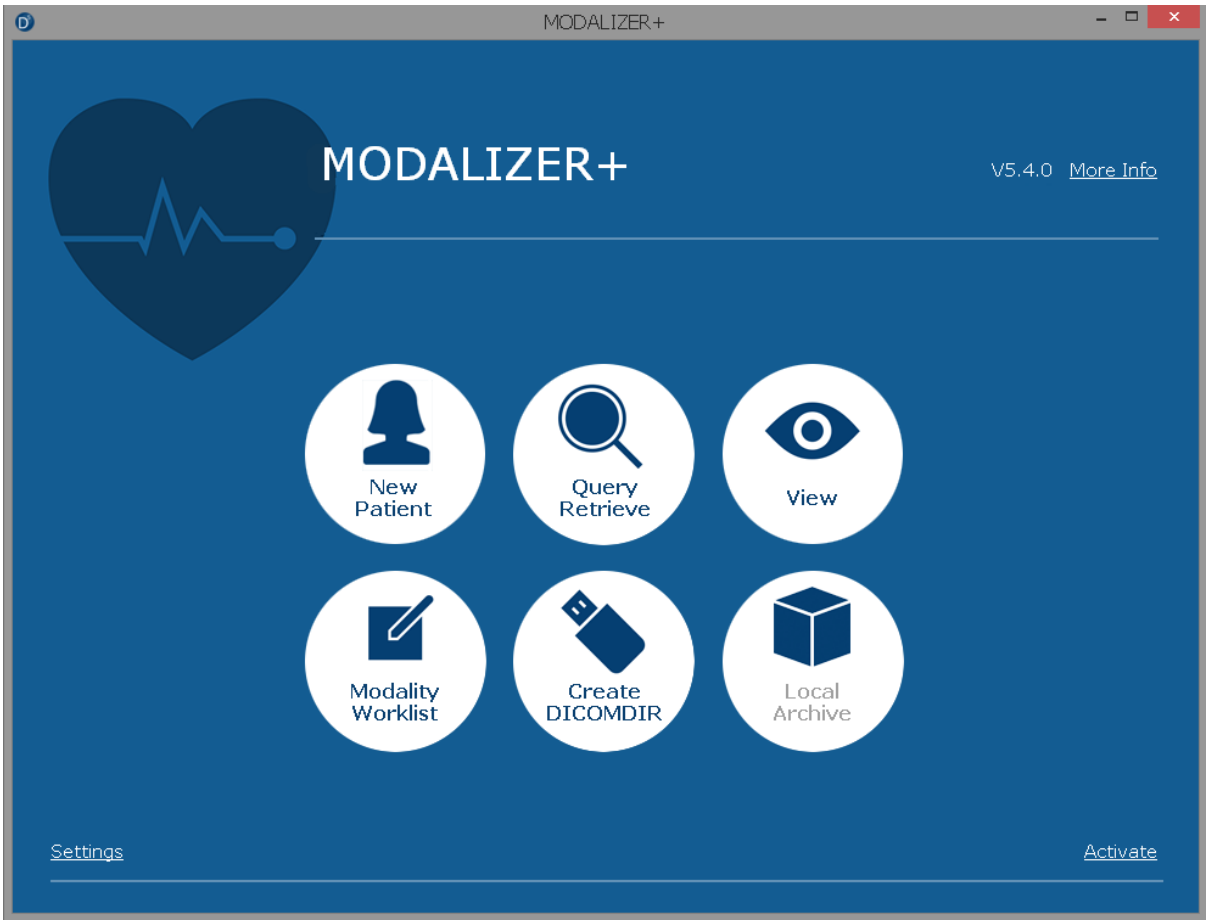
MODALIZER+

User's Manual

POINT-OF-CARE
IMAGING AND REPORTING



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Reference Documents

Title	Date	Link	Comments
DICOM Conformance Statement			

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1. Introduction

MODALIZER+ is a powerful and easy-to-use Point-of-Care Imaging and Reporting tool. It was carefully designed to capture, scan and display Images and documents in PACS Environment. MODALIZER+ provides a complete solution for Healthcare personnel to document patient encounter and perform other related tasks. MODALIZER+ is a state of the art DICOM Application with rich feature set combining Imaging Modality, Reporting Tool, DICOM Viewer and Conversion Tool:

- Capture, scan and convert Images from image files, USB Cameras and TWAIN/WIA Imaging Devices, MPEG, PDF, JPG, PNG, TIFF and Bitmaps.
- Fully Customizable, auto-complete, PDF Report Template.
- Integrate with a PACS to store, search, retrieve and display Images and Reports.
- Workflow Integration using DICOM Modality Worklist and Modality Performed Procedure Step to obtain Patient and Procedure parameters, report procedure progress, and eliminate typos and QA.
- Multi-Modality Image Display and PACS Workstation - creating, connecting, searching, retrieving and storing images and documents on the PACS Creating DICOM Media, Burning CD/DVD and USB with integrated DICOM CD Viewer.
- Manage your own medical image archive using the built-in Local Archive database.
- Built-in DICOM Listener
- Customizable DICOM instances structure and content.
- Configurable “Capture Key” to take images using the keyboard or dedicated hardware such as pedal or external capture button.

1.1. Why convert to DICOM?

Digital Imaging and Communications in Medicine (DICOM) is the standard for handling, storing, printing, and transmitting medical images. DICOM is the most widely deployed healthcare-imaging standard in the world. DICOM images can be exchanged between two entities that are capable of receiving image and patient data in DICOM format.

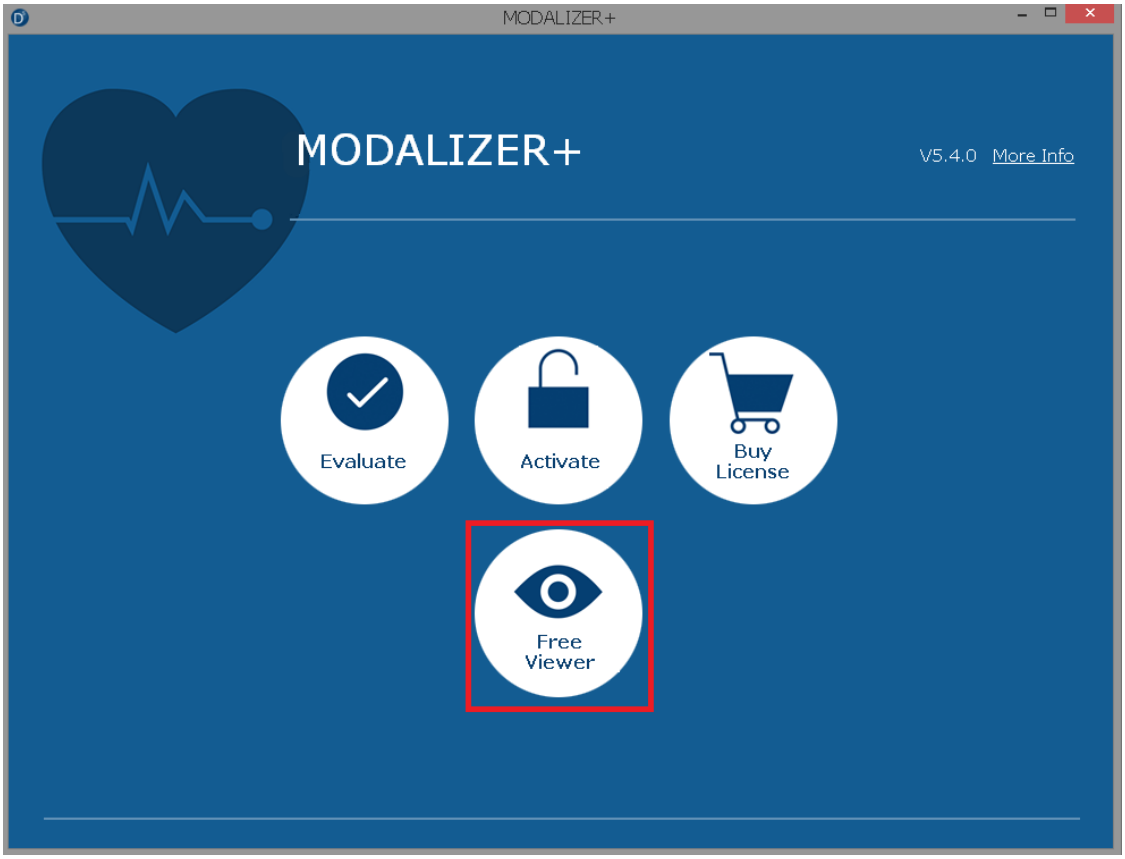
DICOM enables the integration of scanners, archives, workstations, printers, and network hardware from multiple manufacturers into a picture archive and communication system (PACS).

1.2. Supported Image and Document Types

MODALIZER+ supports the following conversions: PDF, JPEG, PNG, BMP, TIF, MPEG-2, MPEG-4. MODALIZER+ can convert series of images of the same type and size to Multi-Frame DICOM objects stored in a single file.

1.3. Free DICOM viewer

Now MODALIZER+ can be used as a free DICOM Viewer (no need of getting evaluation license to open DICOM files). Click "Free Viewer" or drag-drop DICOM file/folder onto application surface to open viewer screen.
Free viewer doesn't include converter and option to save measurements in GSPS module.



On exiting "free viewer" HRZ's website will be opened in default Internet browser.

2. Quick Start

This section is a quick step by step demonstration of MODALIZER+ Capabilities.

2.1. The New Patient Wizard

- Click “New Patient” in the main menu.
- Enter the patient’s data. Click the ellipses to the right of the patient last name text box to add middle initial, prefix and suffix. Click “Next”.
- MODALIZER+ recognizes TWAIN/WIA Imaging Devices connected to your computer. You can select one of them using the drop-down menu on the top left corner of the image preview panel.
- Select files from your computer by clicking “Add files”. If the camera preview panel is visible, capture images by clicking the red button or capture key (if configured). You can also drag-and-drop files from your computer to the MODALIZER+ window. Click “Next”.
- Select “Convert” for Action and then click “Next”.
- Click “Open destination folder”. The case folder where the converted file are stored will open.
- Click the “Done” button to return to the main menu.
  For more details see New Patient.

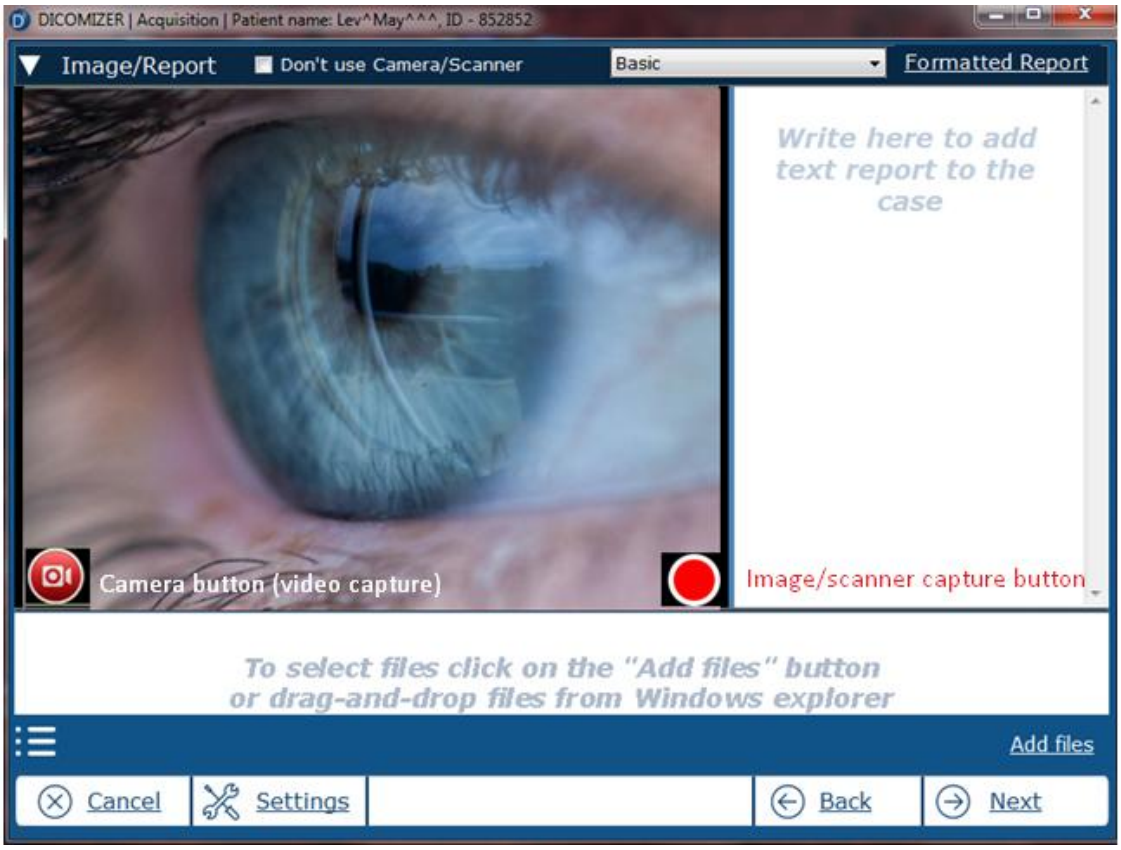
2.2. Capturing Images and Scanning Documents

Video capture directly from MODALIZER+ is available on supported operating system. The video encoder is part of the standard windows 7 operating system but not available by default on windows 8 and later.

MODALIZER+ Automatically detects and connects to TWAIN/WIA supporting devices such as the internal web camera of your laptop, USB cameras and most document Scanners. When a supported imaging device is detected, the capture and preview panels are automatically displayed. MODALIZER+ allows you to work with multiple imaging devices simultaneously and easily switch between devices within the same procedure.

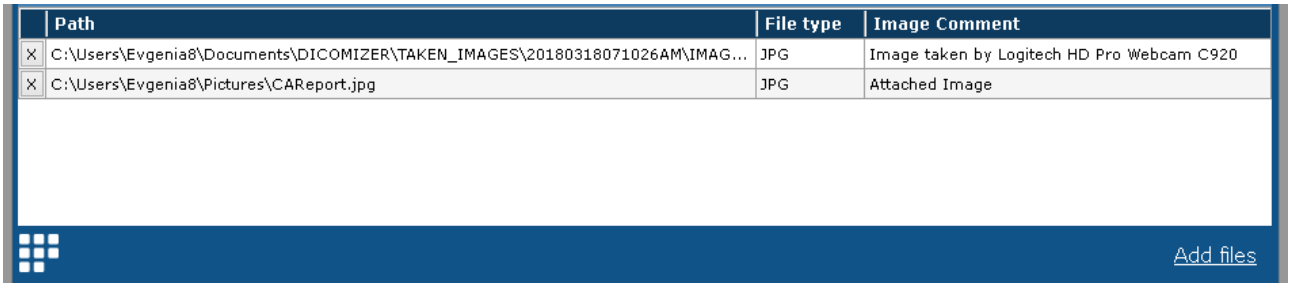
MODALIZER+ is now capable of capturing video streams from Web camera as MPEG-2 video file. To start capturing, click "Camera" button on the bottom left of the video panel.

When connected to a scanner, clicking the red capture button launches the scanner’s interface. The scanned documents are added to the bottom panel of attached documents.



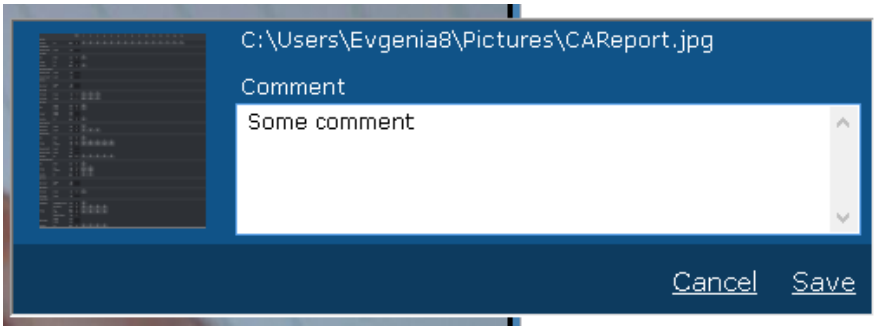
You have an option to add comments to converted DICOM files.

