Two-Factor Authentication, with SMS token

☐ Don't display studies older than: 6 months

☒ Authorized to navigate albums

☐ Don't search studies on PACS-Demand server(s)

☐ Authorized to delete studies

☒ Authorized to share a study with another user

☒ Authorized to share a study by creating a temporary user (email)

☒ Authorized to download DICOM ZIP files

☐ Encrypt ZIP files, with study Patient ID

☒ Authorized to view reports

☒ Authorized to edit reports, status and comment

☒ Authorized to upload DICOM files

☐ Add uploaded files to list of specific studies

☒ Authorized to transfer DICOM files to any nodes

☐ Automatic Notifications Emails

☐ Display a list of recently viewed patients

☐ Not authorized to change his password

☐ Authorized to upload document to a study

☐ Delete this user after: 21. 2.2021

Save as default settings

IP Restriction:

The user has to connect from one of these IP address prefixes.
(IPs addresses separated by commas, for example: "172.18.,192.5.1.")

☒ Accept connections only from intranet addresses

Delete New

Export Users List... Import Users List...

Ok

Username: rossetantoine Password: *****

☐ Automatic notifications when adding studies, every: 1 minutes

Figure 14: Web Portal User Preferences

«PACS ON-DEMAND»

When using OsiriX in a «PACS» environment, it is described as a client/server architecture. OsiriX is the client, the «PACS» is the server. The client software use and display the images stored on the «PACS» server. In this configuration, if you manage a local database, you only see the studies stored on your local database, and not all the studies accessible from the «PACS». That means you don't know if a study exists on the «PACS», unless you actively send a query to the PACS server (by using the Query & Retrieve function, for example). You also ignore if a study stored on your local database has a comparative study on the «PACS», unless you actively search for it.

OsiriX has an elegant feature for this kind of configuration: «PACS On-Demand». The «PACS On-Demand» feature allows you to display the list of the entire studies stored on the «PACS», directly in your OsiriX database. The local and the 'distant' studies (stored on the «PACS») are merged and displayed in the database window. If a study is available at the same time on the local study and on the «PACS», OsiriX display the local images. If a study is available on the «PACS», and not on the local database, the study is display in italic font. You can double-click on such study, to automatically retrieve it, locally.

OsiriX uses «DICOM C-FIND SCU» requests to generate the list of studies stored on the «PACS». The performances are hence directly related to the performances of the «PACS». The studies are retrieved by the protocol defined in the Locations Preferences window.

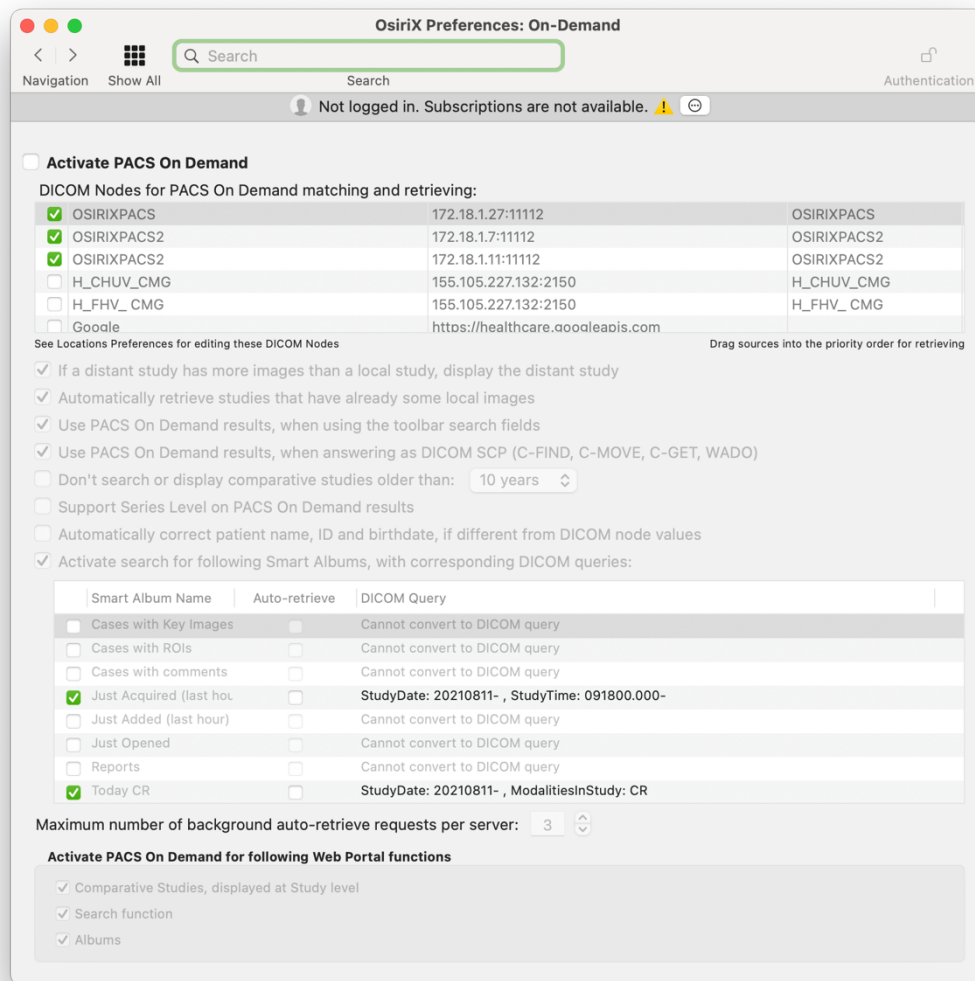


Figure 15: «PACS On-Demand» Preferences

For each smart album, you can activate a «DICOM» search on the selected «DICOM» nodes. If you activate one of the listed smart albums, OsiriX will try to find if matching studies are available on distant «DICOM» nodes. You can match the following «DICOM» criteria: Study Acquisition Date and/or Study Modality. To edit the «DICOM» criteria, double-click on the line.

DATABASE

The database window is the main window of OsiriX. It is also known as the browser window. In this window, you will find the content of the local database, currently used by OsiriX for the storage of image files and related data. All the files operations, such as importing, deleting, archiving and sending images are done in this window. The menu related to this window is the File menu. OsiriX can switch between different databases either located on the local disk or in remote locations.

The Database window is composed of three main sections: the Study list, the Series list and the Preview area. At the top of the window, the toolbar contains some of the main tools that can be activated through graphic icons.

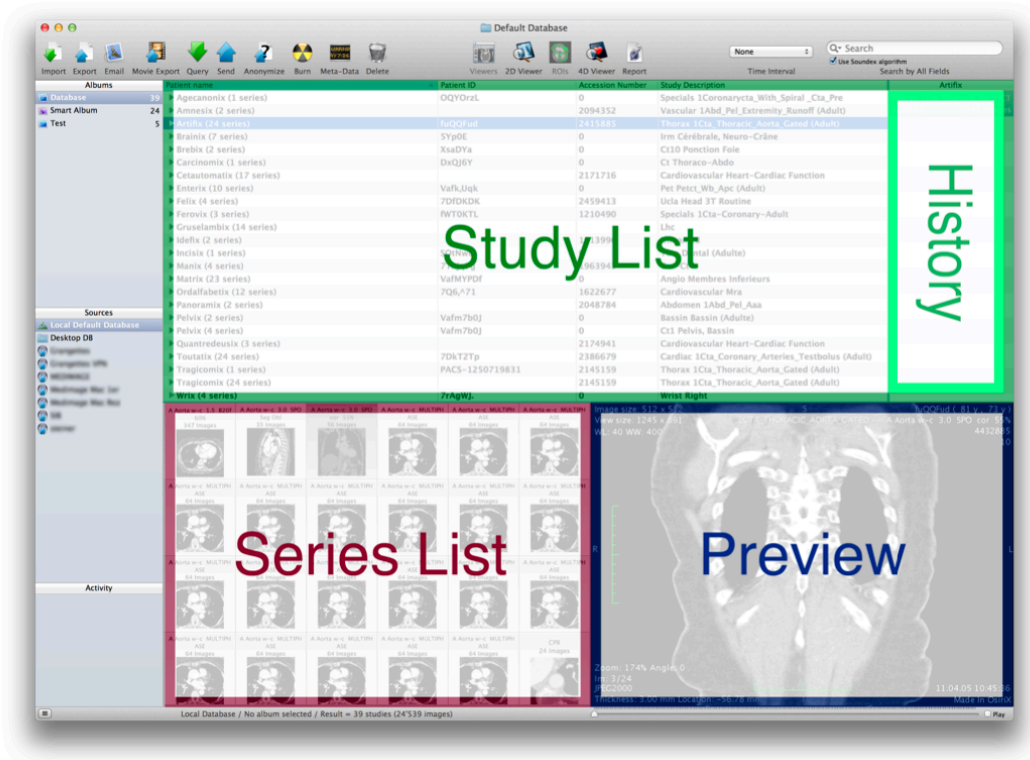


Figure 16: Database window

On the left side, a panel can be displayed on the left-hand side of the window, giving access to image albums containing collections of studies or filters and external locations of images that can be accessed remotely. Below the locations list, there is a list of processes running in the background, such as database maintenance process, sending process, ...

On the right of the study list, there is an 'History' view. On this list, OsiriX displays all the available comparative studies of the selected study. OsiriX will search in the entire database, including on distant DICOM nodes if «PACS On-Demand» feature is activated. When selecting a study in this History view, the corresponding study is automatically select in the study list.

Study List: This part of the window displays one line per study. Each study is described with several columns, such as *name*, *patient ID*, *referring physician*, *acquisition date*, ... Each column can be re-ordered, moved or hidden (right click on the columns header to display the menu). Some columns are editable (if you activated the «DICOM Editing» preference, in Preferences→General window): *name*, *ID*, *patient ID*, *referring physician*, *performing physician*, *acquisition date*, *date of birth*, *institution* and *description*.

Series List: This part of the window displays the series of the selected study. Each series is represented by a small image thumbnail. Select one series to display it in the Series Preview area. You can double-click on it to open it in the 2D Viewer window. By clicking on the righthand button of the mouse, in this area, you can have access to a list of useful functions, such as merging series, deleting a series, ...

Series Preview: This section of the main window (lower right quadrant) allows a quick preview of the selected Series. All basic image manipulations such as «WL/WW», zoom, pan, and rotate are available in this view.

At the bottom of the preview pane, a scroller allows you to browse through the stack of images in the series and directly select a given image. If checked, the Auto-Play button will loop through the image continuously.

Side Panel: A side panel can be displayed on the left side of the database window. This area contains a list of different albums and folders available, the list of external locations of images that can be linked for image transfer and remote access, and finally a list of active background processes.

The albums: OsiriX provides a convenient way of organizing studies and images in different albums.

Study albums can be created and added to your album list. To create a new album, right-click in the Albums area and choose Add Album from the contextual menu. This menu can also be found in the Albums item of the File menu. A pull-down window will appear at the center of the database window and will prompt you for an album name. Once the album is created it will appear in the list.

OsiriX supports smart albums, allowing image files to be automatically stored in selected albums. To create a smart album, right-click in the Albums area and choose Add Smart Album from the contextual menu. This menu can also be found in the Albums item of the File menu. A dialog will appear prompting you for a name and selection criteria. More than one criteria can be selected by clicking the "+" button. Criteria such as imaging modality, time interval, as well as keywords in selected fields can be used to create smart rules for automatic study selections.

TOOLBAR



This tool opens the selected Series or Studies in the 2D Viewer



This tool is designed for loading and displaying series containing multiple dimensions, such as MR perfusions series, CT cardiac gated series, etc.

By pressing this button, OsiriX will scan the selected series and open a 2D Viewer window with four dimensions.

A series is considered to be a 4D series if it contains multiple series with the same dimensions (matrix size) and the same number of images. For example, a cardiac CT exam with 20 phases: $20 \times 512 \times 512$ images.



This tool allows you to authorize a specific user to see the selected studies or series through the Web Portal (see 4.5). The *Add Studies* feature will only be available if the Web Portal is activated. This function is equivalent to the Share button, displayed at the end of the study html page (if permitted by the administrator), when browsing on the Web Portal.



This displays/hides the *Album & Locations* side panel.



This tool allows the user to write the selected study (or series) to a CD or DVD.



This tool deletes the selected Studies or the selected Series, removing it from the database index and erasing the associated «DICOM» files.



This tool allows you to send studies by email. For security reasons, the files will be encrypted with a password that you provide. The email recipient will need to know the chosen password in order to open the images. The Mail application is launched, the zip file is added, and you can write text for the email, before sending the email.



This tool exports images in «DICOM» format to a given location on the disk or on an external device. Series can be exported in hierarchical folders or all together in a single directory.



This tool allows the user to manually import images from «DICOM» files that reside either on the local disk or on external or remote devices.



This tool displays the content of the «DICOM» header of the study, series and images.



This tool will export the selected study or series in movie sequence format, with an optional HTML description of the files.



This tool allows you to send a notification regarding the selected studies to one the Web Portal's user. The *Notification* feature will only be available if the Web Portal is activated, and if the mail settings are correctly configured. The user will receive an email with a direct link to view the selected studies on the Web Portal.



This tool opens the Query & Retrieve window that allows the user to retrieve images from any «DICOM» source. If the shift key is pressed while clicking on the icon, a query with the selected patient (in the study list) is automatically performed, allowing you to easily retrieve other exams of the same patient.