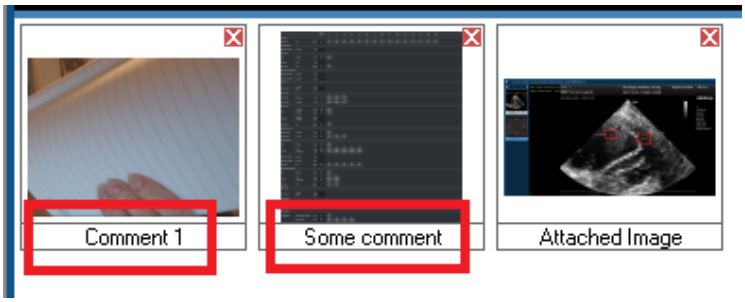
When on Acquisition screen image is captured / selected from the disk - application adds default comment to each of them ("Image taken by..." or "Attached image"):



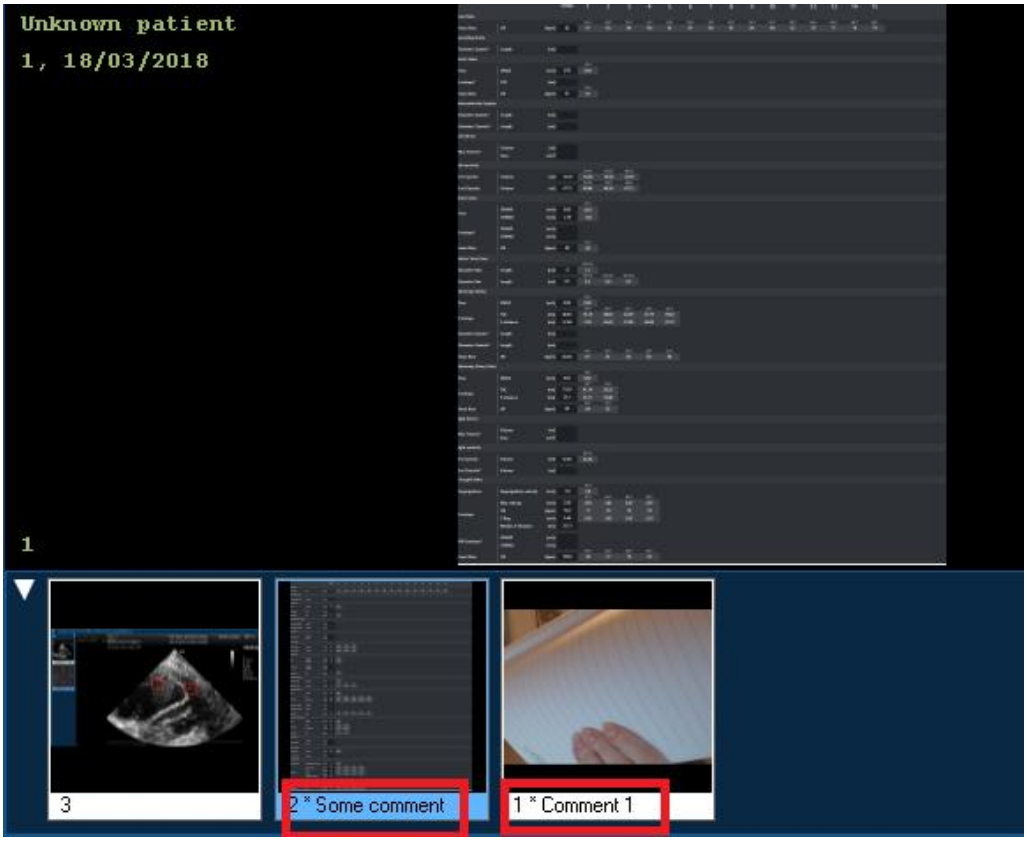
Path	File type	Image Comment
C:\Users\Evgenia8\Documents\DICOMIZER\TAKEN_IMAGES\20180318071026AM\IMAG...	JPG	Image taken by Logitech HD Pro Webcam C920
C:\Users\Evgenia8\Pictures\CAReport.jpg	JPG	Attached Image

You can change default comment by editing them in the grid or in pop-up window which can be opened by double-click on comment row in the image thumbnail:

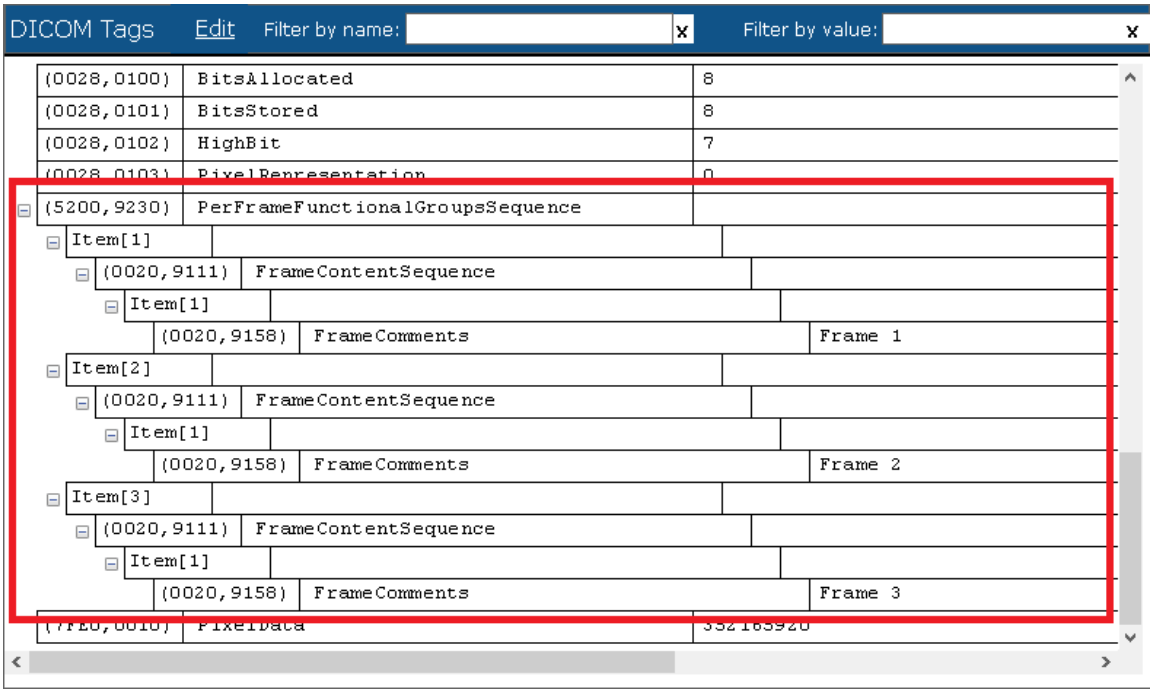




NOTE: Default comments will not be inserted into converted files!



If user selects to build one multi-framed DICOM file - comments will be inserted into "PerFrame" sequence:



2.3. Filling a Report

MODALIZER+ is a great reporting tool, automated, customizable, and fully integrated with your PACS and Worklist Manager.

MODALIZER+ Formatted Report automatically fills patient and study information into report templates. The report templates are customizable. You can add your own logo and signature, and use your own stationery style.

There are 3 methods of creating a report:

1. Formatted Report - to create a new PDF using the predefined formatted template select required template from the list, and click “Formatted Report” button – this will create a new file from the template. Edit and save it as PDF. Close the editor. Verify that the PDF file was added in the bottom panel.
2. Attach an existing PDF file from your computer - select your PDF files using the “Add files” button or drag-and-drop the files on the Acquisition screen.
3. Create a DICOM Structured Report by typing text in the report text panel.

Note: For more details on this feature read the Reporting chapter.

2.4. DICOM Removable Media Export (CD/DVD/USB)

To complete this task, please verify that you have a CD/DVD Writer in your computer. If you don't have a CD/DVD Writer, you can export the study to any removable media like Disk-on-Key or to a directory on your hard disk.

Prepare the DICOM files that you would like to export.

- Select "Create DICOMDIR" from the main screen.
- Select the folder with files to export.
- Click "Scan". MODALIZER+ will now read the data from the files and prepare them for export. MODALIZER+ will display the study details.
- Verify that the "Copy, Arrange and Rename" option is selected.
- Checkmark "Include DICOM Viewer to DICOMDIR".
- Select a destination folder to which MODALIZER+ will prepare the files for export.
- Click "Next".
- Select the destination drive for the media.
- Click "Burn to disc".
- After the operation completes eject the disc.
- Test the disk: Insert the media. If your AutoRun option is disabled click the DICOMViewer.exe - the study will be displayed in the DICOM Viewer.

Note: For more information see Burn CD/DVD.

2.5. Viewing DICOM files

To display a DICOM file simply drag-and-drop the files on the MODALIZER+ window. You can drag-and-drop one or more files, a directory or a DICOMDIR file. You can also drag-and-drop files and folders on the MODALIZER+ desktop icon.

Note: Read more about HRZ's DICOM Viewer.

2.6. Connecting To PACS

Maximize your MODALIZER+ capabilities by connecting to a PACS. Once MODALIZER+ is integrated with your Storage Server and Worklist Manager you will be able to use Modality Worklist to obtain Patient and Procedure parameters and Query/Retrieve to search for DICOM objects by criteria like patient name, id and birth date.

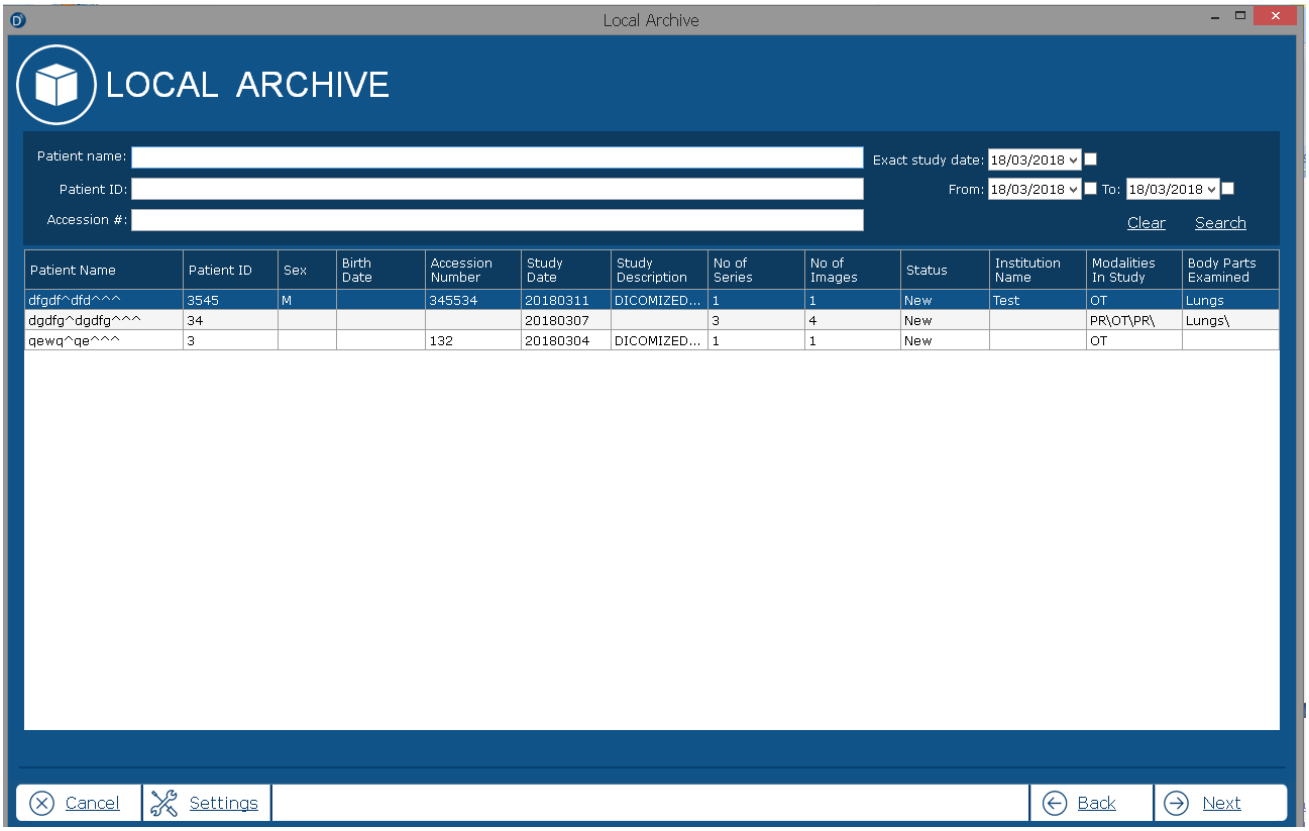
Read more about Storages Servers configuration and WorkList Servers configuration.

2.7. The Local Archive

MODALIZER+ includes a local DICOM Archive to store all created, converted, and imported studies. All the files in the local archive are stored according to the DICOM Standard using the DICOM file format.

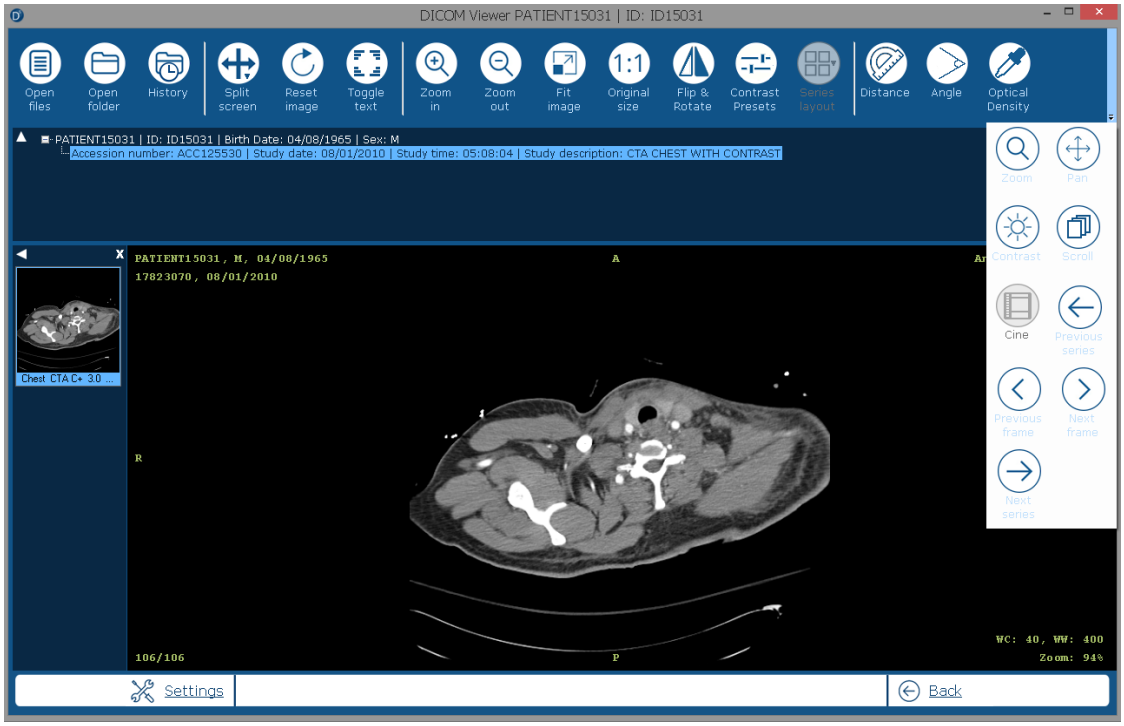
To enable the local archive open the settings screen and checkmark “Use Local Archive”.

There is an option to start MODALIZER+ from command line with some specified parameters. See detailed description in Appendix A.