This tool will display the report associated with the selected study (if available). If no report has been entered so far, the program will open a template report (if multiple templates are available a pull down list will allow you to select one from the list).



For the selected study, this tool will open only images containing «ROI» or labeled as key images. To open only the key images, hold down the option key. To open only the images with «ROIs», hold down the shift key.



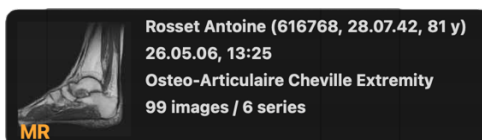
This tool will send the selected study to a «DICOM» node using «DICOM Send» protocol.



Click on this icon to bring the opened viewers windows (if any) to the foreground.



This icon will activate / inactivate a small pop-over window (info panel), that follows the mouse position. This pop-over window displays informations about the study under the mouse (thumbnail, modality, date of birth, description, ...).



An example of the info panel

COMMUNICATIONS

Typically, a «PACS» network consists of a central «PACS» server, which stores a database containing images. Multiple clients can retrieve and display these images on medical imaging software. The images are stored in «DICOM» format. The modalities (MRI, CT, PET, Ultrasounds, ...) send the images to the «PACS» server by using a «DICOM» push («DICOM C-STORE», or «DICOMweb STOW-RS»). The server and the clients communicate using the «DICOM» protocol («DICOM C-STORE» or «Query & Retrieve»). The clients can display the images using medical imaging software: a «DICOM» viewer. This entire architecture is based on a client/server concept and uses a network to communicate the data.

IMPORTING AND RECEIVING DATA

There are two ways of importing images to the OsiriX database: directly from files contained on a CD/DVD, for example, or through the network. OsiriX supports the most standard «DICOM» protocol for receiving images and data through the network: «DICOM C-STORE SCP». OsiriX also supports more recent or advanced standards for receiving images, such as WADO-RS downloading, through HTTP connections, or «DICOM C-GET SCU» and «DICOM C-MOVE SCU». OsiriX can only receive images when the application is running, as the listener is launched with OsiriX. When images are received through the network, they are automatically written in files, stored in the «OsiriX Data» folder and indexed in the database.

The purpose of the «DICOM Query & Retrieve» is to retrieve images from remote «DICOM» servers or OsiriX workstations to store them locally. After the images have been received, they can be loaded and processed in OsiriX. «DICOM Query & Retrieve» uses multiple «DICOM» protocols: «C-

FIND SCU» and «QIDO-RS», to search a study, then «C-MOVE SCU»/«C-STORE SCP» or «C-GET SCU»/«C-STORE SCP» or «WADO HTTP», to retrieve the images. To perform a «DICOM Query & Retrieve», you have to open the «Query & Retrieve» window, available from the Network menu.

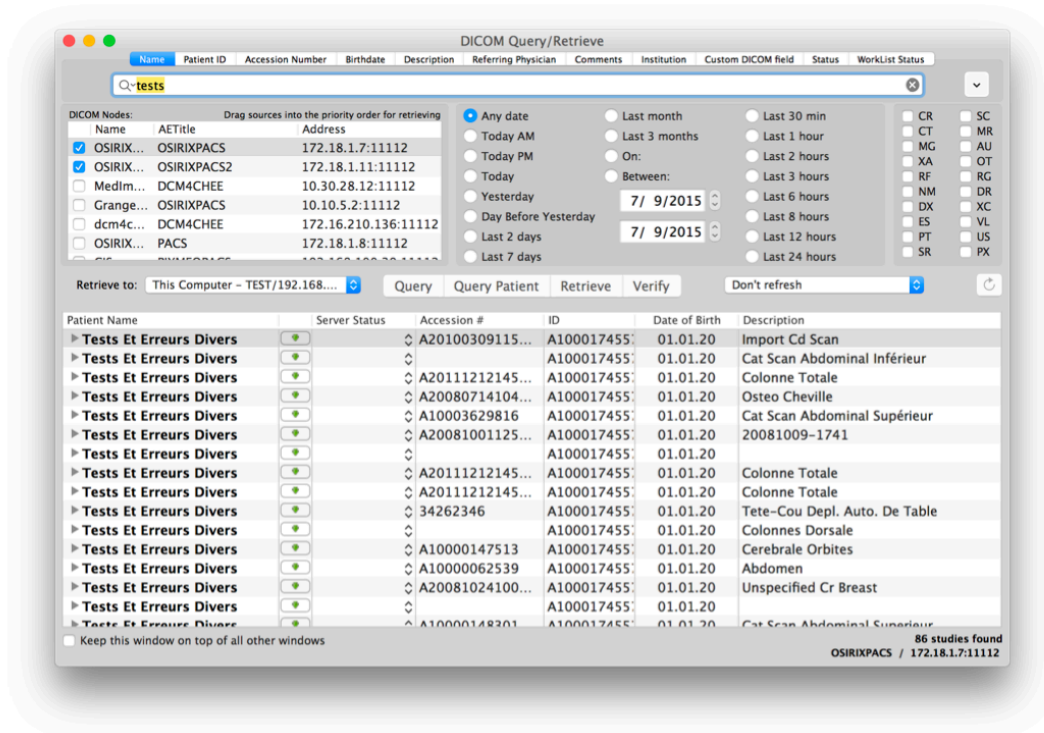


Figure 17: Query And Retrieve window

SENDING DATA

OsiriX supports the «DICOM C-STORE SCU» and «DICOMweb STOW-RS» protocol for sending data to another OsiriX workstation or DICOM compatible software.

SHARING DATA

OsiriX can load images from CD/DVD or receive images through the network, but it can also share the content of its database with other workstations (other OsiriX workstations or other «DICOM» compatible workstations). This feature is particularly useful if you want to use OsiriX as a «PACS» server, as a «DICOM» router, or share the images created or generated in OsiriX, such as 3D rendered images, annotations, reports, ...

«META-DATA» WINDOW

The «Meta-Data» window, available from the Database window and the 2D Viewer window, allows the user to read the content of the «DICOM» header of the current file. Depending on the parameters set in the General Preferences, the user can modify the content of the header fields.

A search field, located in the window toolbar, allows the user to quickly find an element based on the name of the field or its value.

When the «DICOM» header edition is authorized (see General Preferences), click on the Edit button to enable the edition (click again to disable it). The modifications can be done at the image level (only the current image will be modified), at the Series level (all images of the Series will be modified), at the Study level (all Series of the Study will be modified) or at the patient level (all Studies of the same patient will be modified). To modify the value of a field, double click on its current value and type in the new value. Hit the return key to validate.

When loaded from the 2D Viewer, the «Meta-Data» window displays an additional tool in the toolbar: Sort Images. This tool allows you to change the order of images contained in a series. By default, the order is based on the «InstanceNumber» «DICOM» field. When this function is triggered, OsiriX will use the values of the selected field to reorder the series. This function doesn't modify the «DICOM» files or the OsiriX database structure. The reorganized order is hence temporary, the default order will be available again once you close and reopen the series.

OSIRIX MD

Field Name	Definition	Offset	Tag	VR	Size	Content
DICOMObject	n/a				100...KB	
FileMetaInformationGroupLength	n/a	140	0002,0000	UL	4 B	190
FileMetaInformationVersion	n/a	156	0002,0001	OB	2 B	256
MediaStorageSOPClassUID	n/a	166	0002,0002	UI	26 B	1.2.840.10008.5.1.4.1.1.2 [CTImageStorage]
MediaStorageSOPInstanceUID	n/a	200	0002,0003	UI	42 B	1.2.840.113704.1.111.3552.1214916703.15546
TransferSyntaxUID	n/a	250	0002,0010	UI	22 B	1.2.840.10008.1.2.4.91 [JPEG2000]
ImplementationClassUID	n/a	280	0002,0012	UI	22 B	1.3.6.1.4.1.19291.2.1
ImplementationVersionName	n/a	310	0002,0013	SH	10 B	OSIRIX001
SourceApplicationEntityTitle	n/a	328	0002,0016	AE	6 B	Osirix
ImageType	i>	342	0008,0008	CS	28 B	ORIGINAL PRIMARY AXIAL HELIX
InstanceCreationDate	i>	378	0008,0012	DA	8 B	20080701
InstanceCreationTime	i>	394	0008,0013	TM	14 B	145143.000000
SOPClassUID	i>	416	0008,0016	UI	26 B	1.2.840.10008.5.1.4.1.1.2 [CTImageStorage]
SOPInstanceUID	i>	450	0008,0018	UI	42 B	1.2.840.113704.1.111.3552.1214916703.15546
StudyDate	i>	500	0008,0020	DA	8 B	20080701
AcquisitionDate	i>	516	0008,0022	DA	8 B	20080701
ContentDate	i>	532	0008,0023	DA	8 B	20080701
AcquisitionDateTime	i>	548	0008,0028	DT	22 B	20080701144928
StudyTime	i>	570	0008,0030	TM	14 B	141007.000000
AcquisitionTime	i>	592	0008,0032	TM	14 B	144928.000000
ContentTime	i>	614	0008,0033	TM	14 B	144933.417000
AccessionNumber	i>	636	0008,0050	SH	12 B	A10003135888
Modality	i>	656	0008,0060	CS	2 B	CT
Manufacturer	i>	666	0008,0070	LO	8 B	Philips
InstitutionName	i>	682	0008,0080	LO	8 B	LATOURIX
ReferringPhysicianName	i>	698	0008,0090	PN	18 B	GROSSHOLZ**MARIANNE
StationName	i>	724	0008,1010	SH	6 B	ICT256
StudyDescription	i>	738	0008,1030	LO	32 B	CAT SCAN ABDOMINAL COLONOSCOPIE
ProcedureCodeSequence	i>		0008,1032	SQ		CTABDCOL BROKER CAT SCAN ABDOMINAL COLONOSCOPIE
SeriesDescription	i>	868	0008,103e	LO	8 B	abd 1mm
InstitutionalDepartmentName	i>	884	0008,1040	LO	10 B	Radiology
ManufacturerModelName	i>	902	0008,1090	LO	14 B	Brilliance 64
ReferencedStudySequence	i>		0008,1110	SQ		1.2.840.10008.3.1.2.3.1 2.16.840.1.113669.632.20.121711.10000155501
ReferencedPerformedProcedureStepSequence	i>		0008,1111	SQ		1.2.840.10008.3.1.2.3.3 1.2.840.113704.1.111.3276.1214914191.21
ReferencedPatientSequence	i>		0008,1120	SQ		1.2.840.10008.3.1.2.1.1 1.2.124.113532.172.18.155.20070702.125900.277252
ReferencedImageSequence	i>		0008,1140	SQ		1.2.840.10008.5.1.4.1.1.2 1.2.840.113704.1.111.3552.1214916401.14848
PatientName	i>	1342	0010,0010	PN	8 B	COLONIX
PatientID	i>	1358	0010,0020	LO	6 B	123123
IssuerOfPatientID	i>	1372	0010,0021	LO	32 B	041G04:20061118:120819573:001183
PatientBirthDate	i>	1412	0010,0030	DA	8 B	20080822
PatientSex	i>	1428	0010,0040	CS	4 B	0000
OtherPatientIDs	i>	1440	0010,1000	LO	6 B	123123
PatientAge	i>	1454	0010,1010	AS	4 B	078Y
PregnancyStatus	i>	1466	0010,21c0	US	2 B	4
ContrastBolusAgent	i>	1476	0018,0010	LO	8 B	CONTRAST
ScanOptions	i>	1492	0018,0022	CS	6 B	HELIX
SliceThickness	i>	1506	0018,0050	DS	2 B	1
KVP	i>	1516	0018,0060	DS	4 B	120
SpacingBetweenSlices	i>	1528	0018,0088	DS	4 B	-0.5
DataCollectionDiameter	i>	1540	0018,0090	DS	4 B	500
SoftwareVersions	i>	1552	0018,1020	LO	6 B	2.2.6
ProtocolName	i>	1566	0018,1030	LO	16 B	ABDOMEN IJ ABDO
ReconstructionDiameter	i>	1590	0018,1100	DS	4 B	436

Figure 18: «Meta-Data» window

TOOLBAR



This item launches the Validator. It will analyze the «DICOM» file and display a report with incorrect or corrupted DICOM fields.



With this item, you can export the «DICOM» fields in XML, JSON or Text format.



This item launches your Web browser and display the complete «DICOM» standard.



With these items, you can activate the edition of «DICOM» fields.

Edit button: activate the edition mode

Add button: add a «DICOM» field

Apply button: write the changes to the disk

Radio buttons: select at which level the changes are performed



If the «Meta-Data» window is opened from a 2D Viewer window, you can use this button to re-sort the displayed images, according to the selected «DICOM» field.



The search field can quickly display the corresponding «DICOM» fields that match the searched string.

2D VIEWER WINDOW

This chapter describes how images are visualized in OsiriX. The 2D Viewer is a window displaying a set of «DICOM» images organized as a stack. The 2D Viewer is also the starting point for all the post-processing tools.

DISPLAYING A STUDY

There are different ways of displaying a study or a series of images. By default, OsiriX will display each individual series of images as a stack in a window.

Multiple series can be opened at the same time. Initially the program will adjust the window sizes to allow all the series to be displayed side-by-side in a tile mode. You can subsequently resize each window manually and reposition its location on the screen at will.

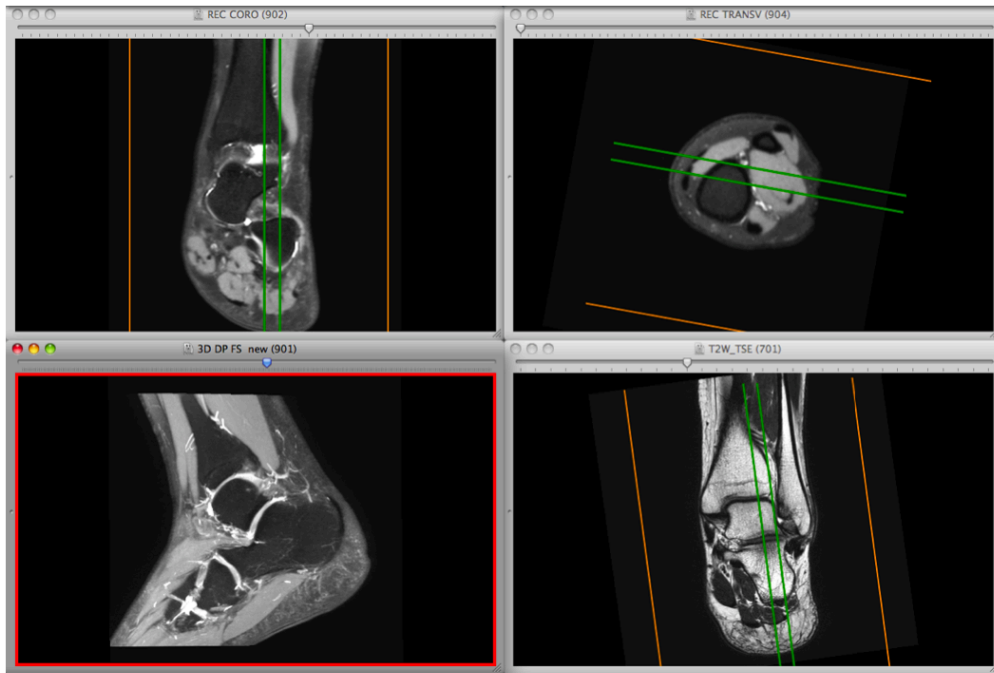


Figure 19: 2D Viewers windows

All 2D Viewers have a lateral bar on the left of the window displaying the list of all available series for the current patient. Clicking on a thumbnail in the list will load the corresponding series in the viewer, replacing the current one.

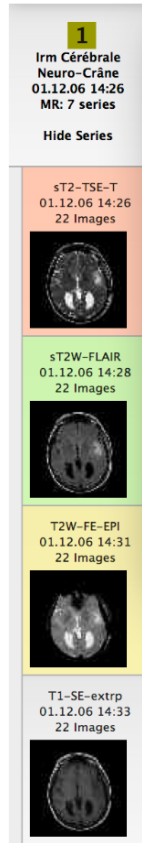


Figure 20: Series List

MOUSE TOOLS

You can assign the function to the left and right button with this toolbar item. The following tools are available:



Figure 21: Mouse tools



Window Level & Width

The Window Level & Width settings, also known as brightness and contrast, are essential for viewing any black and white, large-dynamic DICOM series. You can change the window level with the mouse.



Figure 22: Different Windows Levels & Width applied to the same image.



Pan Tool

This tool allows the user to move the image in the 2D Viewer. To use this tool, click anywhere in the image and hold down the mouse button. Moving the mouse horizontally or vertically will translate the image with the same number of pixels.



Zoom Tool

This tool allows the user to change the magnification value of the image. To use this tool, click anywhere in the image and hold down the mouse button.



Rotate Tool

This tool allows the user to rotate the image in the 2D Viewer. To use this tool, click anywhere in the image and hold down the mouse button. Moving the mouse around the image center will rotate the image with the same angle.



Scroll Tool

This tool allows the user to scroll through the stack of images. To use this tool, click anywhere in the image and hold down the mouse button. Moving the mouse vertically will scroll through the stack of images.



3D position

This tool allows to synchronize all the windows to show the same point. For example, if you have a coronal and axial series, this tool will go to the image index that show this point on each series. It requires a 3D dataset with multiple series.



«ROI» (Region Of Interest)

This tool allows to select a «ROI» tool.

IMAGE FUSION (BLENDING)

The 2D Viewer allows the user to easily fuse two series of images. Image fusion is the technique of displaying two different images on the same viewport using alpha compositing. The most common use of fusion is for PET-CT reading, where the PET series is fused on the CT series.

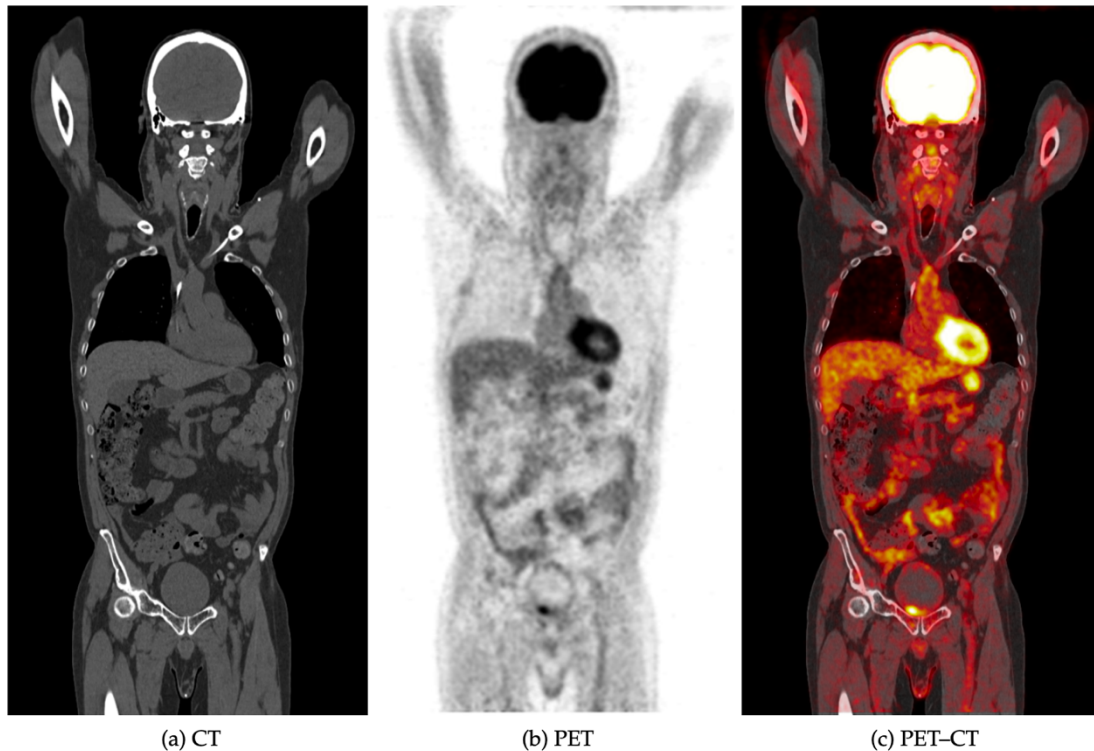


Figure 23: Fusion of the PET on the CT

Any series can be fused with another series as long as they share the same dimensions: 3D series can be fused only with other 3D series and 2D series with other 2D series.

To activate the fusion, OsiriX needs to know which series has to be used. First open the two series. Locate the one to be fused. Grab the small icon located on top of its window and drop it on the target series window. To grab this icon, click on it and hold the mouse button pressed until it becomes dark gray. Then, move it on top of the other series and drop it.

From the processing options proposed by OsiriX, choose *Image Fusion* to complete the fusion.

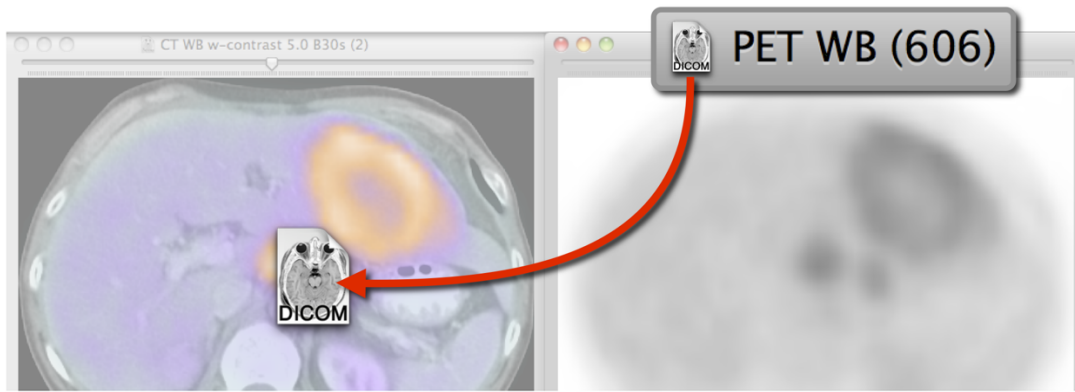


Figure 24: Drag and drop the icon from one window to another

For PET-CT and SPECT-CT studies, OsiriX will automatically fuse the PET (resp. SPECT) on the CT when both are open. The two series need to be part of the same study. This behavior can be turned on or off through the PET Preferences.

PET-CT and SPECT-CT can be quickly fused and defused using the *Fuse/De-Fuse PET/SPECT – CT* option from the *2D Viewer* menu.

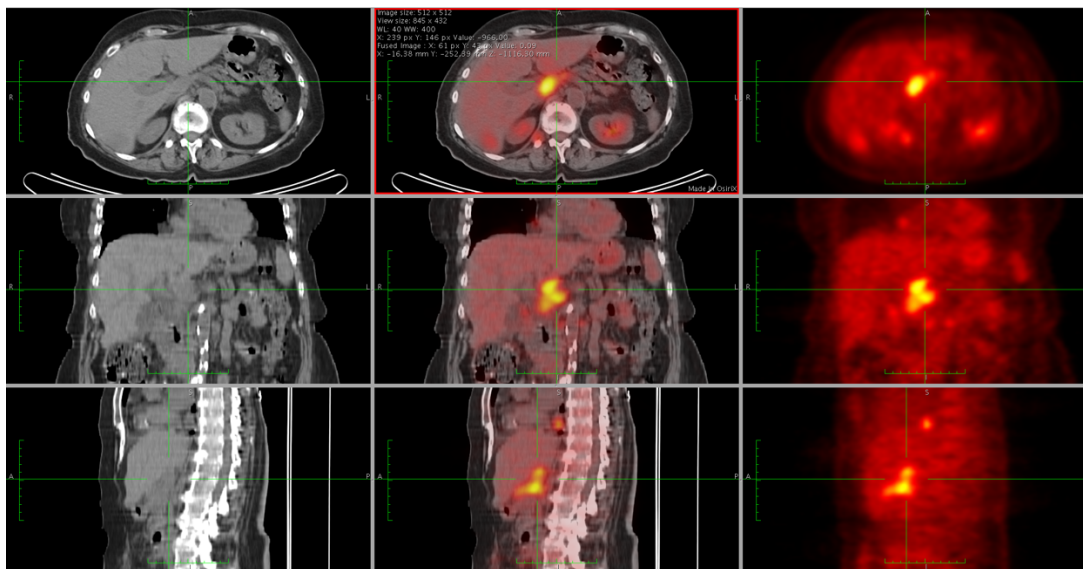


Figure 25: A PET-CT study

MAGNIFYING LENS

There are built-in Magnifying Lens in the 2D Viewer. You can press the shift key to have an enlarged view of the image under the mouse. You can turn off this feature in the Viewers preferences. While maintaining the shift key pressed, you can increase the size and the power of the lens, by pressing the up/down arrows or left/right arrows on your keyboards.

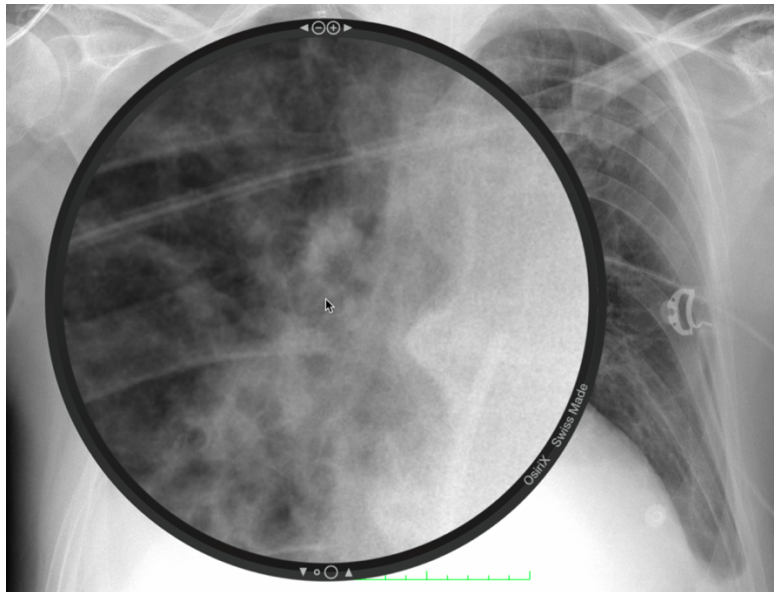


Figure 26: Magnifying Lens

PROPAGATE SETTINGS

When several 2D Viewers are open, OsiriX allows the user to synchronize the viewing settings. This option is called Propagate Settings. When propagation is turned on, the following settings are affected: «WL/WW», pan, zoom and rotation. Whenever one of these settings is modified on one viewer, the same setting modification is applied to the other viewers.