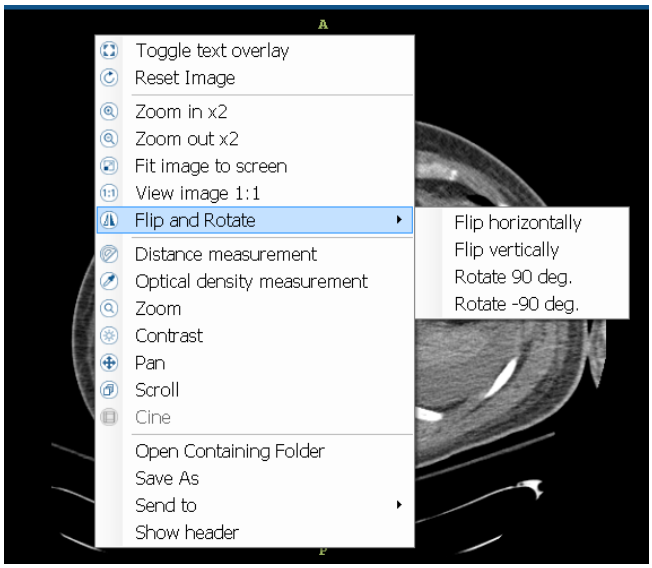
3. DICOM Viewer

MODALIZER+ is a powerful and friendly Multi-Modality DICOM Viewer.



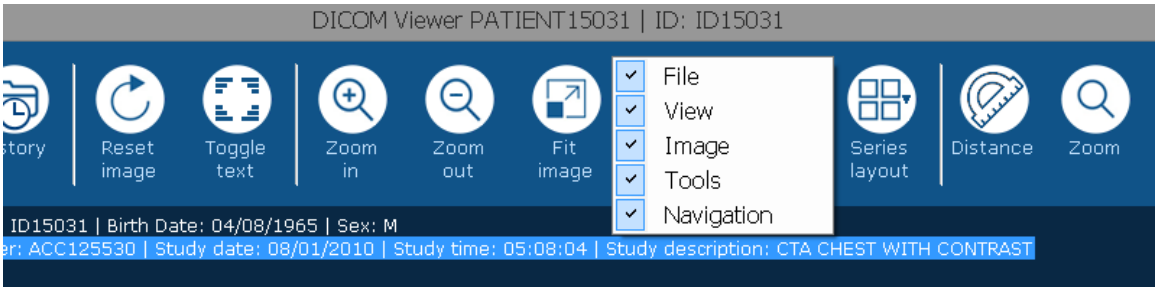
The DICOM Viewer consists of:

1. Main display area – presents the selected image. Press CTRL-H to show/hide the DICOM attributes, CTRL-T to show/hide the text overlay. Right click to open the context menu with various operations, start/stop tools, open folder containing current image, send image to PACS and save it according to an original SOP class and transfer syntax (as JPEG/PNG/BMP/PDF/MPEG file). In addition each file can be saved as "Text" (DICOM dump):



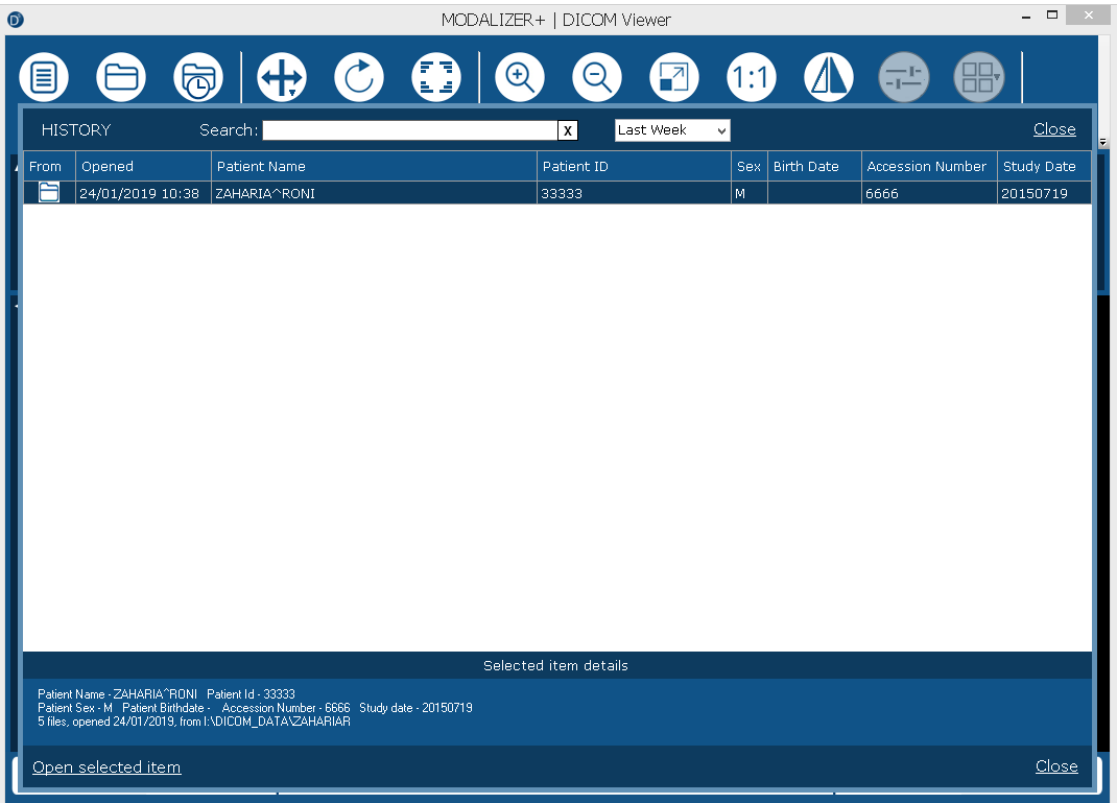
2. Patients and Studies tree –right click on the study row to show the context menu with options to send the study to PACS, close it (remove from the viewer) or export it to external media (available only for studies from Local Archive).
3. Series thumbnails of the currently selected study - right click on the thumbnail shows a context menu with an option to send the series to PACS.
4. Preview of the images within the currently selected series (as thumbnails in the bottom panel). If the images within the series are spatially related then they will be grouped and not displayed as individual files. If all the images of the current series are spatially related then no image thumbnail is displayed for the series. You can send a single image to PACS - the right click on the image opens a context menu with such an option.
   On selection series first image will be displayed in central area. To display another image - click on its thumbnail or click left/right arrow to load next/previous image.
5. Tool buttons strip allowing to perform various operations on the current image and load new images from folder/file open dialog or from history record. DICOM Viewer operations can be made from the toolbar or from the context menu from right-click on the image panel.

The panels can be expanded/collapsed by clicking the white triangles at the top left of each panel.
Right-click on tool menu background opens context menu allowing to select which groups of buttons has to be visible (selection is saved between application runs):



3.1. Loading images to the Viewer

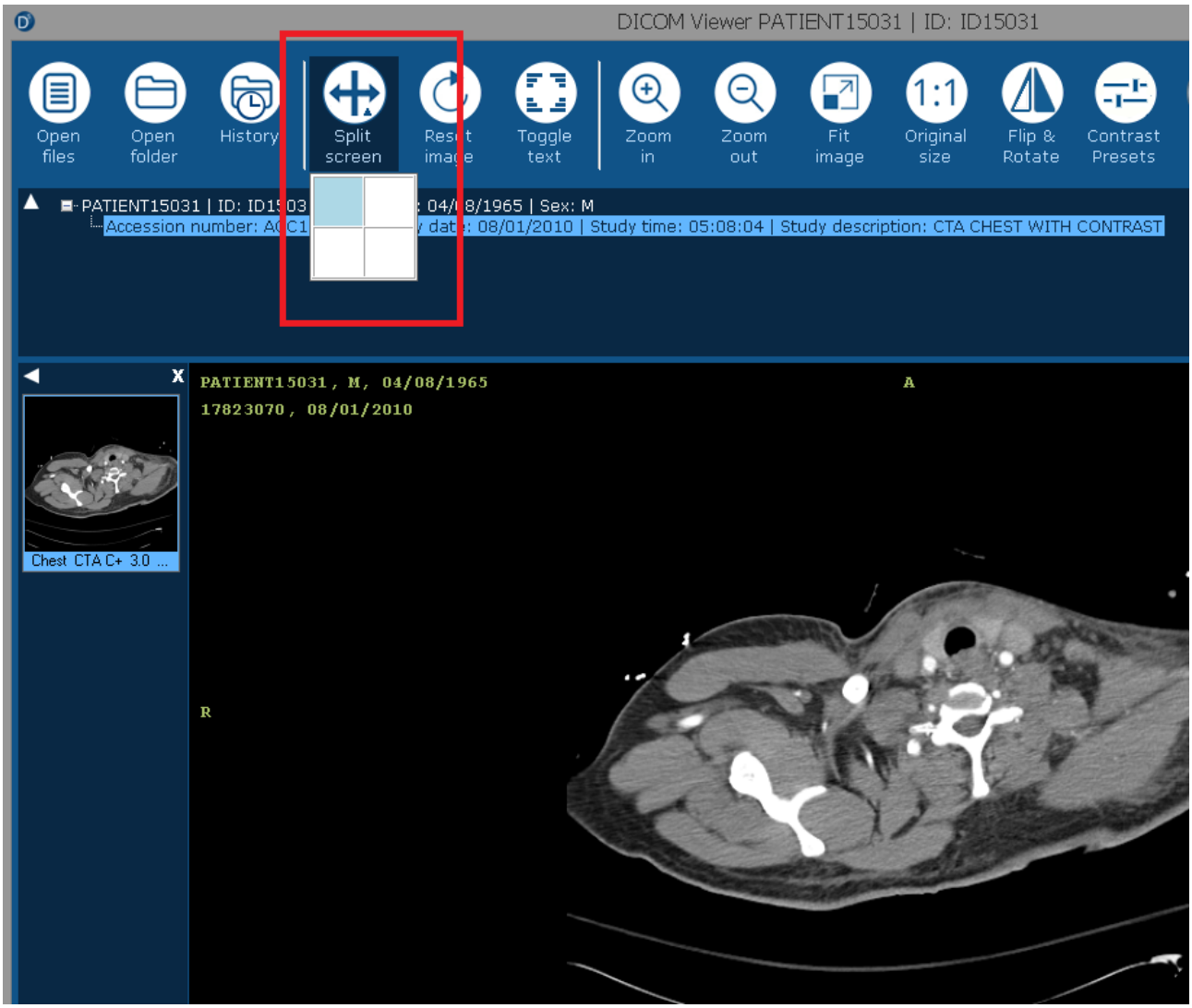
There are few ways to display DICOM files - you can drag and drop the items or to click “Open Files” to browse for a folder and select the files to view. In order to display an entire folder’s content use “Open Folder” button.
There is also an option to open files from the History screen:



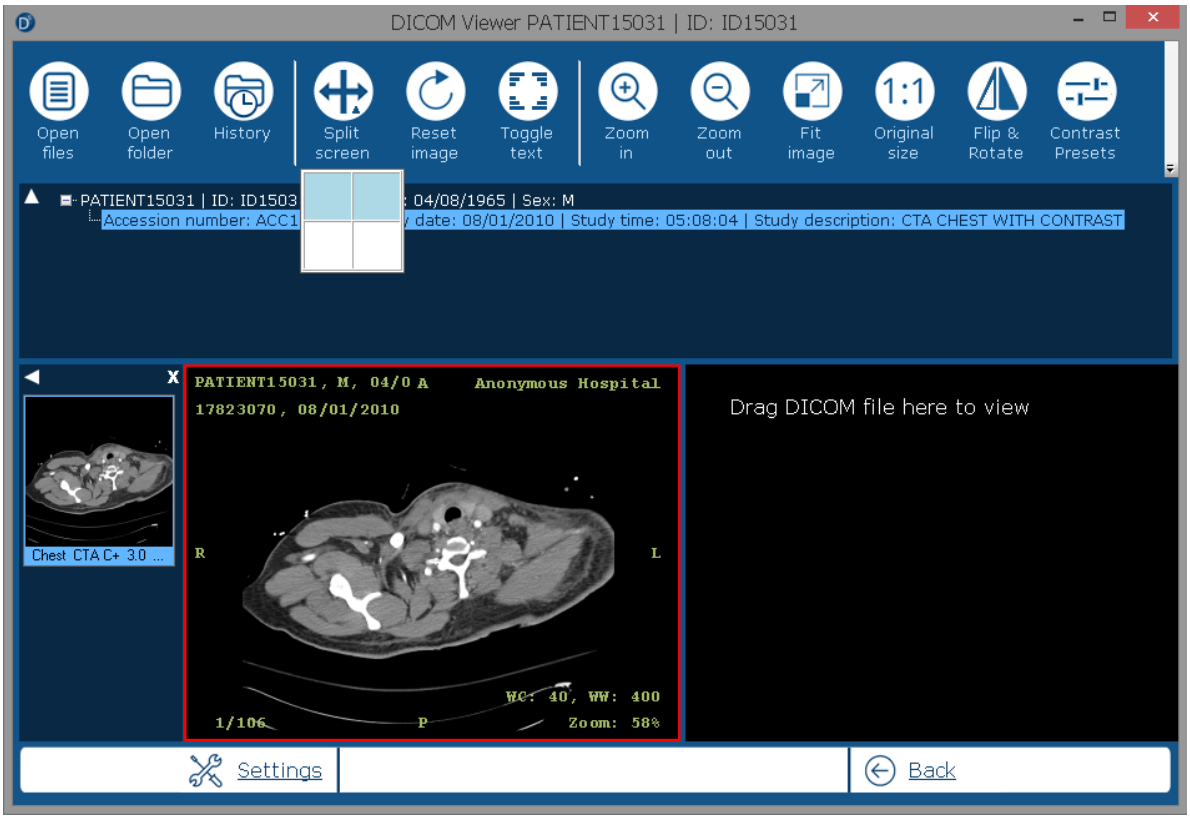
Each "open action" (Files, Folder, DICOMDIR etc.) contains one or more study rows. Study row templates is "[Patient Name],[Patient ID],[Accession Number]". To find study - type required text in the "Search" field on the top. Select entire action as shown in the image above or single study, check its details in the panel below and click "Open selected item" to load files.

If a DICOM file contains embedded video – the viewer displays it in the built-in video player (if possible), or in system Video player. Embedded PDF will be opened in system PDF viewer, SR report - in built-in HTML viewer.