SYNCHRONISATION

When several 2D Viewers are open, OsiriX allows the user to synchronize the image position. This option is called Synchronization. When synchronization is turned on, the opened viewers always display the same stack z level if possible. This function works automatically if the series belongs to the same study: for example, two abdominal acquisitions of the same CT study. This function works only if the 2D Viewers display series with the same plane orientation. When synchronization is turned off, you can scroll through the opened viewers independently.

This function can be activated manually, allowing you to compare two series acquired in different studies. Hence, you can compare a CT study acquired in January and another CT study acquired in February, for example. You need to manually move the two series to a similar area and then press the synchronization button. OsiriX will then record the current image position for the two series and tries to keep them in synchronization. That means you can safely use this function, even if the acquisition parameters are not identical.

REFERENCE LINES

When displaying several series of the same study with different orientations, OsiriX draws reference lines on the non-active viewers. Those lines allow the user to clearly locate the current image on the other series.

The reference lines can be hidden/shown using the Annotations item of the 2D Viewer menu.

FULL SCREEN MODE

When double-clicking on the image, the full screen mode will be activated / deactivated.

CLOSING THE VIEWER WINDOWS

To go back to the database window, use the Show Database Window item from the File menu or the Database toolbar item. This action will close all opened viewers and bring the database window to the front.

TOOLBAR



This button displays a list of the different two-dimensional and three-dimensional reformatting and rendering methods. These functions are also available from the *3D Viewer* menu.



This displays a «3D MIP» of the currently displayed Series in a small floating panel.



This button displays the 3D position panel.



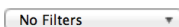
This set of tools allows the user to scroll in the 4th dimension. This feature requires a 4D dataset.



This tool allows the user to start and stop the automatic scrolling of the images. The rate at which the images are displayed is defined in the *Rate* tool. You can use the keyboard space bar to enable/disable the automatic scrolling. You can move to the next image by pressing the right arrow key and to the previous image by pressing the left arrow key.



This button allows the user to enable and disable the angle of «Cobb».



This menu allows the user to apply a convolution filter in real-time.



This button allows the user to close all displayed windows and to go back to the database window.



This button automatically closes the viewer window and delete this series from the database.



This button allows the user to send the current image as an email message.



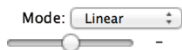
This tool inverses the order of the image in the series. The first image will become the last image and vice versa.



This tool flips the image horizontally. The plane orientation annotations displayed on the image will be correctly modified: right and left annotations will be flipped, for example.



This tool flips the image vertically. The plane orientation annotations displayed on the image will be correctly modified: up and down annotations will be flipped, for example.



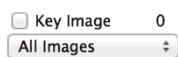
This tool allows the user to set the fusion parameters, used for PET-CT, for example.



This button will display the Region Growing panel.



This function will generate a screen capture of the displayed image, launch iPhoto and add it to your album of choice.



These buttons allow the user to set key images and to switch from viewing *only key images* to viewing *all images*.



This button will display the «Meta-Data» window, displaying all the associated «DICOM» fields contained in the displayed image.



These buttons allow the user to choose the function assigned to both mouse buttons. One can choose among viewing functions and «ROIs» functions. These functions are also available in the contextual menu of the 2D Viewer window.



This button will export the series as a movie sequence file. Multiple parameters are available to create this movie file, such as *number of frames*, *starting frame*, *interval*, ...



This button will display the *Navigator* Panel.



These buttons allow the user to reorient the dataset in an axial, coronal or sagittal direction.



These buttons allow the user to display the previous and the next patients, and the previous and next series.



This button will display the «DICOM Print» window, allowing the user to print the entire series or a subset of the series using a «DICOM» Printer. The «DICOM» Printers list is defined in Preferences.



This button allows the user to turn the settings propagation on and off.



This slider allows the user to change the frame rate of the displayed images, when automatic scrolling is activated.



This button allows the user to write a report for the current study. Depending on the settings, the report software will be launched, allowing you to type the report.



This button will reset the display settings: the position of the image in the window, the size of the image will fit the window, the rotation will be reset and the default window level and width will be applied.



This button will reload the pixel data from the files. This function is useful if the dataset was modified: a convolution filter was applied to the raw data, for example.



These sliders allow the user to modify the balance of each RGB channel. This tool works only for RGB images. The modifications are applied in real-time on the displayed image. The raw data is not modified.



This button will display the «ROI» *Manager* window.



This button will export the series or a subset of the series as «DICOM» files. These newly created «DICOM» files will be added to the database.



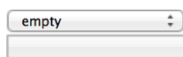
This button will send the series or a subset of the series to a «DICOM» node, with the «DICOM C-STORE SCU» protocol.



This button will display the *Set Pixels Value* window.



This button will apply or remove a mask to the series. You can manually define the mask area by drawing a *Rectangle* «ROI» on the image. If there is a shutter mask already defined in the «DICOM» fields, associated to the image, this defined shutter mask will be used.



A status and a comment can be set for each study and each series.



These tools allow the user to set up the parameters of the subtraction algorithm.



This button displays the parameters used to compute the «SUV» (standardized uptake value).



This button allows the user to turn stack synchronization on and off.



This allows the user to set the «*Thick Slab*» parameters.



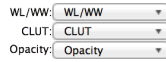
This button allows the user to tile the opened windows.



This pop-up menu allows to select how many windows are displayed on the screen, and where they are positioned.



This tool allows to select which annotations are displayed on the image. The available modes are: none, graphic, basic, full.



These pop-up menus allow the user to change the settings for the «WL/WW», the «CLUT» and the opacity.



This button activates the 'screen capture' mode. In this mode, you define a selection on the window to delimitate the area to export as a screen capture. You can export it in the clipboard, in a «DICOM» file, or as a PNG file on the Desktop.

REGIONS OF INTEREST («ROI»)

This section describes the different types of «ROIs» and the use of the «**ROI**» tools. «**ROI**» stands for "Region Of Interest" and is used in OsiriX to describe a measurement, an area or an annotation. A «**ROI**» is an overlaid object that is displayed on an image.

OsiriX stores the «**ROIs**» as DICOM SR encapsulated files. This means that the «**ROIs**» are DICOM compliant files and can be transported over a DICOM network, However the «**ROI**» description in the file is proper to OsiriX and may not be readable on other software.

To draw an «ROI» on an image, you must first select the corresponding tool from the Mouse button function in the 2D or 3D Viewer toolbar. The last button has a tiny gray arrow on the right-hand side that displays the list of «ROI» tools when clicked. Another way to select an «ROI» tool is to use the contextual menu of the Viewer: right click on the viewer and choose the «ROI» tool from the «ROI» sub-menu. Each «ROI» tool can also be accessed through its keyboard shortcut. The shortcuts are single keystrokes that can be modified through the Hot Keys Preferences. The shortcuts are displayed in the «ROI» tools menu next to each tool.

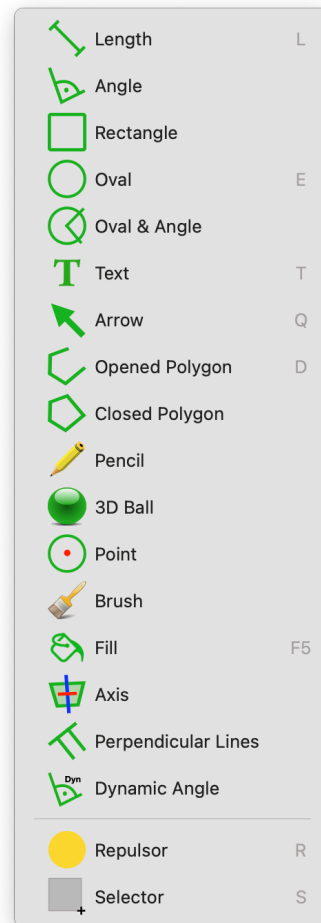


Figure 27: List of available «ROIs»

Length «ROI»: This «ROI» allows the user to draw simple lines and to compute linear measurements. To draw a line, click on its starting point and keep the mouse button pressed. Drag the mouse to the ending point and release the button.

Angle «ROI»: This «ROI» allows the user to draw and measure angles. To draw an angle, click three times on the image to define the 3 points. The angle will be measured on the second vertex.

When the third point has been created, the «ROI» is finalized and the value of the angle as well as the conjugate angle is displayed.

Rectangle «ROI»: This «ROI» allows the user to draw rectangles and squares and to compute their area. To draw a rectangle, click on one of its corners and keep the mouse button pressed. Drag the mouse to the opposite corner and release the button.

Oval «ROI»: This «ROI» allows the user to draw ellipses and to compute their area. To draw an ellipse, click on the image to establish its center point and keep the mouse button pressed. Drag the mouse away from the center to define the size and eccentricity of the ellipse. Release the mouse button when the shape of the «ROI» is correct.

Text «ROI»: This «ROI» allows the user to add textual annotations to the image. Click anywhere on an image to create a text label centered at this position. The label can be modified through the «ROI» Info Panel. The «ROI» Info Panel will also allow you to change the size (thickness), the color and the opacity of the text.

Arrow «ROI»: This «ROI» allows the user to draw arrow annotations. Click on the point indicated by the arrow and keep the mouse button pressed. Drag the mouse away to draw the arrow and release the mouse button to finalize the «ROI».

Closed Polygon «ROI»: This «ROI» allows the user to draw polygons. Click on as many corners as needed and double-click on the last one to finalize the «ROI». The first and last corners are always connected even during the creation process.

Pencil «ROI»: This «ROI» allows the user to draw polygons just like the Closed Polygon except that the drawing method is different. To draw a Pencil «ROI», click on the first corner and keep the mouse button pressed. Drag the mouse along the desired path and release the button to finalize the «ROI».

3D Ball «ROI»: This «ROI» allows the user to draw a 3D Ball (sphere) on a volumic dataset. This ball is defined by a center and a radius. As a 3D object, it will be visible on several images. If you display the contextual menu for this «ROI» (right-click in the «ROI»), you can also compute an isocontour and a peak value for this «ROI».

The isocontour definition is: In the displayed sphere, keep only the voxels with a value in the range defined. Compute the volume of all these voxels, and the mean of these voxels values.

The peak value definition is: In the displayed sphere, find the voxel with the highest value. Around this voxel, define a new sphere with a diameter defined below, and compute the mean value of all the voxels contained in this sphere as the peak value. If there are several voxels with the same highest value, the highest peak value will be displayed.

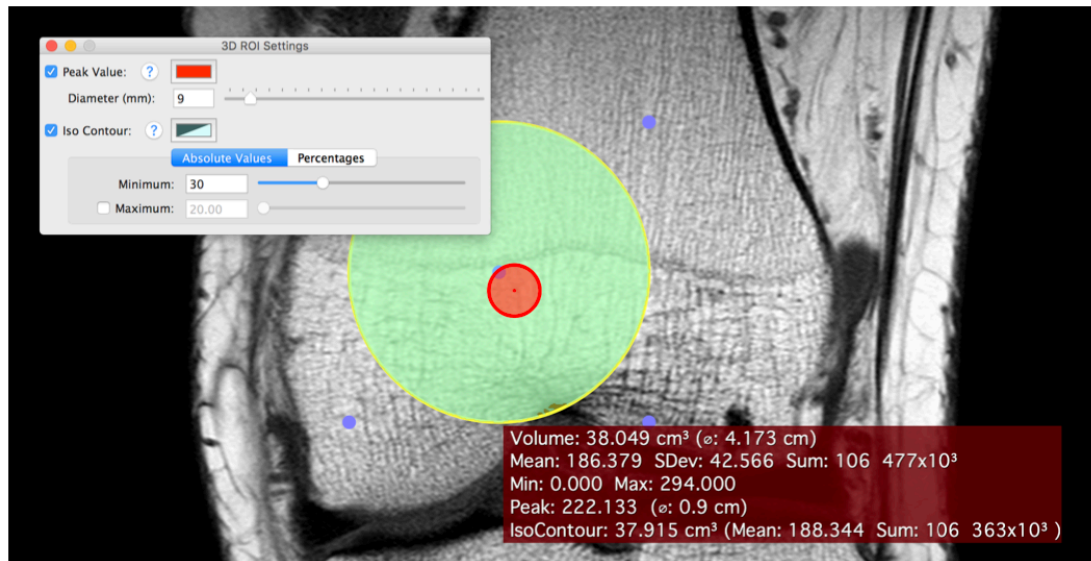


Figure 28: 3D Ball «ROI»

Point «ROI»: This «ROI» allows the user to draw a single point on an image and get the underlying pixel value, the 2D position (x, y) on the image (in pixels) and the 3D position (x, y, z) in the stack (given in [mm], only for 3D data). To draw a Point «ROI», simply click on the desired point.

Point «ROIs» will also be visible on some of the 3D reconstruction tools such as 3D Volume Rendering, 3D Surface Rendering, ...

Brush «ROI»: The brush «ROI» tool allows the user to draw plain regions: click on the image and draw the desired shape while holding down the mouse button. Release the mouse button to finalize the «ROI».

When selecting the brush «ROI» tool, a floating panel appears which allows the user to modify the size of the brush. Using a thin brush will allow you to draw precise shapes, while using a broad one will allow you to be more efficient in covering larger regions.

Clicking on an existing brush «ROI» allows you to modify its shape.

The floating panel also displays the brush mode, which can be set to draw or erase. The drawing mode is the default one, described above. The erase mode allows the user to remove some parts of existing brush «ROIs». Simply click on a brush «ROI» and draw a path to erase it.