There is also an option to split display area into several parts:



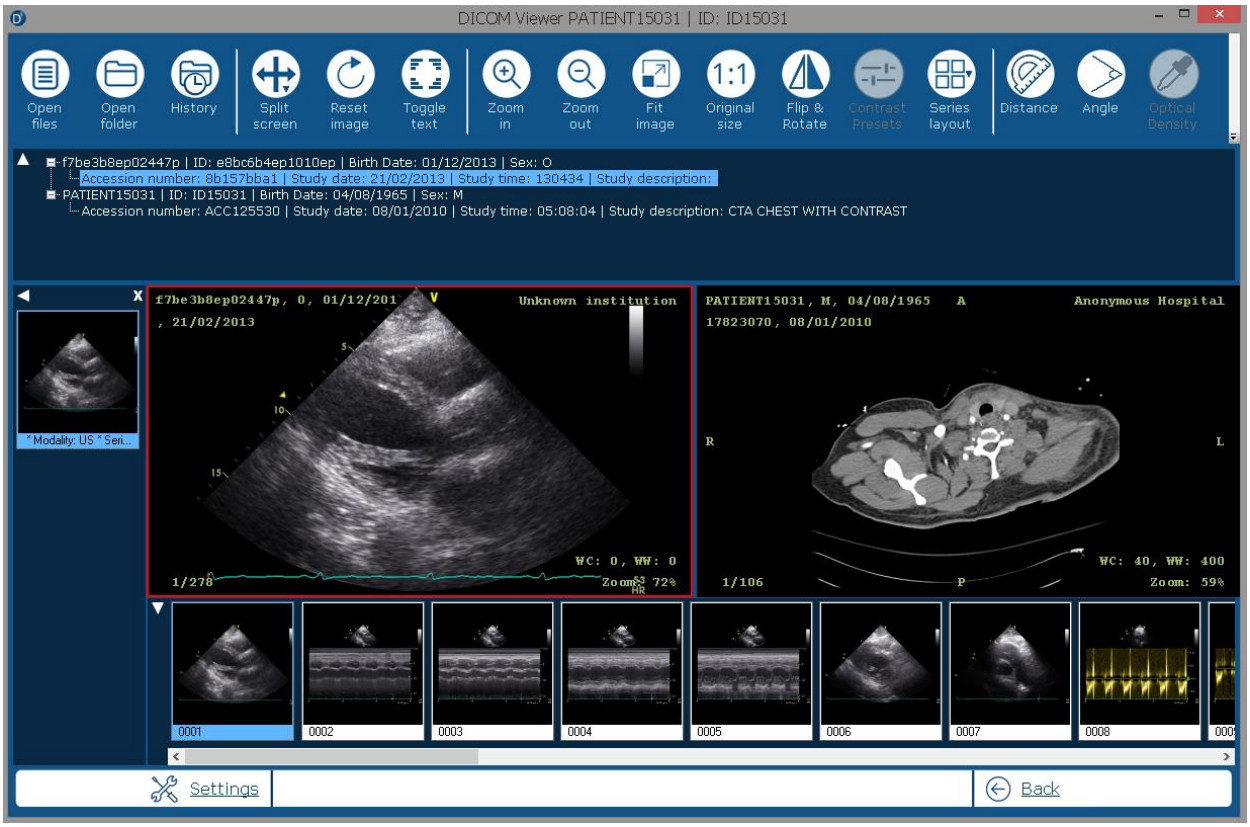
User can select one of the following options to split viewer display area: one part, two parts horizontally, two parts vertically, four parts:


DICOM Viewer PATIENT15031 | ID: ID15031
Open files
Open folder
History
Split screen
Reset image
Toggle text
Zoom in
Zoom out
Fit image
Original size
Flip & Rotate
Contrast Presets
PATIENT15031 | ID: ID1503
: 04/08/1965 | Sex: M
Accession number: ACC1
/ date: 08/01/2010 | Study time: 05:08:04 | Study description: CTA CHEST WITH CONTRAST
Chest CTA C+ 3.0 ...
PATIENT15031 , M, 04/0 A
Anonymous Hospital
17823070 , 08/01/2010
R
L
WC: 40, WW: 400
1/106
P
Zoom: 58%
Drag DICOM file here to view
Settings
Back


DICOM Viewer PATIENT15031 | ID: ID15031
Open files
Open folder
History
Split screen
Reset image
Toggle text
Zoom in
Zoom out
Fit image
Original size
Flip & Rotate
Contrast Presets
PATIENT15031 | ID: ID1503
: 04/08/1965 | Sex: M
Accession number: ACC1
/ date: 08/01/2010 | Study time: 05:08:04 | Study description: CTA CHEST WITH CONTRAST
Chest CTA C+ 3.0 ...
PATIENT15031 , M, 04/08/1965
A
Anonymous Hospital
17823070 , 08/01/2010
R
L
WC: 40, WW: 400
106/106
P
Zoom: 28%
Drag DICOM file here to view
Settings
Back

Different study might be opened in each part. To do it user needs to select required part by clicking on its area (selected part is marked by red border) and open study using usual ways ("Open files"/"Open folder"/"History" buttons). Another option is drag-drop file/folder from Windows explorer onto required part which will be selected automatically.

Click on each part automatically loads its study into series/images thumbnails panels:


DICOM Viewer PATIENT15031 | ID: ID15031
Open files
Open folder
History
Split screen
Reset image
Toggle text
Zoom in
Zoom out
Fit image
Original size
Flip & Rotate
Contrast Presets
Series layout
Distance
Angle
Optical Density
f7be3b8ep02447p | ID: e8bc6b4ep1010ep | Birth Date: 01/12/2013 | Sex: O
Accession number: 8b157bba1 | Study date: 21/02/2013 | Study time: 130434 | Study description:
PATIENT15031 | ID: ID15031 | Birth Date: 04/08/1965 | Sex: M
Accession number: ACC125530 | Study date: 08/01/2010 | Study time: 05:08:04 | Study description: CTA CHEST WITH CONTRAST
Unknown institution
Anonymous Hospital
WC: 0, WW: 0
WC: 40, WW: 400
1/278
1/106
Settings
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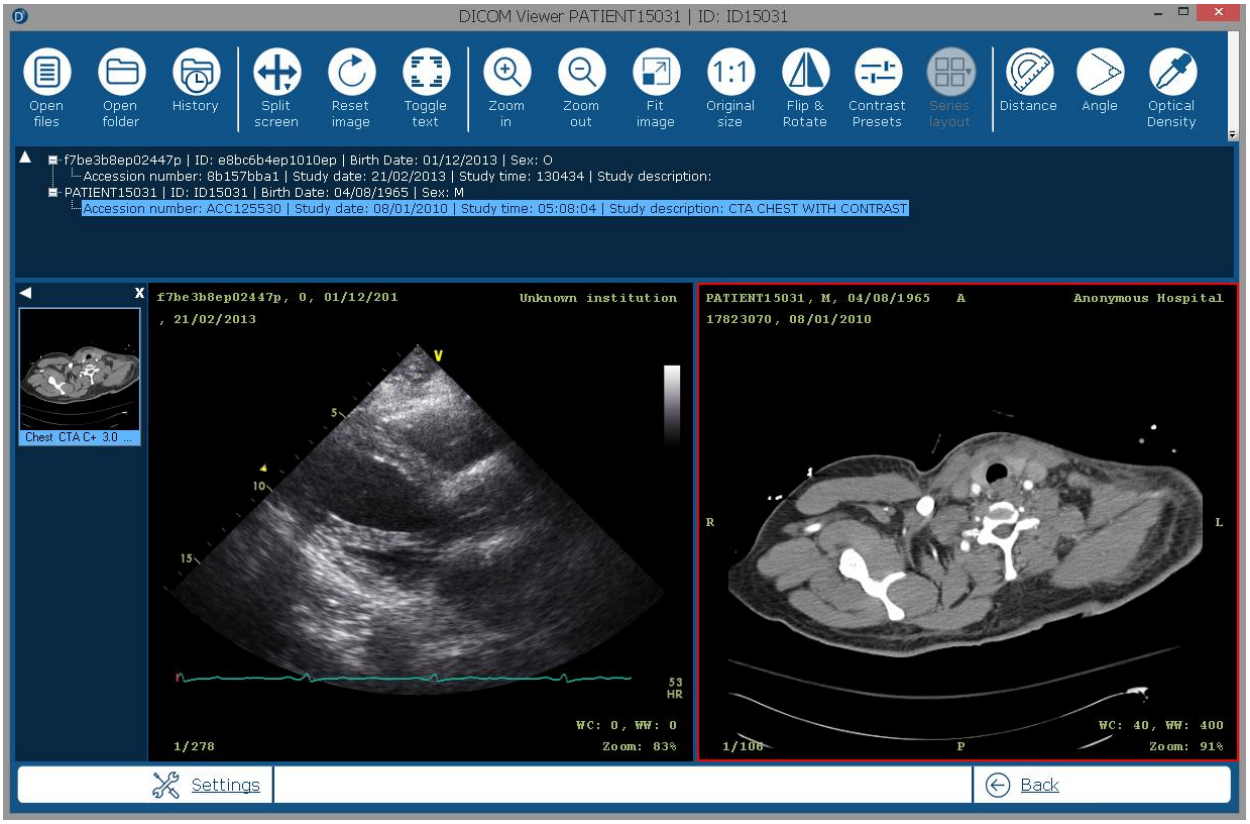
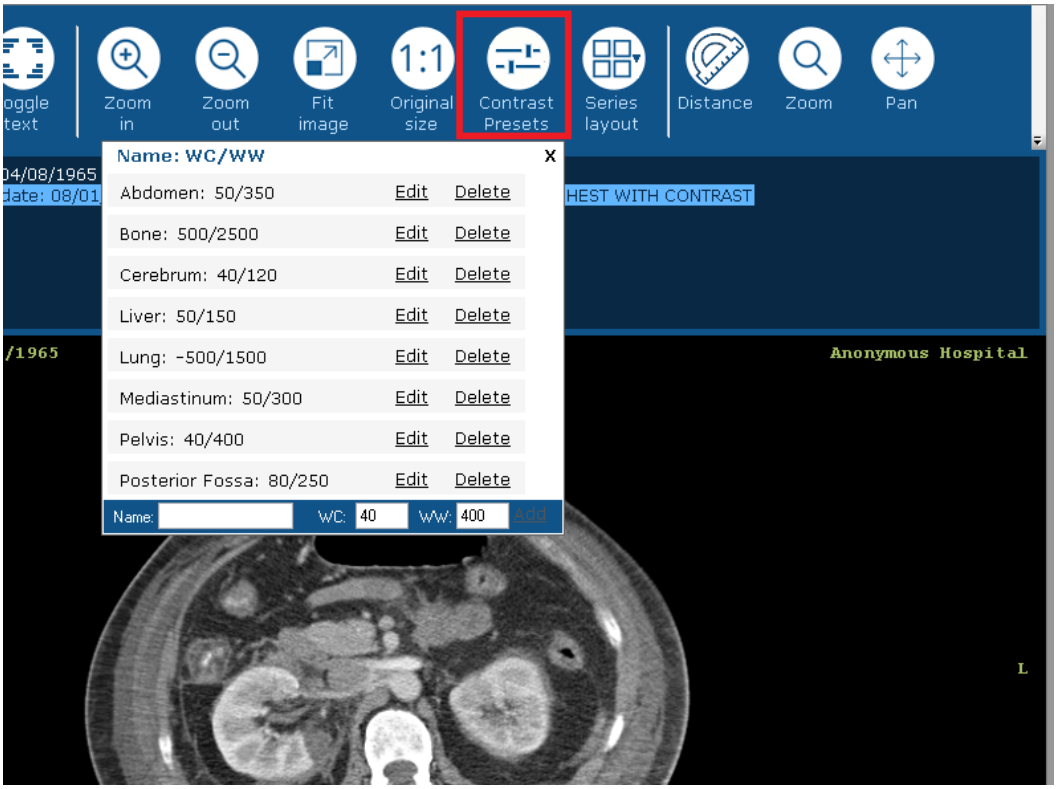
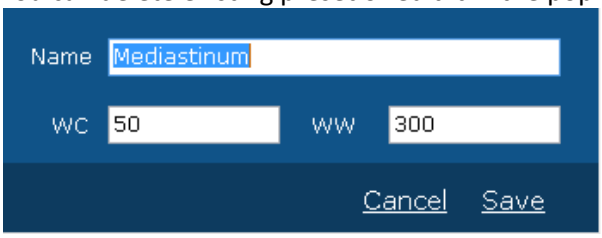

DICOM Viewer PATIENT15031 | ID: ID15031
Open files
Open folder
History
Split screen
Reset image
Toggle text
Zoom in
Zoom out
Fit image
Original size
Flip & Rotate
Contrast Presets
Series layout
Distance
Angle
Optical Density
f7be3b8ep02447p | ID: e8bc6b4ep1010ep | Birth Date: 01/12/2013 | Sex: O
Accession number: 8b157bba1 | Study date: 21/02/2013 | Study time: 130434 | Study description:
PATIENT15031 | ID: ID15031 | Birth Date: 04/08/1965 | Sex: M
Accession number: ACC125530 | Study date: 08/01/2010 | Study time: 05:08:04 | Study description: CTA CHEST WITH CONTRAST
Unknown institution
Anonymous Hospital
WC: 0, WW: 0
Zoom: 83%
WC: 40, WW: 400
Zoom: 91%
1/278
1/106
Settings
Back

4.2. Using Hounsfield units Contrast Presets

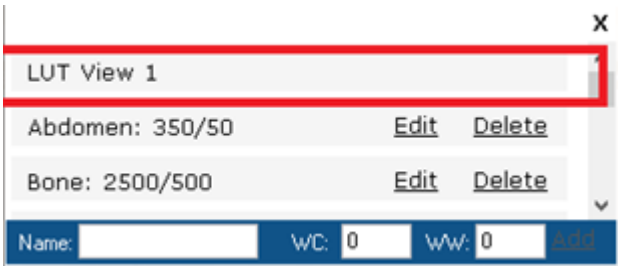
MODALIZER+ comes with a pre-defined contrast presets, you can open this list by clicking "Contrast presets" tool button:



Select required presets to change WC/WW values of the currently opened image.
New custom preset can be added by filling Name/WC/WW values in the bottom line and clicking "Add" button.
You can delete existing preset or edit it in the pop-up window:



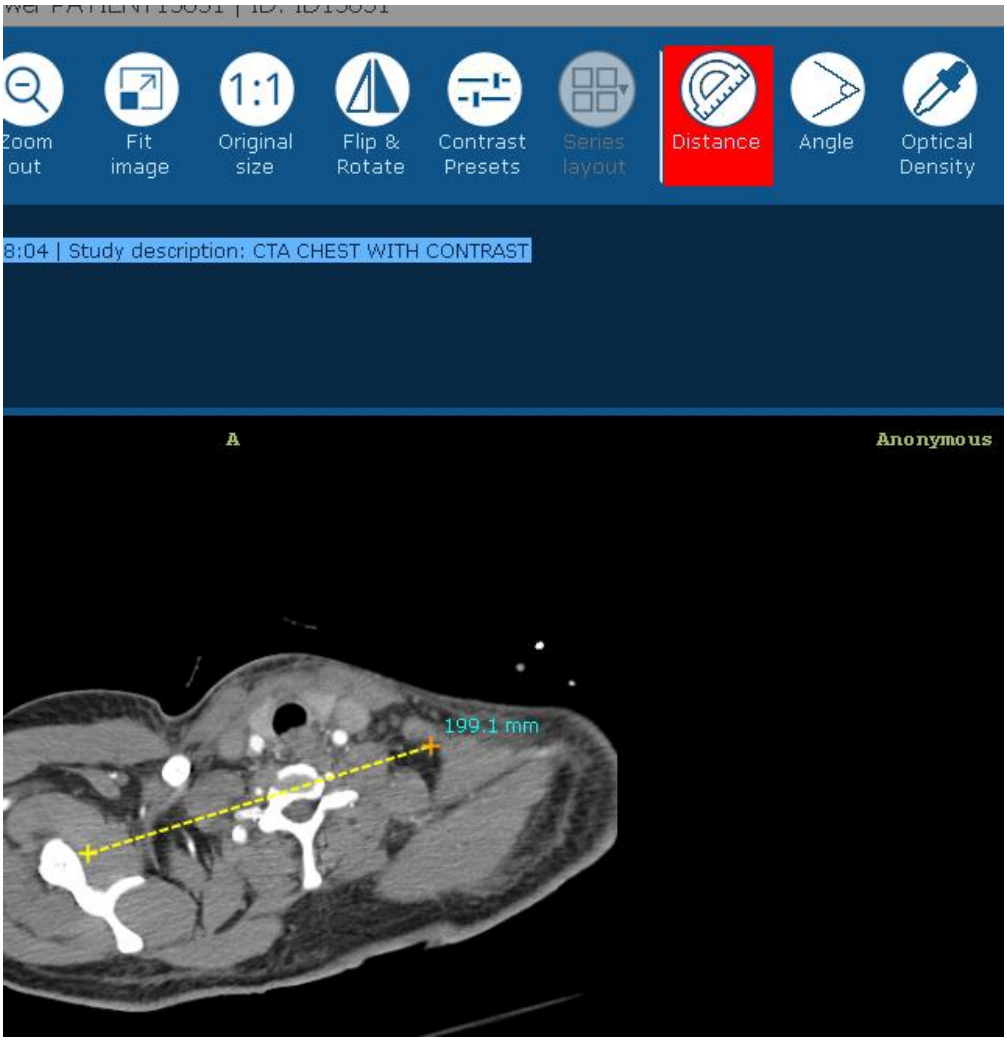
If an image contains one or more VOI LUT (Values of Interest Lookup Tables) their values will be added to the list of contrast pre-sets.



When opening an image with VOI LUT the first table is automatically applied by RZDCX.