The brush «ROI» is the only «ROI» that cannot be resized or rotated. It is attached to its underlying pixels: one «ROI» pixel for one image pixel.

Fill «ROI»: The fill «ROI» tool allows you to create a brush «ROI» or a polygon «ROI» by using a growing region function. Click on the image to define the seed point for the region function, then move the mouse while maintaining the mouse button pressed to define the values interval for the growing region. Release the mouse button to finalize the «ROI».

You can change the type of «ROI» produced in the Viewers Preferences: brush «ROI» or polygon «ROI».

Axis «ROI»: The mean axis is calculated and displayed based on four points.

Dynamic Angle «ROI»: The angle between two lines is calculated: the first two points and the last two points. The angle and its opposite are displayed in the info box. The sum of these two angles is equal to 360 degrees.

«Repulsor» Tool: The «Repulsor» is a special tool that is not be used to create «ROIs», but to modify their shapes.

To use the «Repulsor», click on the image and hold down the mouse. The «Repulsor» is represented by a yellow glowing disc. Its center is defined by the mouse position and its radius is defined by the distance to the closest «ROI» when the mouse is clicked. When clicking close to a «ROI», the radius of the «Repulsor» appears small and when clicking far from it, the radius appears large.

While holding down the mouse button, drag the mouse toward the target «ROI». The «ROI»'s contour will be locally re-shaped by the «Repulsor» border.

The «Repulsor» disc will disappear when releasing the mouse button and the tool will have no effect until the mouse button is pressed again.

If one or more «ROIs» are selected, only these «ROIs» will be affected by the «Repulsor». Others will be ignored. If no «ROI» is selected, the «Repulsor» affects them all.

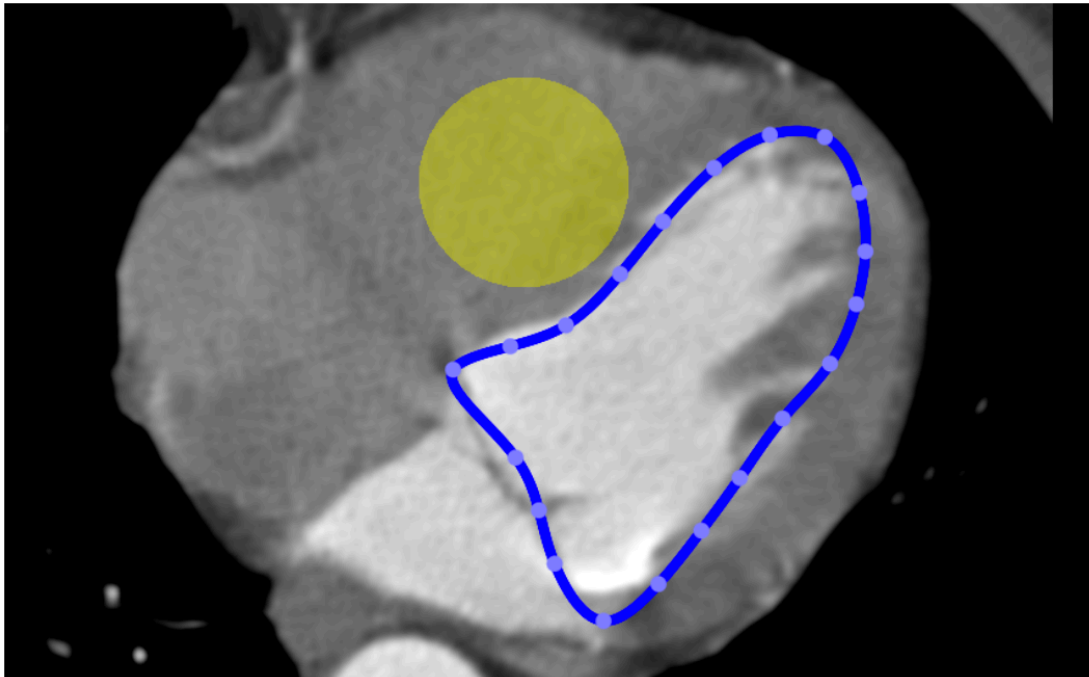


Figure 29: The «Repulsor»

«Selector» Tool: The «Selector» is also a special tool that will not create «ROIs». The Selector allows the user to select «ROIs». To do so, either click on an «ROI», or click and drag the mouse to create a selection rectangle. All «ROIs» under, or partially under, the selection area will be selected.

POST PROCESSING

This chapter describes the global concept of post-processing in OsiriX.

OsiriX provides a large variety of rendering tools for the display and manipulation of three-dimensional data. Advanced rendering tools are an essential means of communication between radiologists and clinicians. Rendering images in three dimensions and providing adequate multidimensional visualizations have become part of the routine tasks of interpreting radiologists.

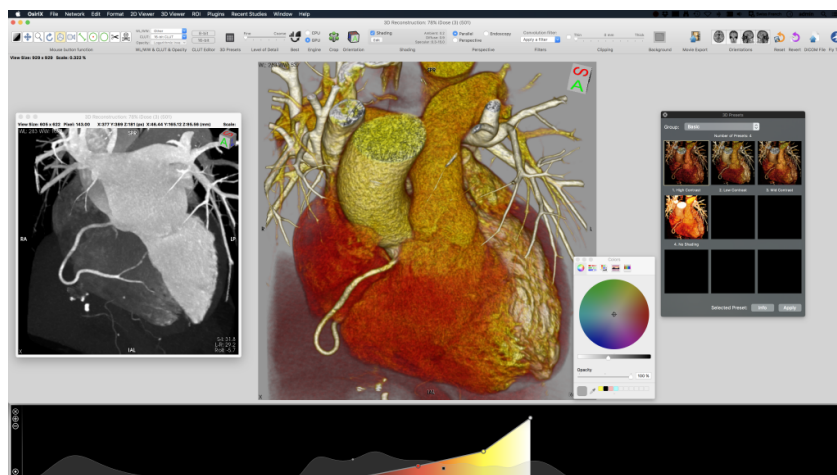


Figure 30: 3D window

«3D VR» & «3D MIP»



Figure 31: «3D VR» and «3D MIP»

This 3D rendering technique is commonly used to visualize volumes of soft tissue data. It assigns different colors and transparencies to different intensity values in the data set. This technique can be applied to CT and MRI images. It is the most used technique for pseudo-realistic rendering of 3D medical images. The predefined settings allow the user to generate reasonable images with very little adjustments. The simplest adjustment that the user will have to make is to the contrast and intensity of the image. This sets the threshold values of the image rendering algorithm that assigns a given opacity to the lowest level of intensity displayed. Thanks to this very simple maneuver it is then very easy to set the rendering of different tissue densities (skin, muscle or bones). The contrast and intensity assigned to the images will select the threshold density value used for rendering the opaque tissue level. High contrast will select bone density and therefore remove soft tissue and show only dense bone structures, while soft contrast will show only soft tissue such as skin and muscles.

The resulting image is created through a volume ray casting algorithm. In this technique, a ray is generated for each desired image pixel. The process is repeated for every pixel on the screen to form the final image.

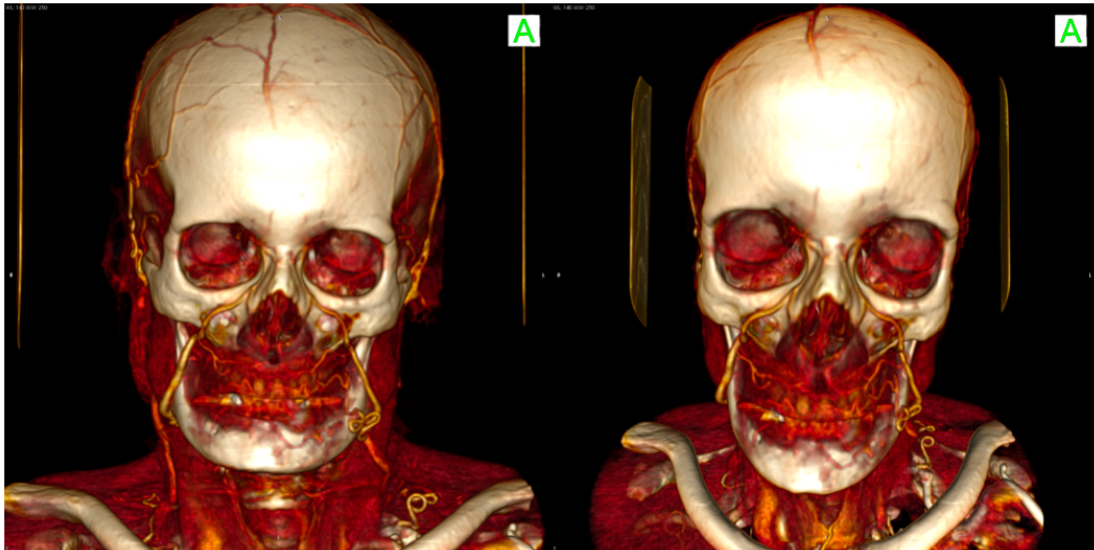


Figure 32: Perspective and parallel projection

3D RENDERING PRESETS

OsiriX allows the user to store 3D rendering settings and color tables in presets. A set of predefined presets are provided by default, but you can add as many presets as needed. These presets can be stored in different groups. They can be easily classified according to imaging modality or by tissue or organ type, for example.

While in the 3D Volume Rendering mode, you can select a preset from the list by clicking on the 3D Presets button or selecting the Select 3D Preset item in the 3D Viewer menu. A floating window with a list of presets with corresponding thumbnail views of the rendering mode is displayed.

You can select between different lists from a pull-down list of different groups. To apply a given preset select the preset from the list and click on the Apply button.

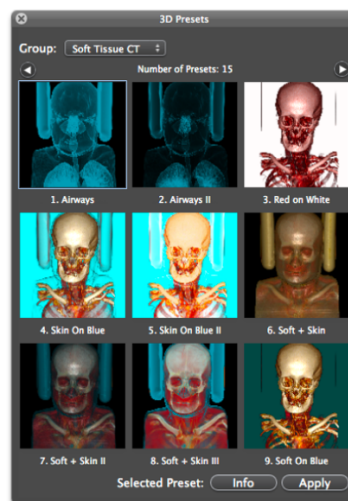
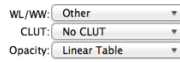


Figure 33: 3D Presets window

You can also review the detailed description of the settings by clicking on the Info button which will display a second floating window with the different parameters.

TOOLBAR



This allows the user to change the settings for «WL/WW» using presets, «CLUT» and Opacity.



This allows the user to have easy access to the 8-bit and 16-bit editors.



This allows the user to choose the rendering settings from a list of presets. You can select one of the proposed presets.



This allows the user to set the level of details for the Volume Rendering of the 3D view. You can choose the level of detail by moving a slider between *Fine* and *Coarse*.



This allows the user to temporarily force the 3D view to render images in high quality.

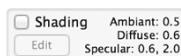


This allows the user to resize the rendering area, by limiting the rendered dataset. You can manipulate the 6 sides of the bounding box of the volume. Any data outside of this box will not be rendered.



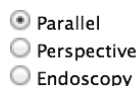
This allows the user to display/hide the orientation labels and cube. The tool displays 4 labels (1 on each side of the 3D view) and a cube. It computes the orientation of the volume and displays the cube of the same orientation with the following labels on its sides:

- L – Left
- R – Right
- P – Posterior
- A – Anterior
- S – Superior
- I – Inferior

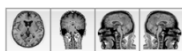


This allows the user to edit the settings for the shadings of the Volume Rendering. This item can only be used when the rendering mode is «VR» and not «MIP». You can choose to turn the shadings on and off. You can modify the following parameters:

- Ambient coefficient, from 0.0 to 1.0
- Diffusion coefficient, from 0.0 to 1.0
- Specular coefficient, from 0.0 to 4.0
- Specular power, from 0.0 to 50.0



This allows the user to choose perspective parameters for the rendering.



This allows the user to switch from different predefined camera positions.



This allows the user to select a tool for the mouse left-click.



You can choose for the 3D view to be either rendered in «VR» or in «MIP».



This allows the user to modify the fusion percentage. If no Series is fused, the tool is not activated. You can modify the fusion percentage.



The user can animate the time parameter of a 4D Series. You can play/pause the animation, choose the frame rate and choose the time position. In order to be activated, a 4D dataset is required.



This allows the user to create a movie sequence of the 3D volume. You can set the following parameters:

- The number of frames to be generated (from 1 to 360)
- The direction of the rotation (horizontal or vertical)
- The amplitude of the rotation (180 or 360)
- The quality of the resulting rendering (Current or Best)
- The size of the resulting movie. Choose from the following:
 - Current
 - 512×512
 - 768×768



This allows the user to export the currently rendered image to iPhoto. This opens Apple's iPhoto application and adds the JPEG image.



This opens Apple's Mail application and creates a new email message containing the JPEG image as an attachment.



This resets the 3D Volume Rendering to the default viewing settings. It changes the following view settings to the default value:

- Zoom
- Rotation
- «WL/WW»
- Pan
- Camera Position



This reloads the data from the original «DICOM» files and re-renders the 3D volume. It cannot be undone.



This creates new «DICOM» images from snapshots of the 3D scene. It writes the resulting data on the disk and adds the new «DICOM» files to the database.



This allows the user to create an animated series or movie, along a custom-made camera path. The camera path is created by adding any number of key positions (or steps), as well as deleting and reordering them.

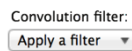
A *reset* button allows you to remove all the steps. The steps can also be saved to an XML file and/or loaded from an XML file.

You can preview the result of the interpolation, by either playing the full animation or by scrolling through it.

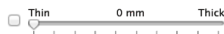
You can choose to export the animation as a new «DICOM» series or as a movie sequence file. The resulting animation can be rendered in *Current* or *Best quality*.



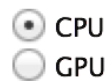
This allows the user to manage the appearance of 3D «ROIs» and compute their volume.



This applies a filter of convolution to the image data.



This allows the user to activate, deactivate and move 2 clipping planes. You can turn the clipping planes on and off. You can also define the distance between them (from *thin* to *thick*). Any data outside the 2 planes will not be rendered.



You can choose the engine used for the image rendering.

3D SURFACE RENDERING (SR)

This 3D rendering technique is commonly used to visualize structures with a sharp and continuous surface, such as bones or lungs for example. This technique can be easily used with CT studies and can be difficult to use with MR studies. It extracts the surface with an algorithm. You can then assign a color and a transparency to this surface. The disadvantage of this technique is that only one surface is calculated and displayed. You cannot see the entire structure, compared to the Volume Rendering technique. Finally, you can export the surface as a vectorial file, that can be manipulated in other 3D software such as Blender.

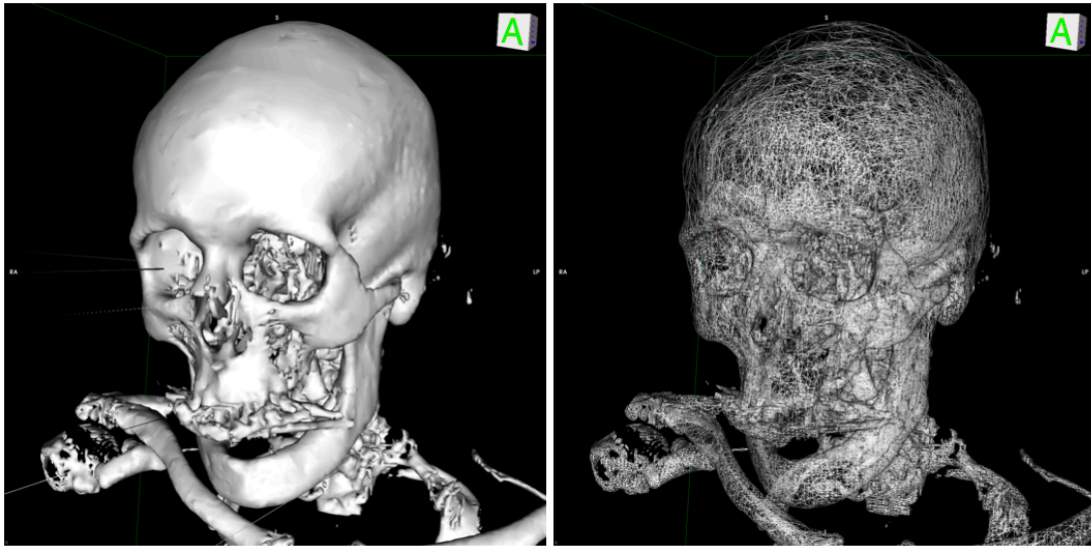


Figure 34: Surface rendering image, and the corresponding triangles

TOOLBAR



This allows the user to set the rendering parameters for the primary and (optional) secondary 3D surface. You can set the following parameters:

- The resolution of the rendering, from *low* to *high*
- Decimate the surface: on/off, with a resolution from 0.0 to 1.0
- Smooth the surface: on/off, with an iteration number from 1 to 100

For both surfaces (primary and secondary), the user can choose:

- To enable / disable it
- The threshold value for the isocontour, either manually or from a list of pre-defined values for CT.
- The transparency, from 0% to 100%
- The color of the surface, from the standard macOS color picker.



Same as previous item, but for the fused series.



This allows you to display/hide the orientation labels and cube. The tool displays 4 labels (1 on each side of the 3D view) and a cube. It computes the orientation of the volume and displays the cube of the same orientation.



This creates a movie sequence file of the 3D surface. You can set the following parameters:

- The number of frames to generate (from 1 to 360)
- The amplitude of the rotation (180 or 360)
- The size of the resulting movie. Choose from the following:
 - Current
 - 512×512
 - 768×768



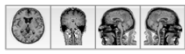
This exports the currently rendered image to iPhoto. Opens Apple's iPhoto application and adds the JPEG image.



This allows the user to export the 3D Surface as vectorial data in a standard file format. You can choose the export format from the following :

- Renderman (.rib)
- VRML (.vrml)

- Inventor (.iv)
- Wavefront (.obj)
- STL (.stl)



This allows the user to switch from different predefined camera positions.



This allows the user to select a tool for the mouse left-click. You can choose to assign one of the following tools to the left mouse button:

- Zoom
- Rotate
- Pan
- Volume rotate *[default left click]*
- Plane rotate
- 3D Point



This allows the user to manage the appearance of 3D «ROIs» and to compute their volume. For each «ROI», you can set the following parameters:

- Map a texture: on/off.
- Red value from 0.0 to 1.0
- Green value from 0.0 to 1.0
- Blue value from 0.0 to 1.0
- Opacity value from 0.0 (transparent) to 1.0 (opaque)



This allows the user to create an animated series or movie, along a custom-made camera path as described in 6.1. To create the camera path, you can add any number of key positions (or steps) as well as deleting and reordering them.

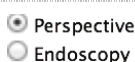
A *reset* button allows you to remove all the steps. The steps can also be saved to an XML file and/or loaded from an XML file.

You can preview the result of the interpolation, by either playing the full animation or by scrolling through it.

You can choose to export the animation as a new DICOM series or as a movie sequence file. The resulting animation can be rendered in *Current* or *Best quality*.



This allows the user to hide and show 3D points «ROIs».



This allows the user to choose the perspective parameters for the rendering.



This resets the viewer to the default viewing settings. It changes the following view settings to the default values:

- Zoom

- Rotation
- Pan
- Camera Position



This creates new «DICOM» images from snapshots of the 3D surface. It writes the resulting data on the disk and adds the new «DICOM» files to the database.



This allows the user to change the color of the background of the 3D Surface view. You can choose any color from the standard macOS color picker.

3D MPR

This viewer produces a «MPR» rendered image from a dataset. The «MPR» plane can be positioned in any direction on the original dataset, including an oblique direction. Three views are displayed. In each view the orthogonal «MPR» plane is shown in relation to the other views. It allows the user to move in a precise manner. For example, you can easily find the four cavities image on a cardiac CT exam. The user can also export a new series, allowing him to reformat the original series in any direction.

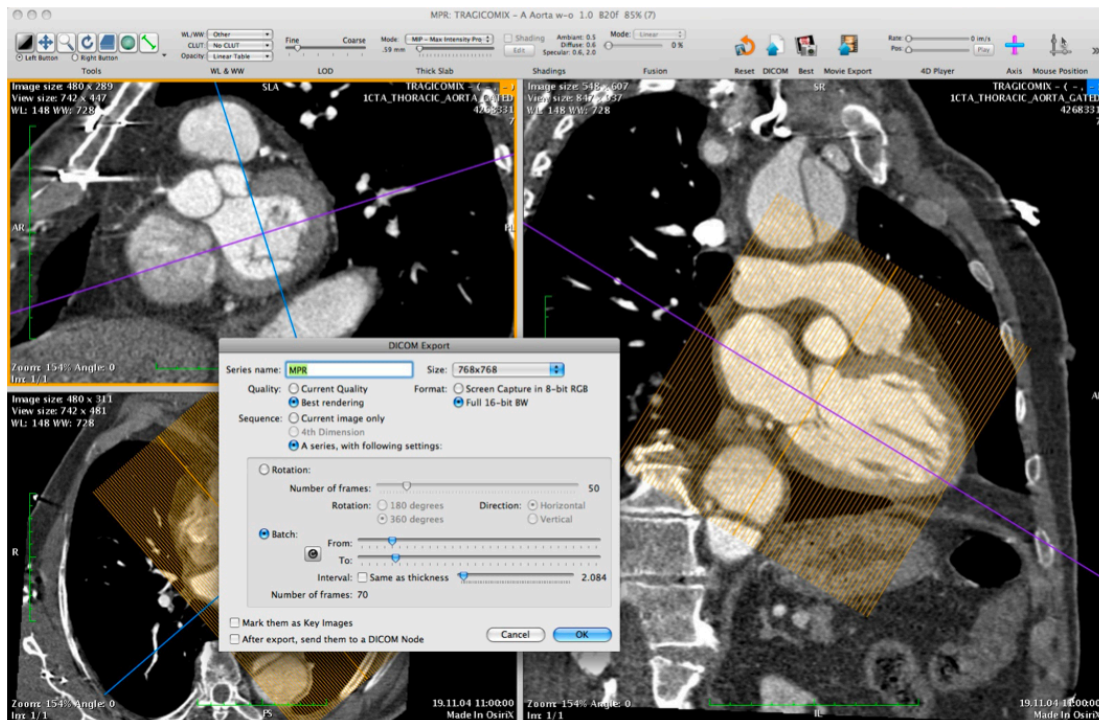


Figure 35: 3D MPR window

«Multiplanar reformatting» («MPR») is a technique to generate sagittal, coronal and oblique views. For a good image quality, a small interval between the original images is needed. Therefore, the image interval (Z axis) of the original series should not be larger than two times the pixel resolution (X and Y axis).

The multiplanar views often clarify the anatomy of small structures and can help to better understand the anatomy of complex structures, such as vessels. These methods enhance the accuracy of diagnostic decisions and are greatly appreciated by the referring physicians, such as surgeons, as they aid in the creation of appropriate treatment plans.

The MPR Viewer window displays three views with orthogonal planes, in relation to the other views. Changing the position or the orientation of one of these three planes will change the two others. To obtain the best results, it is recommended to move the three views progressively as follows:

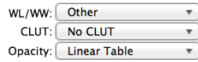
- Start on the coronal view
- Correct the orientation on the axial view
- Correct the orientation on the sagittal view

- And go back to the first view
- And continue this loop until the desired result is obtained

TOOLBAR



Allows the user to select a tool for the mouse left-click, used when clicking on a «MPR» view.



This allows the user to change the settings for «WL/WW», «CLUT» and Opacity using presets.



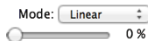
This allows the user to set the level of detail required when rendering 3 «MPR» views. You can choose the level of detail by moving a slider between *Fine* and *Coarse*.



This allows the user to force the 3 «MPR» views to be rendered in better quality. This function is useful if the *Level of Details* is set to a coarse value.



This displays a thick slab rendering of the selected Series. You can choose the rendering algorithm from the following: «MIP», «MinIP», Mean and Volume Rendering.



This allows the user to modify the fusion parameters when two fused datasets are displayed. This tool allows the user to change the fusion mode (linear, log, . . .) and the fusion percentage from 0% to 100%.



This set of tools allows the user to scroll in the 4th dimension. This feature requires a 4D dataset and works like a 4D Player of the 2D Viewer.



This resets the 3 MPR views to the default view settings.



You can use this tool to create new «DICOM» images, based on the «MPR» views. The new images are indexed and displayed in the database window.



This creates a movie sequence file of the selected Series.



This allows the user to change the colors of the axis corresponding to each «MPR» view. For each axis, the user can choose any color from the standard macOS color picker.



This allows the user to choose to display or to hide the axis corresponding to each «MPR» view. You can turn the axis display on or off.



This allows the user to choose to display or to hide the position of the mouse on the other «MPR» views. You can choose to turn on or off the display of the mouse position.



This allows the user to choose to sync or not to sync the zoom parameter of the 3 «MPR» views. You can turn the zoom sync on or off.

2D ORTHOGONAL MPR



Figure 36: The 3 planes reconstructed in Orthogonal MPR

The orthogonal «MPR» tool displays three views in a single window. The default display is the axial view on the left, the coronal view is in the middle and the sagittal view is on the right. Cross reference lines enable the user to move the planes interactively.

This tool supports image fusion. It is a good viewer for PET–CT studies, as it displays nine orthogonal views: three orthogonal views for the CT, three orthogonal views for the fused CT & PET, and three orthogonal views for the PET.

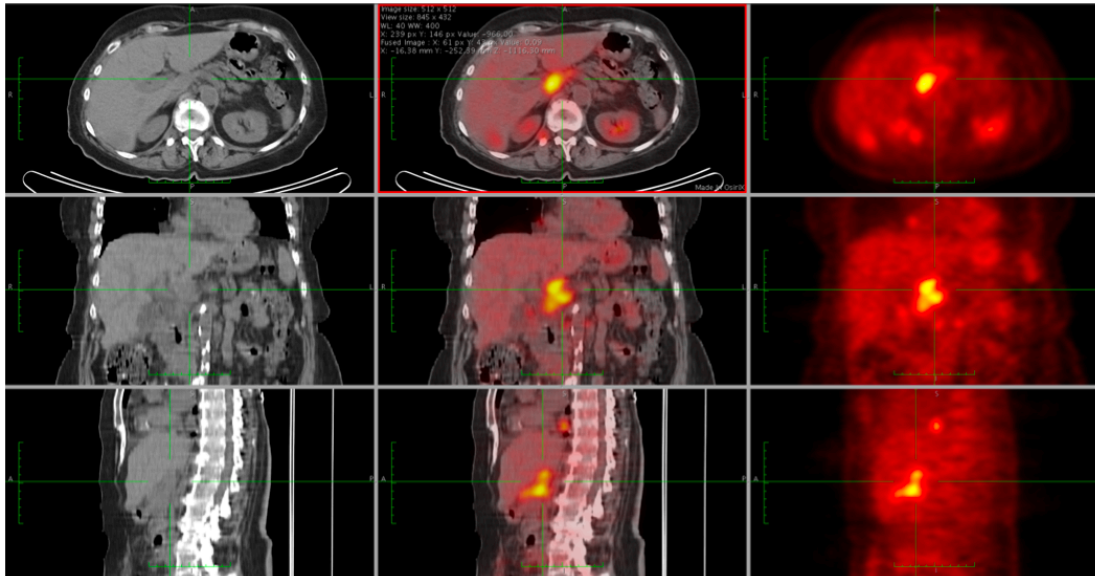
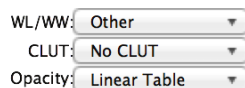


Figure 37: 2D Orthogonal MPR with PET-CT images

TOOLBAR



This applies the selected «WL/WW», «CLUT» and Opacity preset to the «MPR» views.