4.3. Distance /Optical Density / Angle Measurements tools

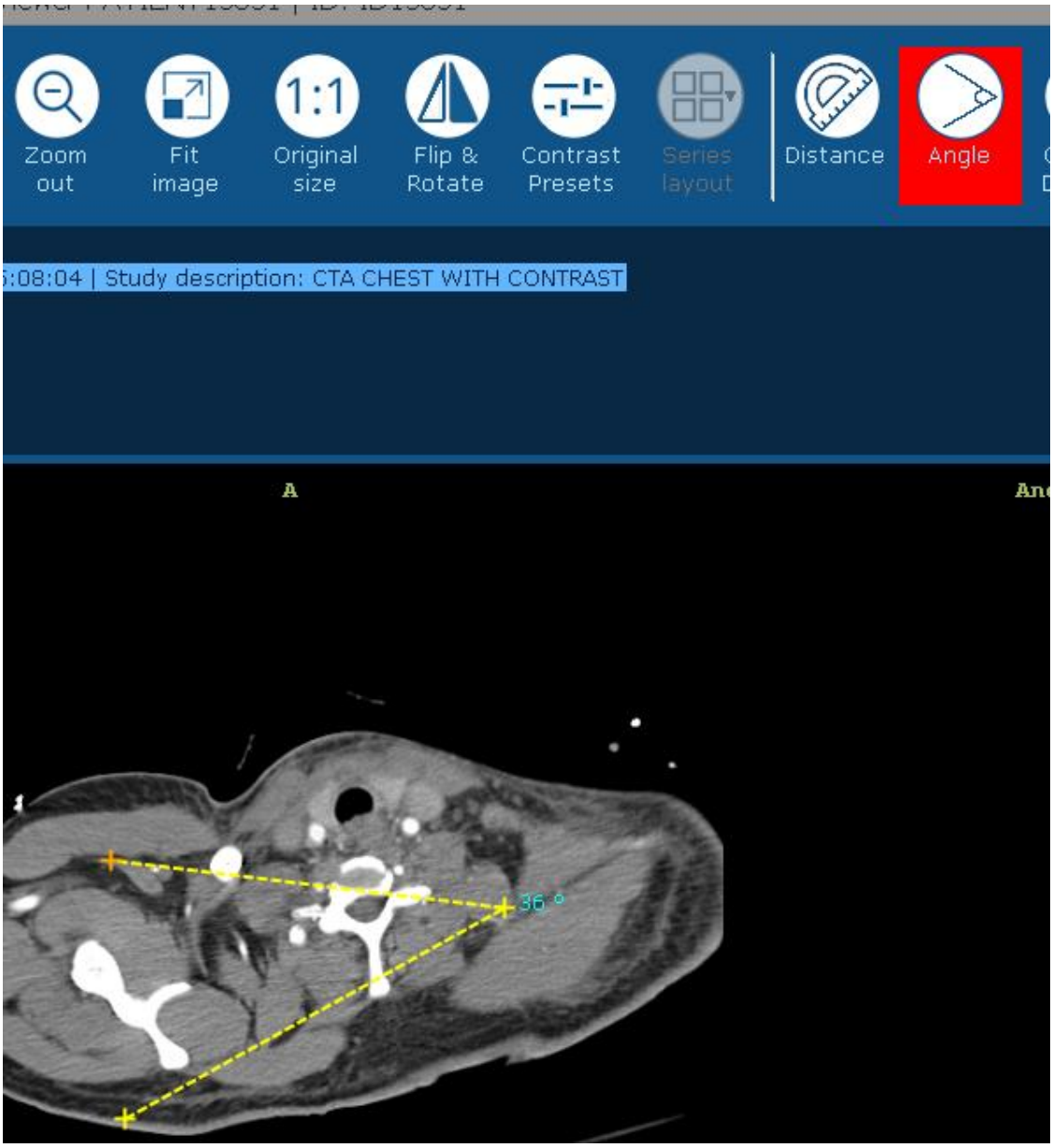
You can measure distance on the image (in mm for calibrated images, in pixels for others), calculate optical density in any selected point (for CT images) OR calculate angle between three points. To start drawing/moving click on "Distance"/"Optical Density" / "Angle" tool button:



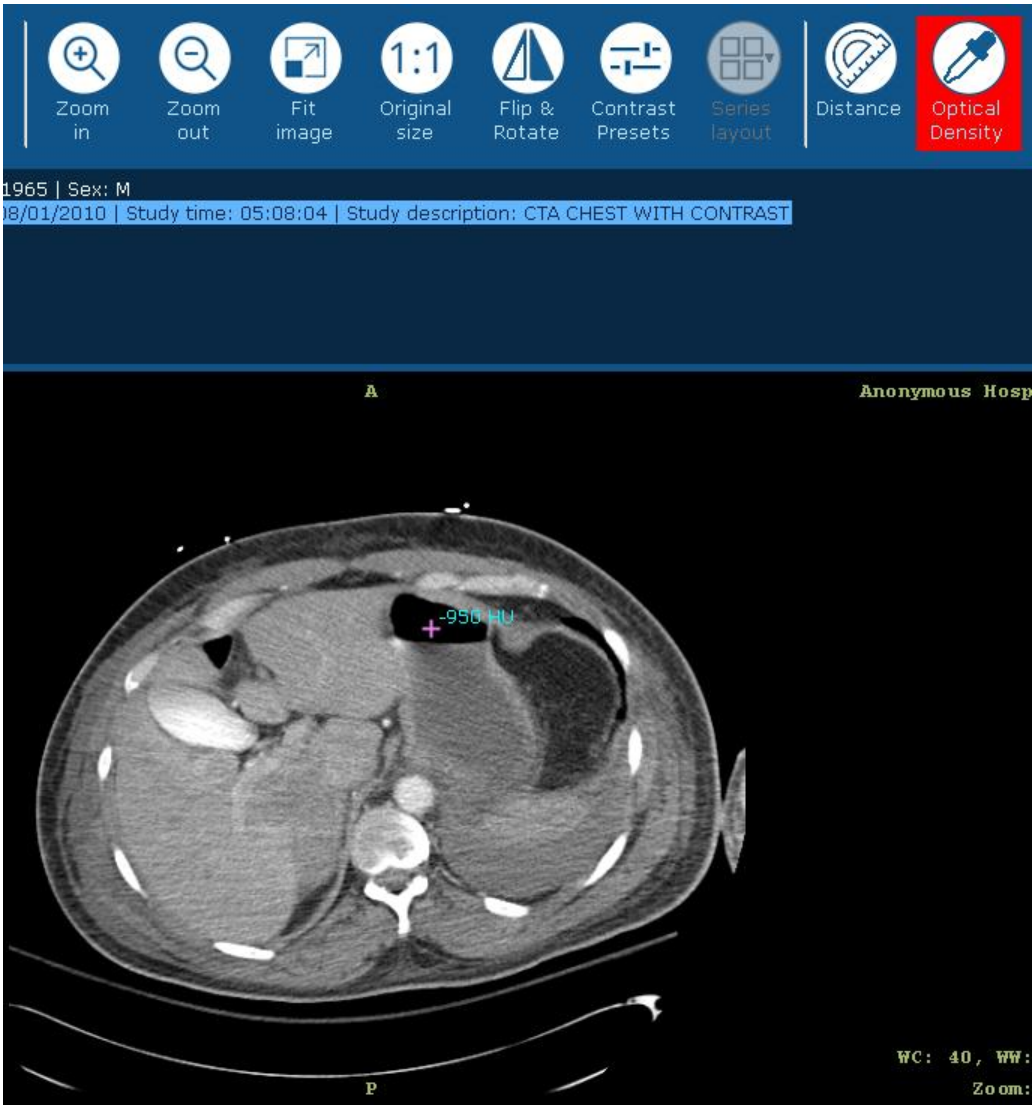
To stop tool click on the button again. If measurement tool is not active, all existing measurements remain visible but you cannot move or delete them.

To start "Distance" drawing, click the left mouse button within the image panel. Start point will be marked as cross and dashed line will appear. Move mouse pointer to another place and left-click again to mark end point. Measured distance will be displayed on mouse move.

To start "Angle" drawing, click the left mouse button within the image panel. Start point will be marked as cross and dashed line will appear. Move mouse pointer to another place and left-click again to mark second (angle peak) point, repeat this to define end point. Measured angle will be displayed on mouse move (after peak point was created)

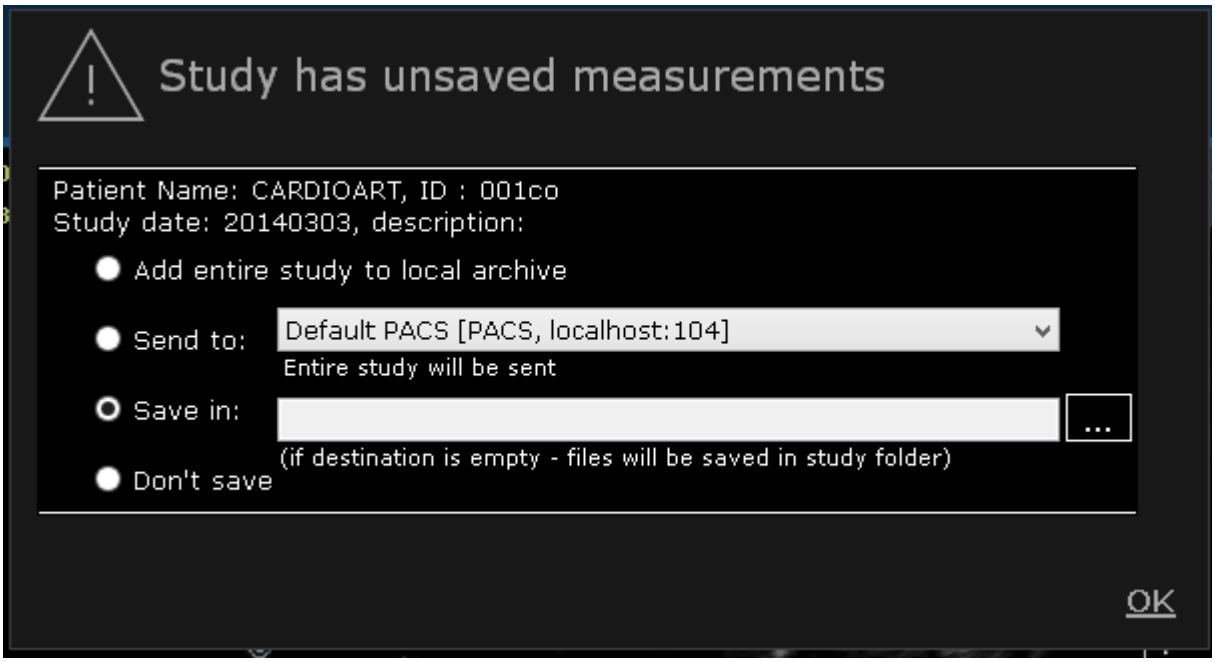


To calculate optical density just click left mouse button once on the selected spot:

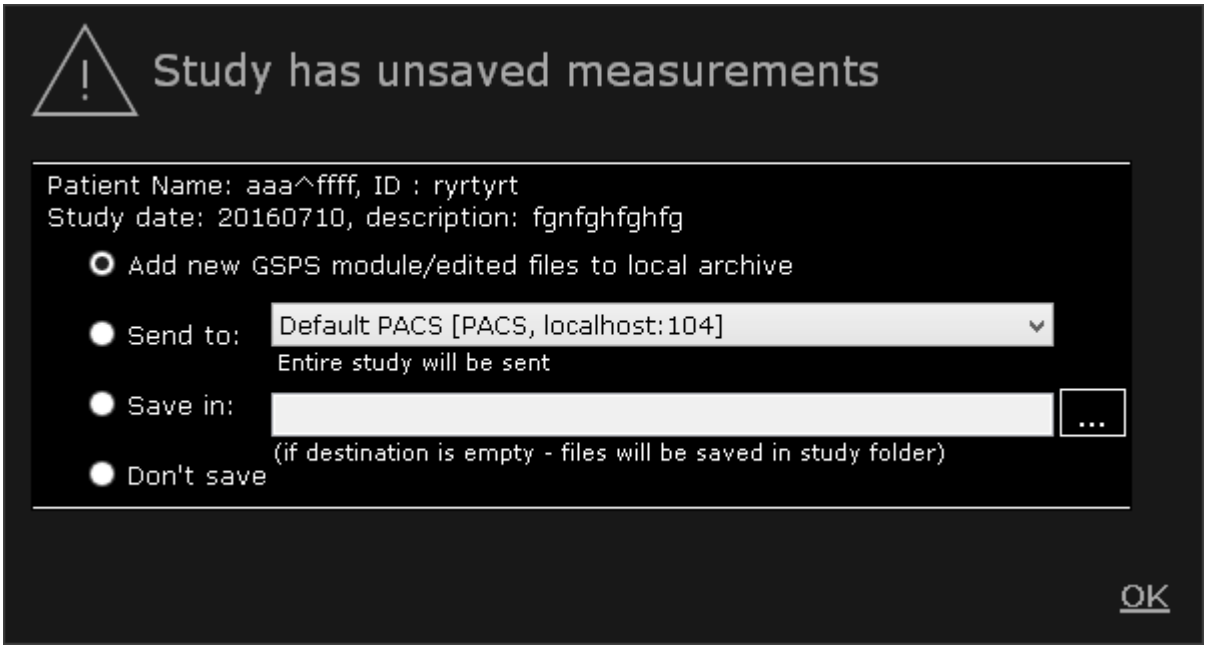


To change existing measurement select start/end cross or entire line (enter mouse pointer), press mouse left button and move pointer holding left-button pressed to required place and release mouse.

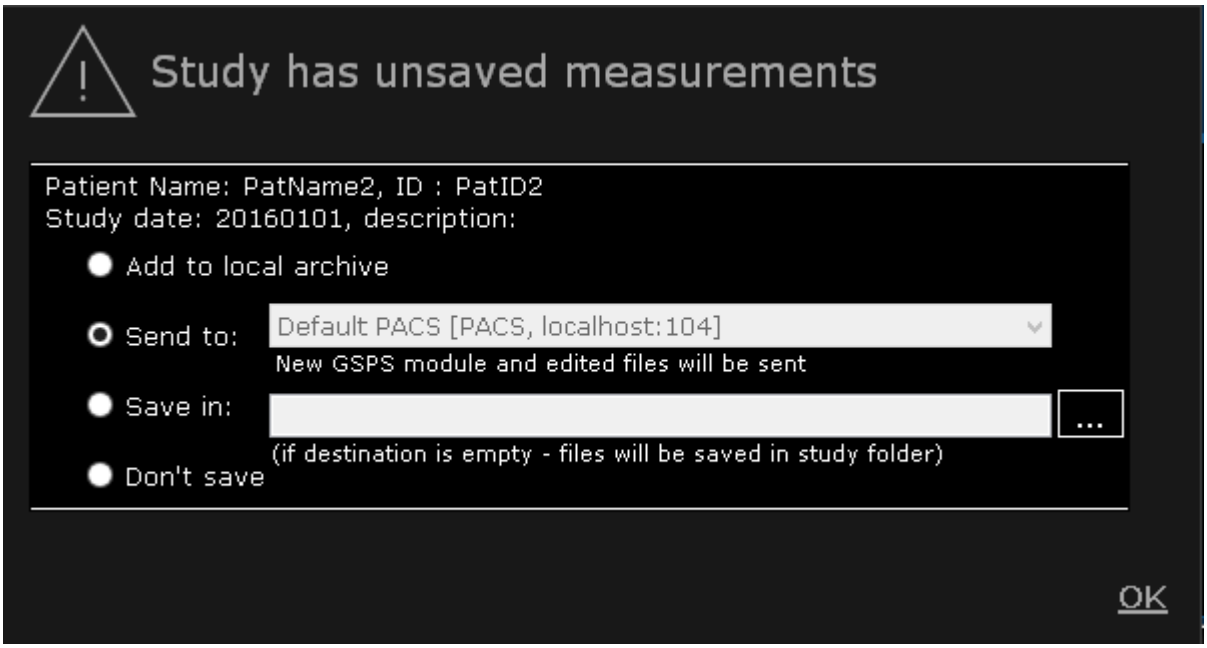
To delete distance line select any part of the line and click on "Delete" button on the keyboard.
You can save measurement lines / point as Grayscale Softcopy Presentation State module file under a new series (about viewing of GSPS modules - see 4.7).
When user closes a study, returns from Viewer screen or exits application, and there are one or more new distance measurements, one of the following pop-up screens will be displayed:



(Opened study is not part of LocalArchive)



(Opened study is part of LocalArchive)

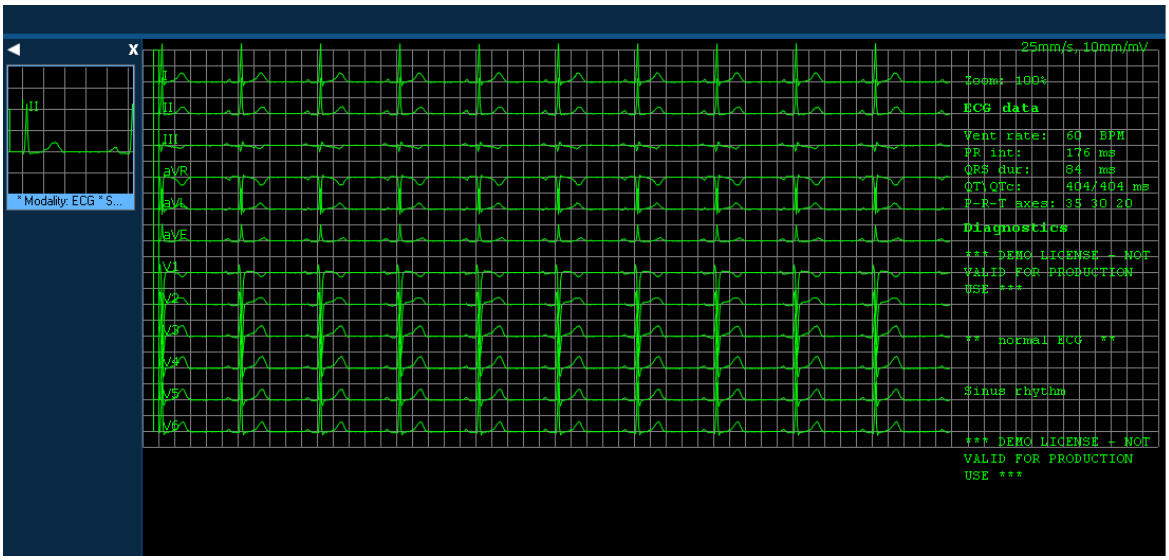


(Opened study was retrieved from PACS)

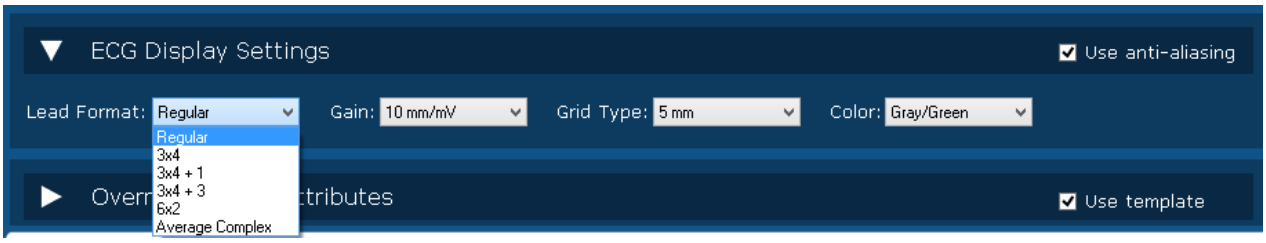
1. Select "Add entire study to local archive" to insert new GSPS file and all other files of the study into Local Archive. This option is available only if "Use local archive" was selected on the General Settings. If a study with the measurement is already a part of the Local Archive - only the new GSPS file will be added
2. Select "Send to" option to send an entire study or only new files to PACS (if a study was retrieved from PACS, source PACS will be selected by application).
3. Select "Save in" to store new GSPS file in selected folder.
4. Select "Don't save" if you don't want to add GSPS file to the study

4.4. ECG Viewer

MODALIZER+ can display DICOM 12 Lead ECG Instances.

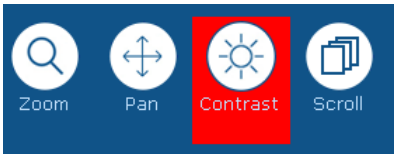


Use the ECG Display Settings tab in the configuration screen to select the graph formats (click "Setting" button from the Viewer, select required parameters and click "Back" on Settings screen. New display parameters are immediately applied.



4.5. Using Zoom/Pan/Contrast/Scroll tools

To start/stop any of these tools click the tool button. When the tool is active the button background is set to red and the mouse pointer changes to the tool mouse icon:

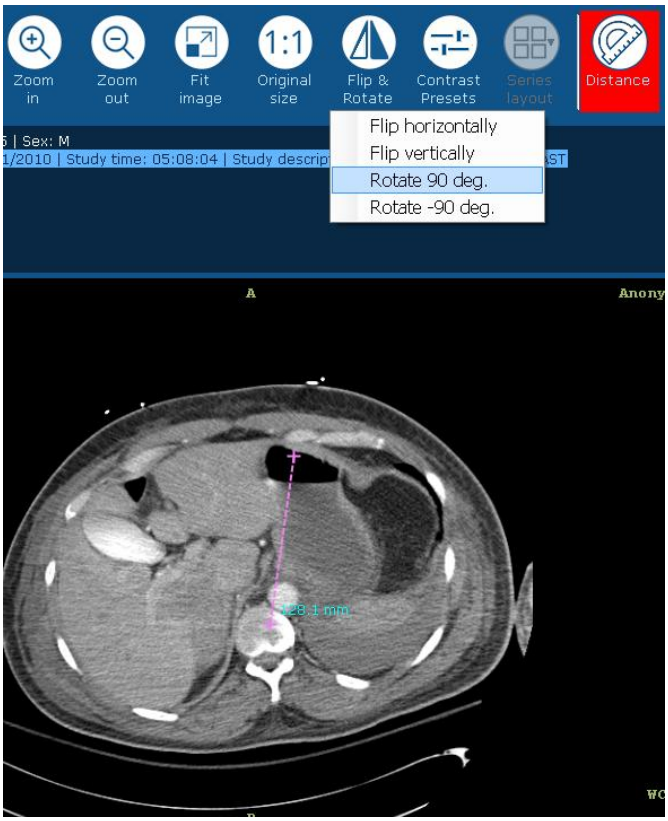


To change image zoom/contrast, move zoomed image inside viewer panel (Pan Tool) or scroll frames - press left mouse button and move pointer holding left button pressed.

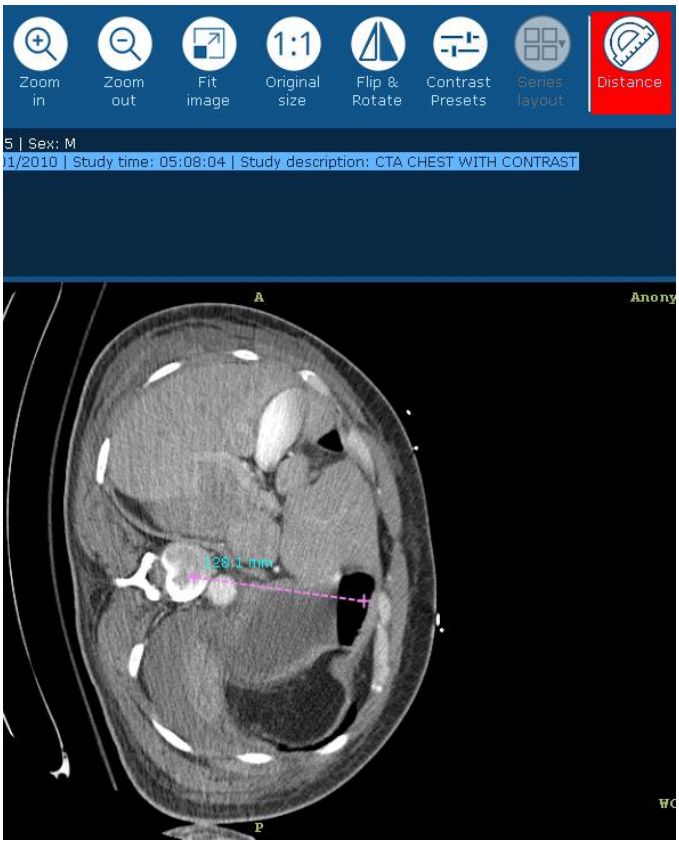
4.6. Flip and Rotate tool

Available actions: Flip Vertically, Flip Horizontally, Rotate 90 Clockwise, Rotate 90 Counterclockwise. All measurements on the current image will be changed accordingly

Before:

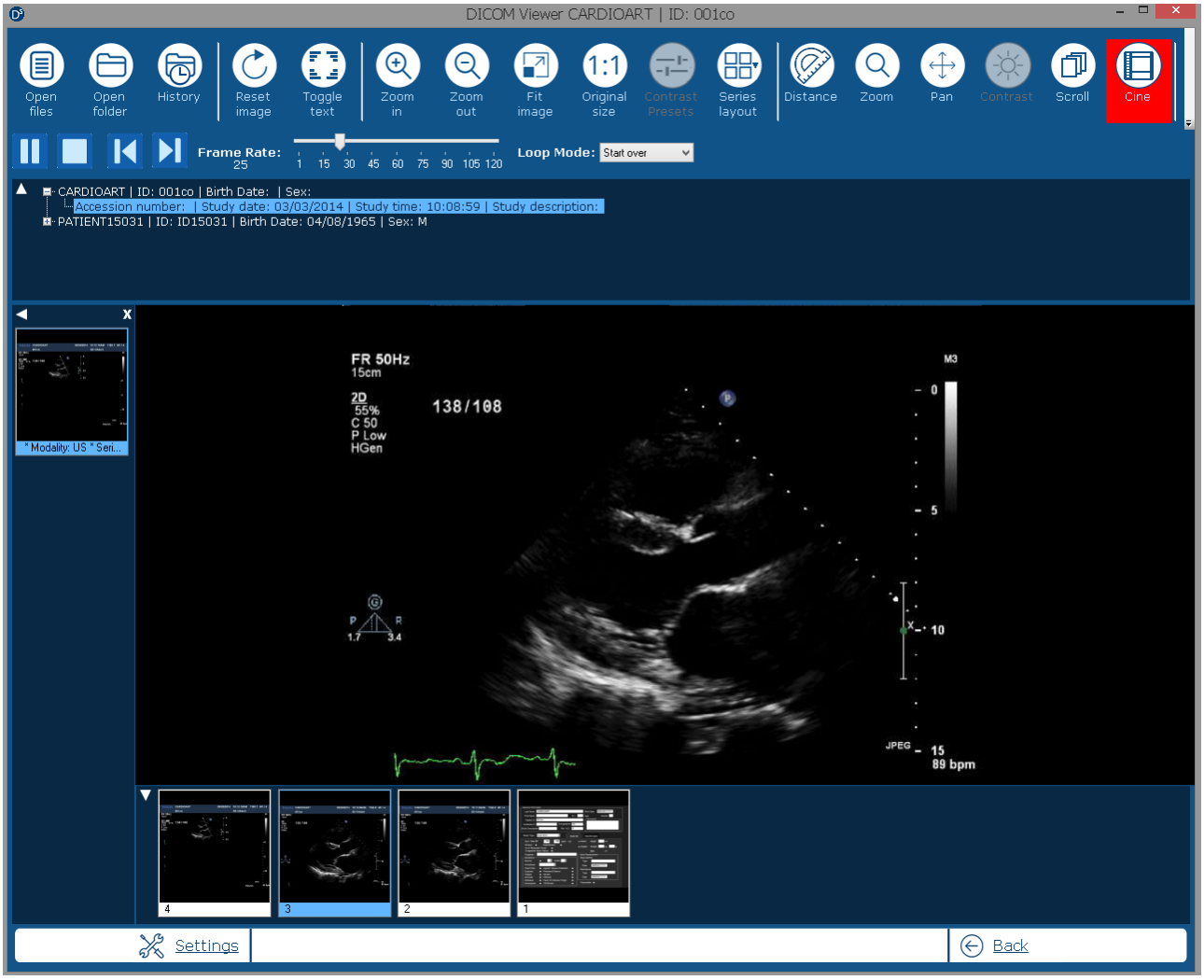

Zoom in
Zoom out
Fit image
Original size
Flip & Rotate
Contrast Presets
Series layout
Distance
Flip horizontally
Flip vertically
Rotate 90 deg.
Rotate -90 deg.
A
128.1 mm

After:


Zoom in
Zoom out
Fit image
Original size
Flip & Rotate
Contrast Presets
Series layout
Distance
5 | Sex: M
1/2010 | Study time: 05:08:04 | Study description: CTA CHEST WITH CONTRAST
A
128.1 mm
P

4.7. CINE tool

If DICOM file contains multi-frame image CINE mode is enabled and the cine buttons can be used.



To Pause/Start CINE - click  button.

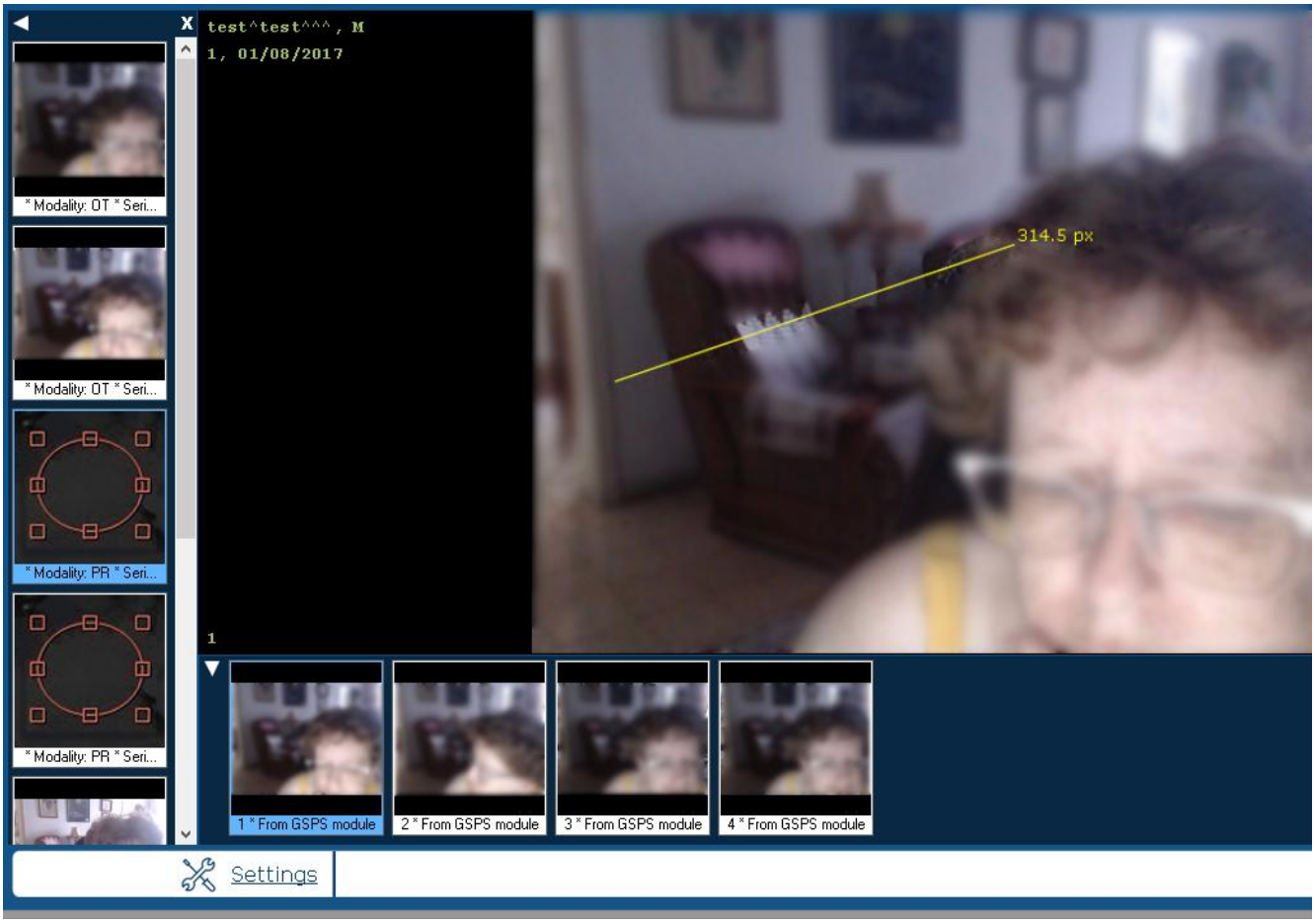
To Stop CINE and close CINE panel - click  button

To go to the first/last frame - click  buttons

You can change CINE frame rate and loop mode:

4.8. Display Grayscale Softcopy Presentation State module

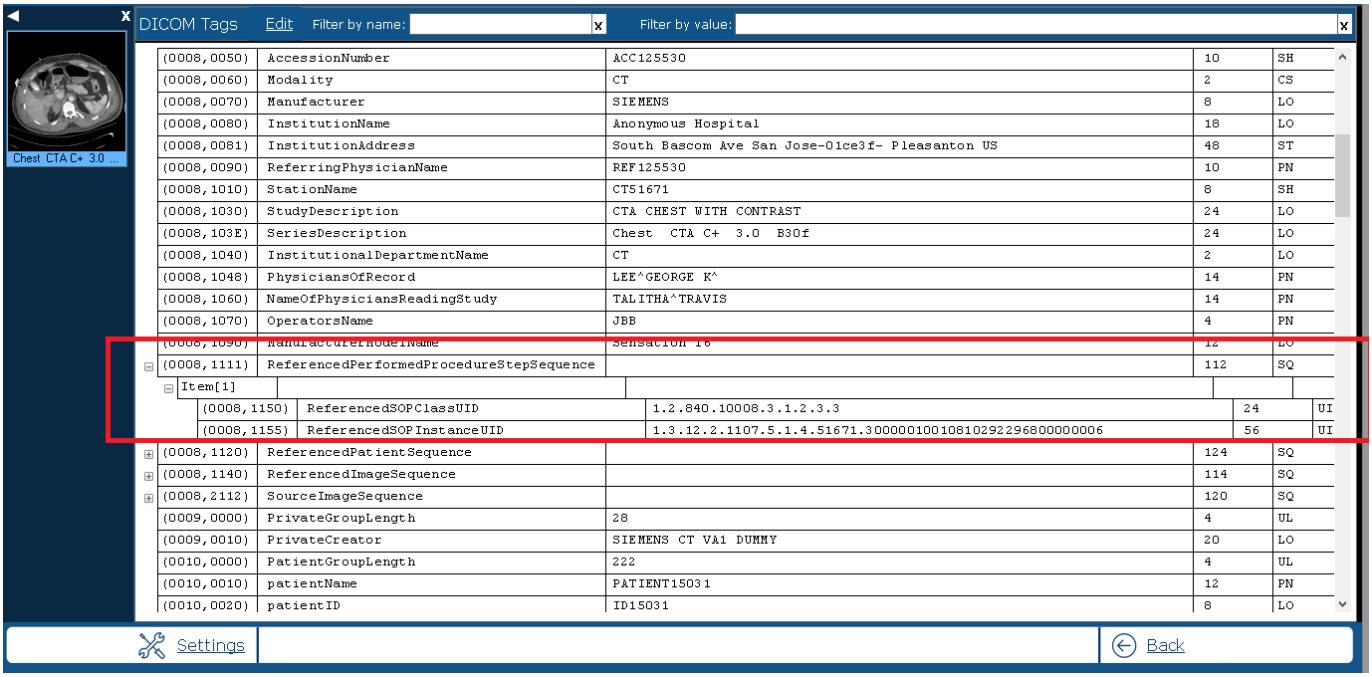
MODALIZER+ can display relative annotations (graphics, text and etc.) stored in files of specific DICOM format. When a user opens a study, the application selects all such files, load their data (relations between annotations and study instances/frames, annotations types/positions etc.) and converts it to graphic objects drawn on the corresponding images.
Each GSPS module (series with PR modality) is displayed as separate thumbnail in the left panel like any other series.
When user clicks a GSPS (modality PR) series, the PR series thumbnail is highlighted , each graphic object containing in GSPS module is displayed as separate image thumbnail in the bottom panel and first of them is displayed in the main area on the image and frame it is referencing.
Click on each image thumbnail loads corresponding image/frame and graphic objects into main area.
When user clicks a non-PR series (images), it will be displayed as "pure image" without drawing.
When the PR series is selected and user chooses "Show header" - the tags of the PR is displayed ("Edit" for PR files is not allowed)



4.9. Header view and edit DICOM object

To view all tags containing in the current DICOM file - right-click on the image and select "Show header" or press Ctrl-H .

Hierarchical tree view will be opened so that sequences might be opened/closed by user.



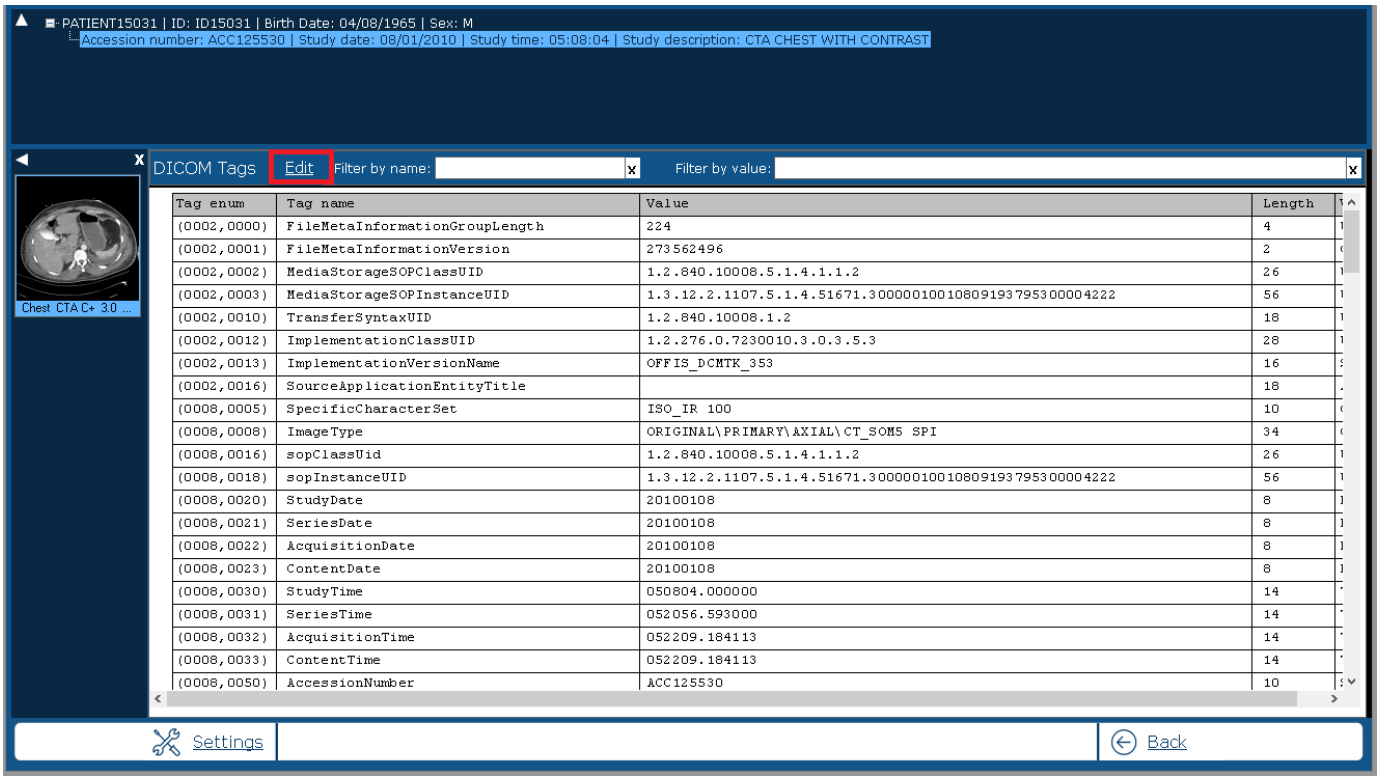
NOTE: By default all private tags are displayed with "?" name, but you have an option to use dicom.dic file (located in the installation folder) to define name of any private tag. Format of the dicom.dic tag line is:

```
# Tag          VR   Name                    VM   Version
(0027,0000)    UL   SamplePrivateGrpLength  1    RZDCX
```

All columns MUST be separated by "Tab".

Dicom.dic file from the installation package contains few lines as example. If you don't need them - open file in Notepad and delete unnecessary lines or just delete dicom.dic from the installation folder.

To start editing - select "Show header" and click "Edit" button:

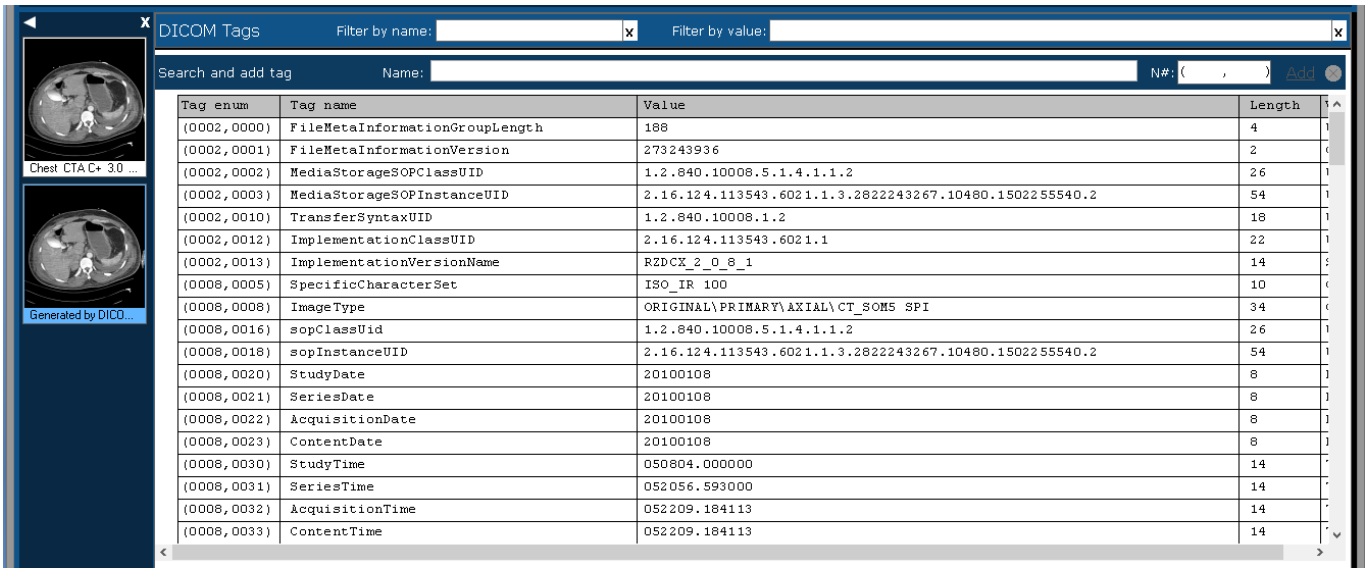


DICOM Object Editor Screen allows user to:

- Add tags
- Add sequence
- Add sequence item
- Add/Edit/Delete tag within sequence
- Duplicate sequence item
- Remove tags
- Remove sequence item
- Change value of tags

A new instance is generated from the original and updated according to the DICOM standard:
1. New series created
2. Referenced instance sequence (0008,114A) with reference to the original series/instance inserted into the new instance

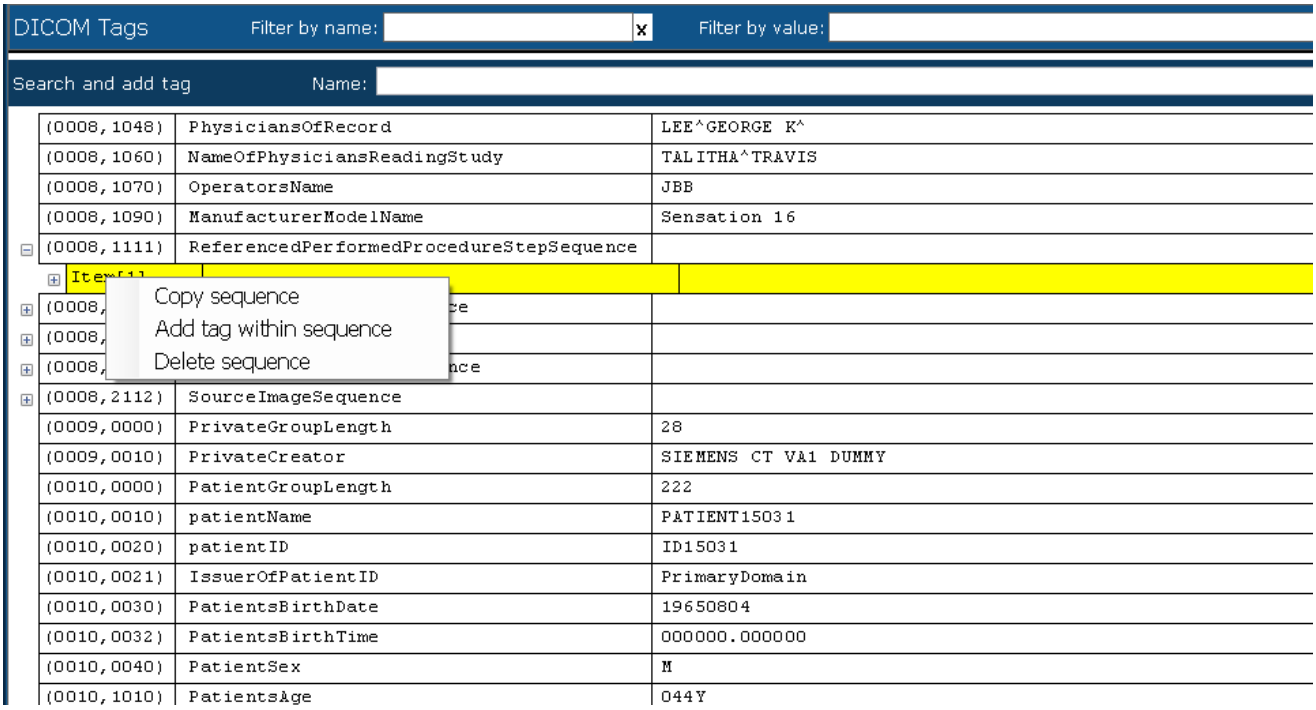
New instance will be opened for editing:



Tag enum	Tag name	Value	Length
(0002,0000)	FileMetaInformationGroupLength	188	4
(0002,0001)	FileMetaInformationVersion	273243936	2
(0002,0002)	MediaStorageSOPClassUID	1.2.840.10008.5.1.4.1.1.2	26
(0002,0003)	MediaStorageSOPInstanceUID	2.16.124.113543.6021.1.3.2822243267.10480.1502255540.2	54
(0002,0010)	TransferSyntaxUID	1.2.840.10008.1.2	18
(0002,0012)	ImplementationClassUID	2.16.124.113543.6021.1	22
(0002,0013)	ImplementationVersionName	RZDCX_2_0_8_1	14
(0008,0005)	SpecificCharacterSet	ISO_IR 100	10
(0008,0008)	ImageType	ORIGINAL\PRIMARY\AXIAL\CT_SOM5 SPI	34
(0008,0016)	sopClassUid	1.2.840.10008.5.1.4.1.1.2	26
(0008,0018)	sopInstanceUID	2.16.124.113543.6021.1.3.2822243267.10480.1502255540.2	54
(0008,0020)	StudyDate	20100108	8
(0008,0021)	SeriesDate	20100108	8
(0008,0022)	AcquisitionDate	20100108	8
(0008,0023)	ContentDate	20100108	8
(0008,0030)	StudyTime	050804.000000	14
(0008,0031)	SeriesTime	052056.593000	14
(0008,0032)	AcquisitionTime	052209.184113	14
(0008,0033)	ContentTime	052209.184113	14

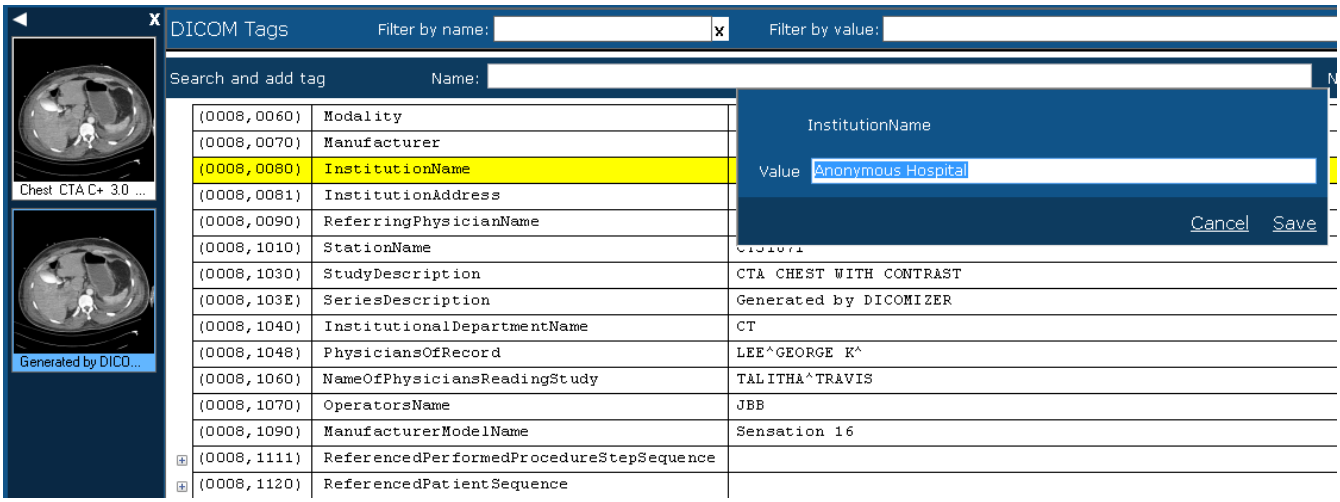
To add tag - use "Search and add tag" options. When user click "Add" button - tag will be inserted on main level or inside selected sequence

User can copy entire sequence, delete it or add tag into it. To select one of the options - right-click on sequence row to open contest menu.