This displays a thick slab rendering of the selected Series. You can choose the rendering algorithm : «MIP», «MinIP» or Mean.



This set of tools allows the user to scroll in the 4th dimension.



The user can choose to assign one of the tools to the left mouse button.



This function creates and saves new «DICOM» images. The new images are indexed and displayed in the database window.



This sends an email message containing a screenshot of the image displayed in the selected «MPR» view. It creates a JPEG version of the view, using the current image state («WL/WW», zoom, rotation, pan and annotations). It then opens Apple's Mail application and creates a new email message containing the JPEG image as an attachment.



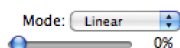
This function re-sizes the «MPR» views so they all have the same widths or heights. By default, the widths or heights are identical, but you can move the view separators manually, thereby resetting the views to their original sizes.



This function resets the «MPR» views to the default view settings.



The 3D Panel displays a small window for viewing the full volume «MIP» of the image data. The data rendered is displayed in a rotating mode that can be stopped or manipulated interactively. This feature is particularly useful for reviewing PET data. Double-clicking on a given point of the 3D rendered image in the 3D panel automatically positions the orthogonal planes on it.



Only available with fused series. This tool allows the user to change the fusion mode (linear, log, . . .) and the fusion percentage from 0% to 100%.



Only available with fused series. This tool allows the user to move the fused dataset as he likes.

3D CURVED MPR VIEWER

This chapter describes how to visualize and reformat a dataset in a curved image: «Curved Planar Reformation» («CPR»).



Figure 38: Curved MPR window

The «Curved MPR» image can be defined in any direction and angle on the original dataset. This plane is defined as a «3D Bezier» path. The «Curved MPR» image is rendered as a straightened or stretched view.

Four views are displayed in this window. The first three views show an orthogonal «MPR» image in relation to the other views. It allows the user to move in a precise manner and to place and edit the «3D Bezier» path. The lower right view displays the «3D Bezier» path as a straightened or stretched curved «MPR» image. The user can rotate around this «3D

Bezier» path and display three perpendicular views along this path (views A, B and C).

The «Curved MPR» views and the corresponding perpendicular views can be exported as new «DICOM» images in the database.

3D MPR VIEWING FUNCTIONS

«Curved Multiplanar» reformatting is a technique used in two-dimensional imaging to create a new image along a path.

The «Curved MPR» rendering technique can help to better understand the anatomy of complex structures, such as vessels. It allows to unroll curved structures (e.g., blood vessels). It makes a tubular structure visible in its entire length within one single image. The whole length of the tubular structure is displayed within a single image by this technique. Vascular abnormalities (e.g., stenoses, occlusions, aneurysms, and vessel wall calcifications) are then easily investigated.

This tool requires a first step where you define the curved path with sequential points on the orthogonal views. The resulting quality depends directly on the position of these points.

OsiriX includes two modes:

- Straightened Rendering
- Stretched Rendering

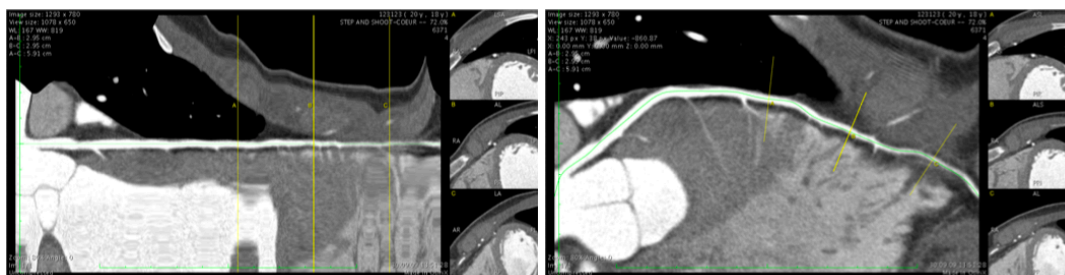


Figure 39: Straightened and Stretched Renderings

STRAIGHTENED RENDERING

This type of curved planar reformation fully straightens the tubular structure. This method generates a linear representation of the vessel with varying diameter. The advantage is the easy perception of variances of the diameter. Due to the elimination of curvature of the central-axis the only varying property along the central-axis is the structure's diameter.

The disadvantage is the inability to measure distances in a non-orthogonal direction: you can only measure distance along the length or in the perpendicular direction, corresponding respectively to the length and the diameter of the structure.

STRETCHED RENDERING

The main advantage of this technique is the preserved isometry (resolution along the X and Y axis are equals, you can measure distances), which is important for accurate preoperative planning of endovascular stent-graft treatment of aortic aneurysms. The lengths of normal and abnormal vascular segments need to be determined accurately for sizing the endovascular prosthesis. This is possible in the case of a stretched image, but not in the case of a straightened image: you can measure structures in any directions in the plane.

CURVED MPR VIEW

The «Curved MPR» view displays the view corresponding to the defined path. This image is calculated in real-time and automatically adjusted to the length of the path. There are also three perpendicular (to the curved plane) views on the right part of this view: A, B and C. These three views represent cross-sectional views, according to the three yellow lines (A, B, C) displayed on the «Curved MPR» image.

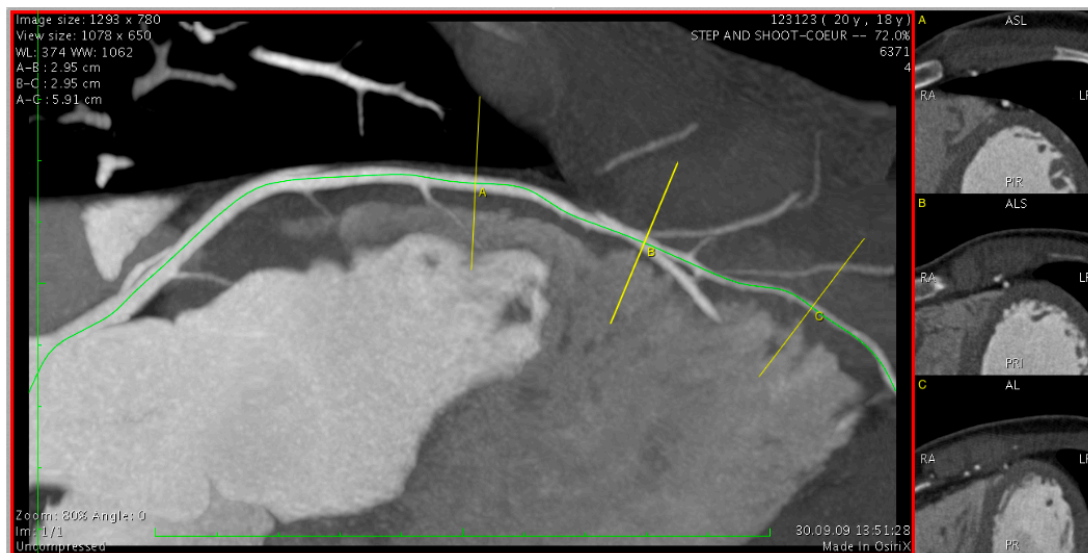


Figure 40: «Curved MPR» View, and the 3 axial views

EXPORTING IMAGES

Images rendered in this window can be exported in «DICOM» format and added to the database as new series of images. These images can then be exported to a «PACS» or another «DICOM» compliant workstation for display.

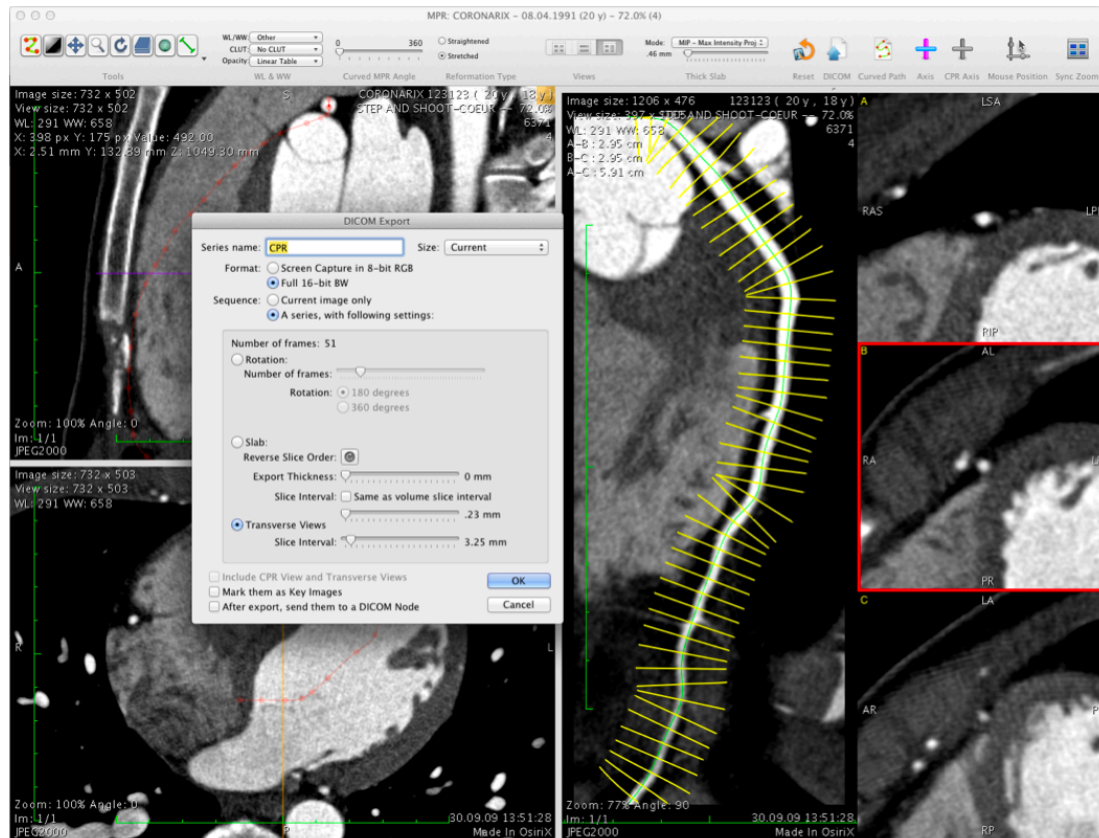


Figure 41: Exporting window

TOOLBAR



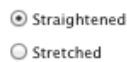
Allows the user to select a tool for the mouse left-click, used when clicking on a «MPR» view.



This allows the user to change the settings for «WL/WW» using presets.



This slider displays the current rendering angle for the image.



You can select the rendering mode: *straightened* versus *stretched*.



You can select the mode for the drawing of the path: *Creation Mode* versus *Editing Mode*. The *Creation Mode* allows you to create a new path and add new points. The *Editing Mode* allows you to edit the existing points of a path.



You can select here the layout of the views.



This resets the 3 «MPR» views to the default view settings.



You can use this tool to export new «DICOM» images based on the view.



This allows you to save the path in a file. This file contains only the 3D points of the path, not the dataset itself.



This allows the user to change the colors of the axis corresponding to each «MPR» view. For each axis, the user can choose any color from the standard macOS color picker.



This allows the user to choose to display or to hide the axis corresponding to each «MPR».



This allows the user to choose to display or to hide the position of the mouse on the other views.



This allows the user to choose to sync or not to sync the zoom parameter of the 3 views.

SECURITY

STORAGE SECURITY

It is advised to activate file storage encryption to guarantee that if someone steals your computer or your hard disk, this person will not be able to access the original «DICOM» files.

On Mac computers, there is a built-in solution to securely encrypt your hard disk: «FileVault».

You can activate it in macOS System Preferences: «Security & Privacy»: «FileVault» panel.



Figure 42: FileVault settings

OsiriX does not include a back-up system for the storage.

It means that if your hard disk, where the database is stored, is corrupted, you will lose your studies.

If you store original «DICOM» files or want to be sure that you will not lose your files (hardware failure or manipulation error), it is advised to use a back-up system.

You can use «Time Machine» to automatically create snapshots of your database (more information on Apple web site: <https://support.apple.com/en-us/HT201250>).

You can also manually copy your «OsiriX Data» folder at regular intervals.

And finally, you can use commercial software to create incremental back-up.

NETWORK SECURITY

If you use your computer in an unknown or untrusted network (intranet or internet), it is advised to secure the network services offered by OsiriX.

To protect the network communications between computers in an untrusted environment, several technologies are available, based on:

Encryption transforms meaningful data into what looks like gibberish using a secret that can also be used to reverse the process.

Authentication is the process of convincing a gatekeeper that you are who you say you are, typically by proving that you know a secret (username and password).

You can use these two global technologies to protect your network from unauthorized accesses:

VPN

A Virtual Private Network extends a private network across a public network and enables users to send and receive data across shared or public networks as if their computing devices were directly connected to the private network. It relies on encryption and authentication technologies.

Firewall

A computer firewall is a software program that prevents unauthorized access to or from a private network.

You can configure it to block/authorize specific network ports to block/authorize only specific services.

To configure a VPN or a firewall, contact your local IT support.

OsiriX offers several network services that can be activated & configured:

1. *Standard «DICOM» network protocol*
2. *XML-RPC and osirix:// URL scheme messages*
3. *Database sharing*
4. *Web Portal*

If you are unfamiliar with these concepts and settings, it's recommended to check with your local IT support, if your environment is secured.

You can find here detailed information about these services and security:

1. Standard DICOM network protocol (No encryption & No authentication)

This is the original protocol to exchange «DICOM» files between computers and software. The original protocol has been created in 1985. At this time, security was not a major concern. That's why the original standard doesn't include encryption and authentication. Hence, if you run OsiriX in an untrusted environment, turn off the «C-GET SCP», «C-MOVE SCP», and «C-FIND SCP» in *Preferences*→*Listener* window, or block the port (displayed in the Preferences) in your Firewall, or use it through a VPN.

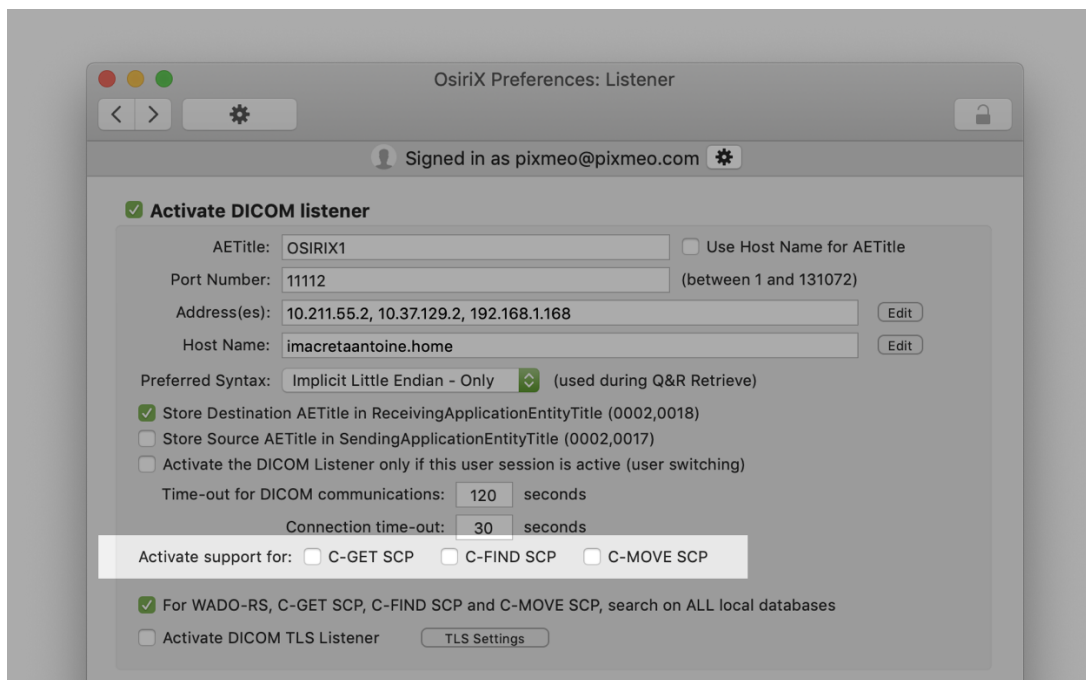


Figure 43: Deactivating «C-GET SCP», «C-MOVE SCP», and «C-FIND SCP».

2. ***XML-RPC and osirix:// URL scheme messages (No encryption & No authentication)***

This protocol authorizes another computer or software to send messages to OsiriX. These messages can open a study or query the database list. You cannot exchange images with this protocol. If you run OsiriX in an untrusted environment, turn it off in *Preferences*→*Listener* window, or use it through a VPN.

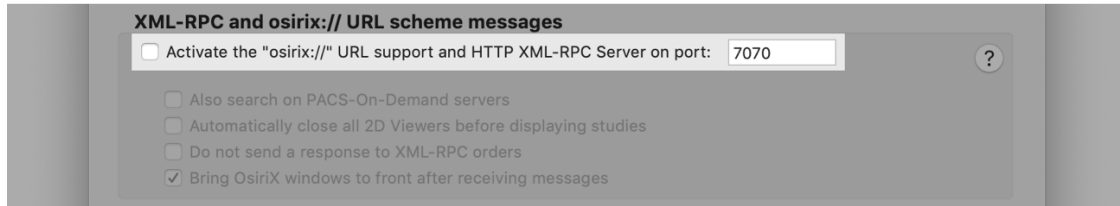


Figure 44: Deactivating XML-RPC and osirix:// URL scheme

3. *Database sharing (encryption: yes, authentication: optional)*

This feature allows you to share your OsiriX database with another computer. The data exchanged is automatically encrypted with the TLS protocol, provided by the operating system. If you run OsiriX in an untrusted environment, activate the authentication (password) in *Preferences→Listener* window to avoid unauthorized access.

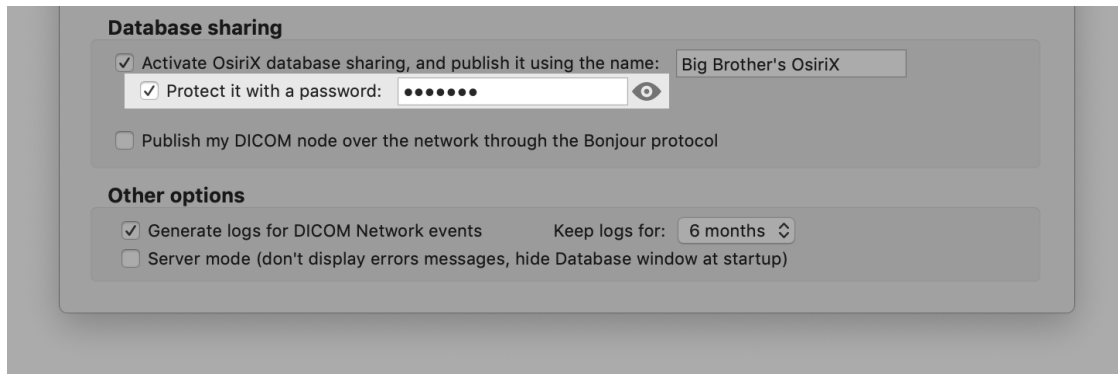


Figure 45: Activating Database sharing authentication.

4. Web Portal (encryption: optional, authentication: optional)

This feature give access to your database from an Internet web browser, such as Safari or Chrome. The connected user can navigate in your database and view the images. The Web Portal supports TLS encryption (HTTPS protocol), through official & trusted Web certificates. The Web Portal also supports user authentication with username & password, including a 2 factors authentication option (SMS token). If you run OsiriX in an untrusted environment, activate HTTPS encryption & authentication in *Preferences→Web Portal* window, or block the port (displayed in the Preferences) in your Firewall. You can buy a certificate from several companies: [Sectigo](#), [DigiCert](#), [GoDaddy](#), ...

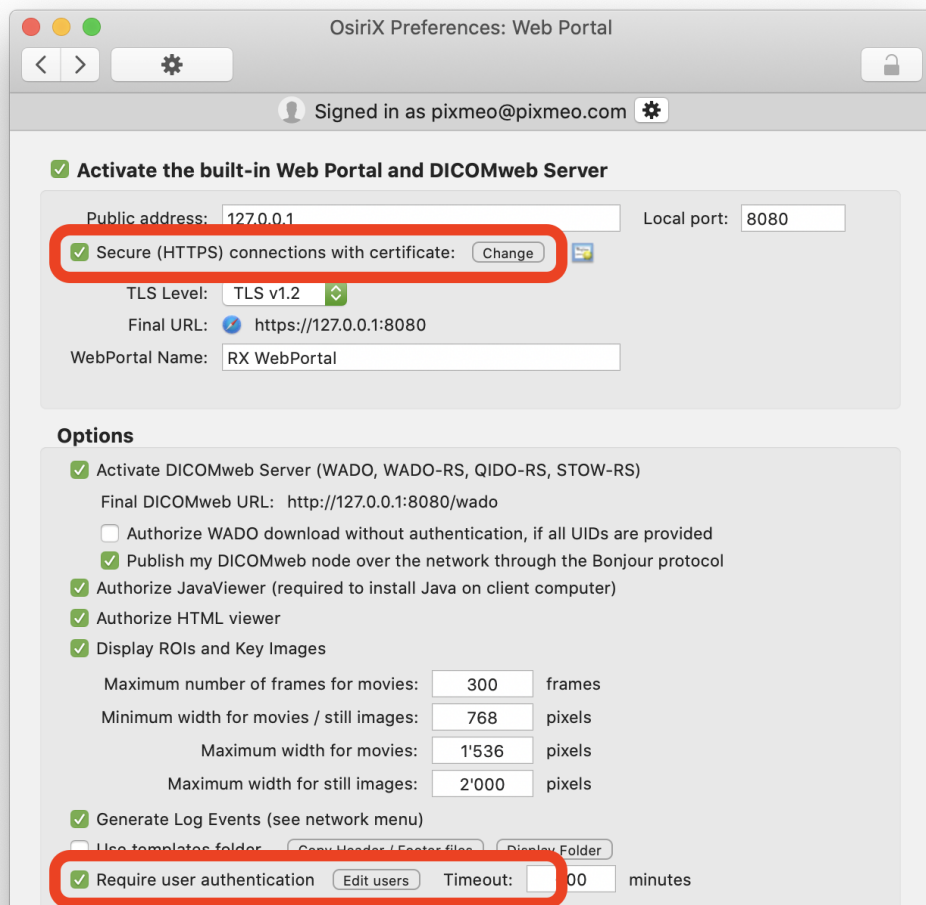


Figure 46: Activating Web Portal authentication

DICOM TLS

This section provides a short description of the «TLS» (Transport Layer Security) support available for «DICOM» communications in OsiriX.

«TLS» is a cryptographic protocol that provides security for communications. It is used in OsiriX as the security layer for «DICOM» communications («Query & Retrieve» and listener).

In OsiriX, both unilateral and bilateral authentication modes are implemented:

- The authentication is unilateral: only the server is authenticated (the client knows the server's identity), but not vice versa (the client remains unauthenticated or anonymous).
- The authentication is bilateral: both parties can be sure who they are communicating with.

You can configure it in Preferences→Listener window.

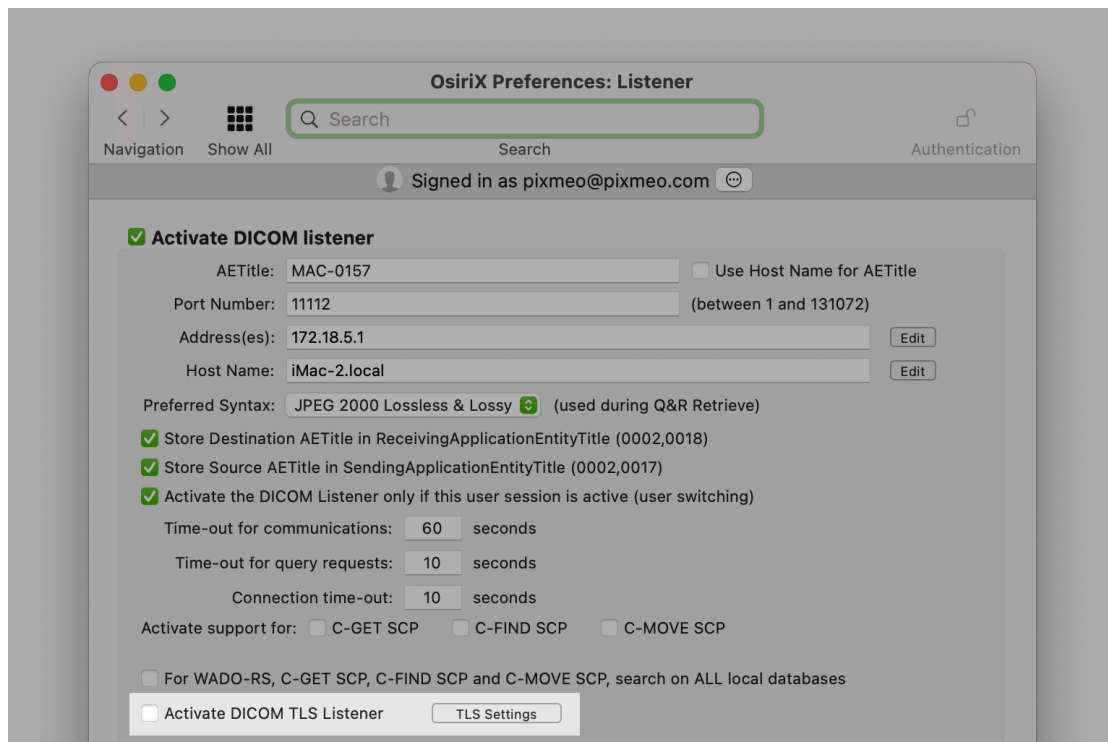


Figure 47: Activate «DICOM» TLS Listener