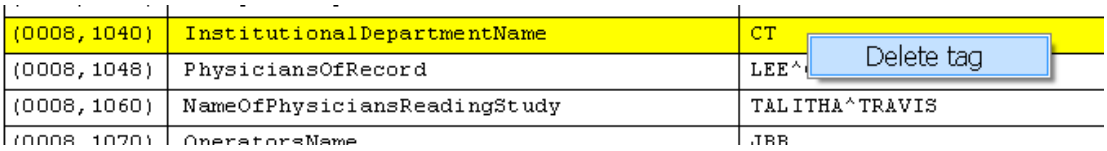


(0008,1048)	PhysiciansOfRecord	LEE^GEORGE K^
(0008,1060)	NameOfPhysiciansReadingStudy	TALITHA^TRAVIS
(0008,1070)	OperatorsName	JBB
(0008,1090)	ManufacturerModelName	Sensation 16
(0008,1111)	ReferencedPerformedProcedureStepSequence	
(0008,2112)	SourceImageSequence	
(0009,0000)	PrivateGroupLength	28
(0009,0010)	PrivateCreator	SIEMENS CT VA1 DUMMY
(0010,0000)	PatientGroupLength	222
(0010,0010)	patientName	PATIENT15031
(0010,0020)	patientID	ID15031
(0010,0021)	IssuerOfPatientID	PrimaryDomain
(0010,0030)	PatientsBirthDate	19650804
(0010,0032)	PatientsBirthTime	000000.000000
(0010,0040)	PatientSex	M
(0010,1010)	PatientsAge	044Y

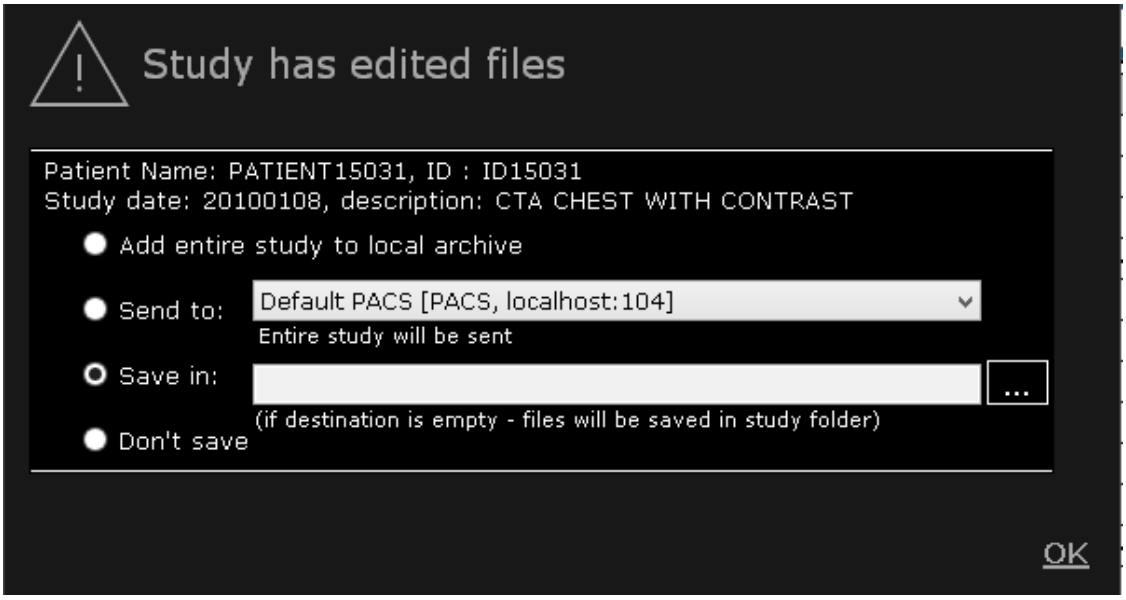
To change tag value - double-click on its row



To delete tag - right-click on its row and select "Delete tag"



On closing study user will be suggested with several option concerning new instance:

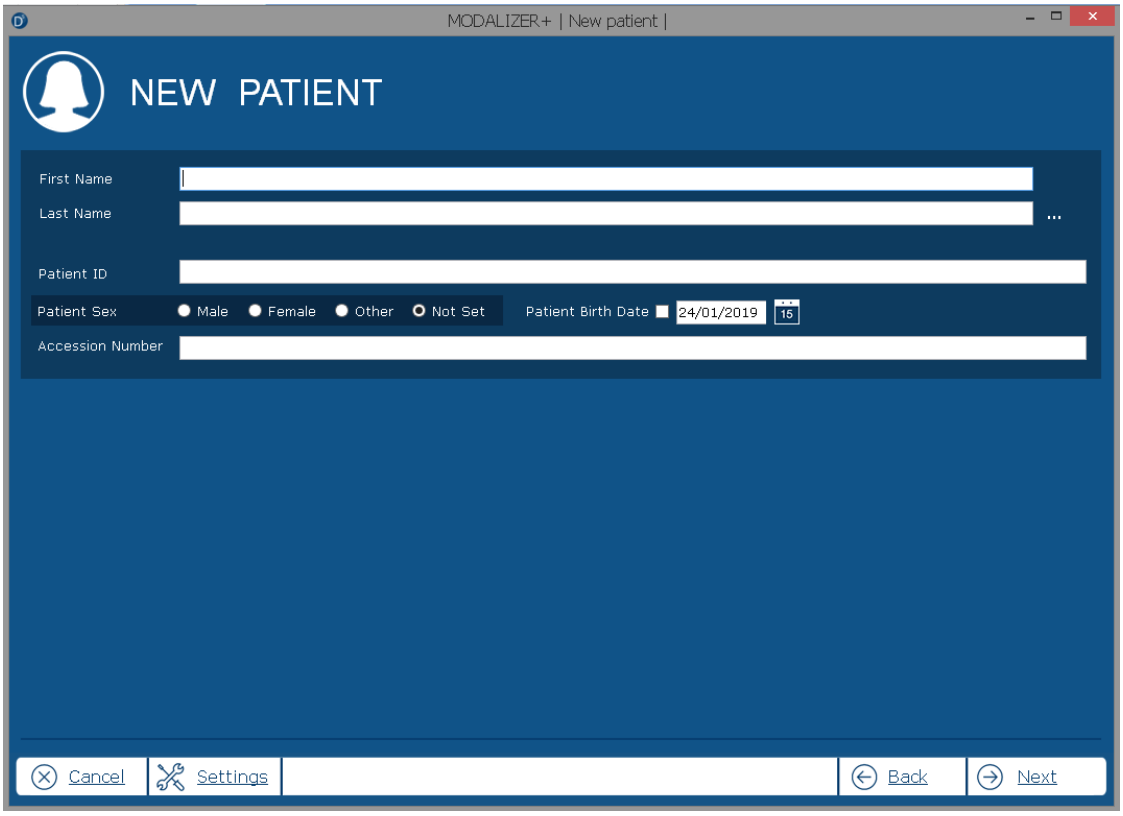


If user decides to save new instance - Rejection Notes KOS Document will be created as new series.

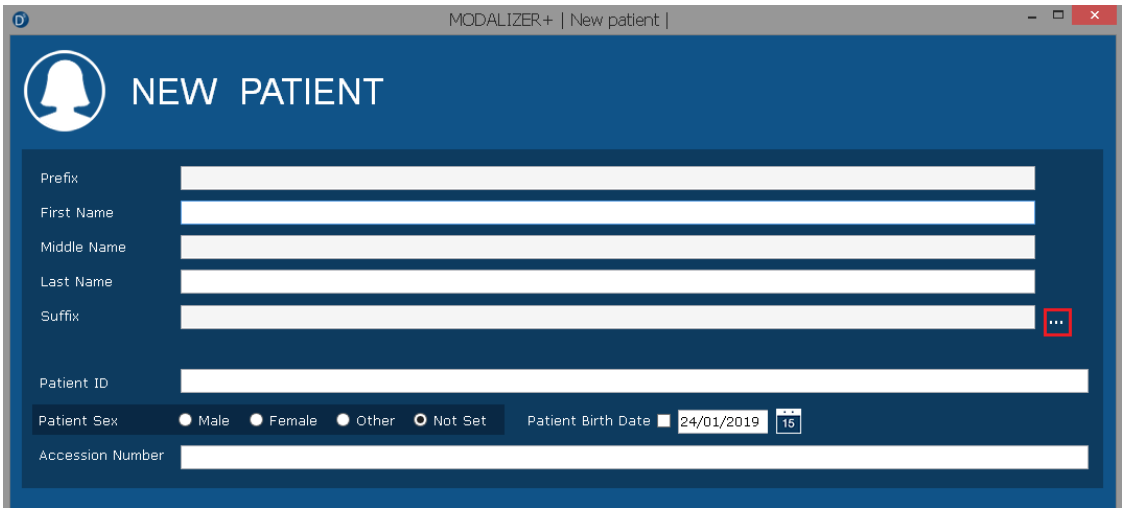
5. Working with Studies

5.1. New Patient

Select the “New Patient” option from the main menu:



Click "..." button to show/hide Prefix, Middle Name and Suffix fields:

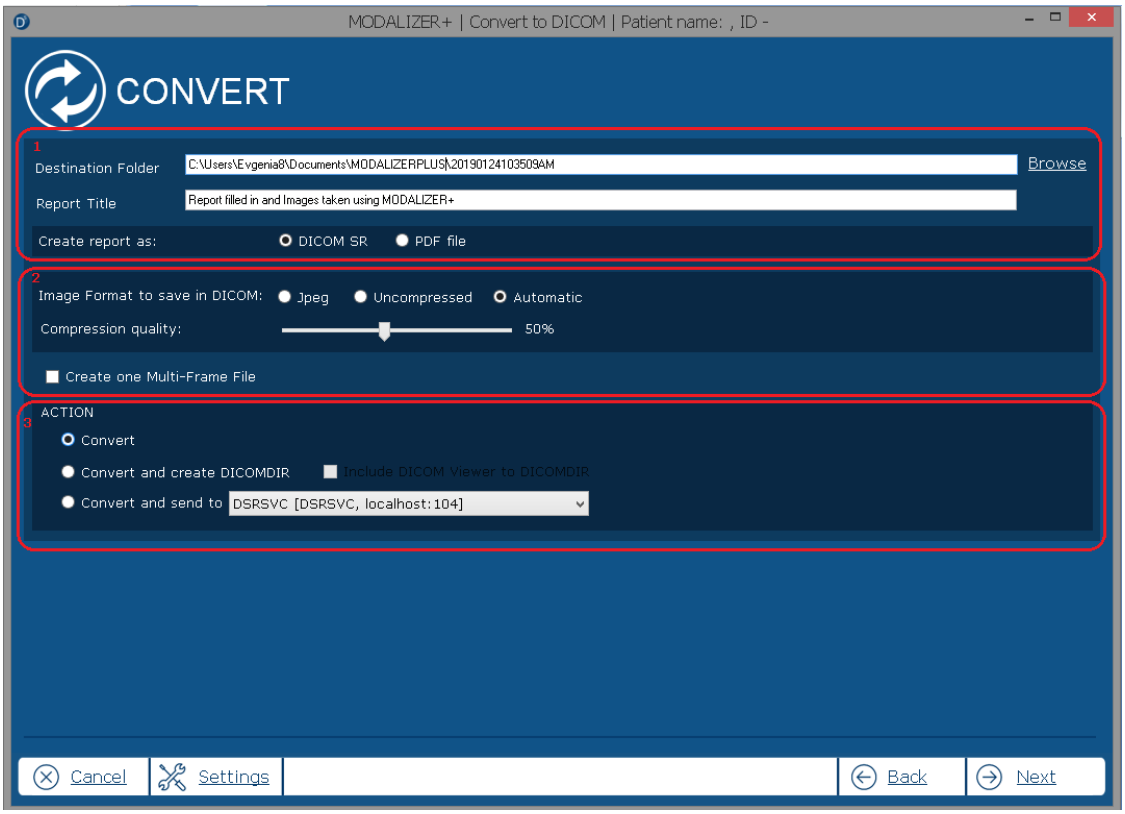


Enter patient's data (not required), then click "Next".

Compose the study with images and report as explained in the Create a new Study section then click "Next".

Create formatted PDF report (optionally) as explained in Writing a Report

Note: Click the button  to change the style of the presentation (thumbnails/list).



The "Convert" screen consists of three panels:

- Panel #1:
  - Destination Folder – where the converted files will be saved. A new directory is created in your documents folder for every conversion under the MODALIZER+ main folder. If "Use local Archive" option is selected in the Settings screen - destination folder will be created as sub-folder of storage place defined in Settings. If not - you can change destination to any folder on your computer.
  - Report Title.
  - Create report as – MODALIZER+ allows you to create a DICOM SR (default) or as an encapsulated PDF.
- Panel #2:
  - Image Format to save in DICOM:
    - "Automatic" (default) - the files will be converted to DICOM the way they are. JPEG Images will be converted as JPEG and other as uncompressed.
    - "Uncompressed - all files will be first uncompressed and converted to DICOM.[1]

[1] Changing the image format may result in quality loss.

        - "JPEG" - all Images will be converted to JPEG as Encapsulated JPEG using the JPEG Lossy Transfer Syntax.[2][3]
    - Create one Multi-Frame File – use this option when you have a series of related images. All images must be the same format and the same size.
- Panel #3:
    - Convert - converting only. The converted files will be saved in the destination folder.
    - Convert and create DICOMDIR. DICOMDIR is a file that includes patient and study information and links to all the converted files.
    - Convert and send to PACS. In order to save the study on PACS you need to configure it. See Storage Server configuration.

5.2. Sending DICOM Images to the PACS

DICOM files are typically stored in a PACS. This allows accessing them from other DICOM applications.

After acquiring the study images the "Convert" screen is displayed. Select an option "Convert and send to PACS". If PACS wasn't defined yet click "Settings" and configure it. Then click "Next".

Click "Send to".

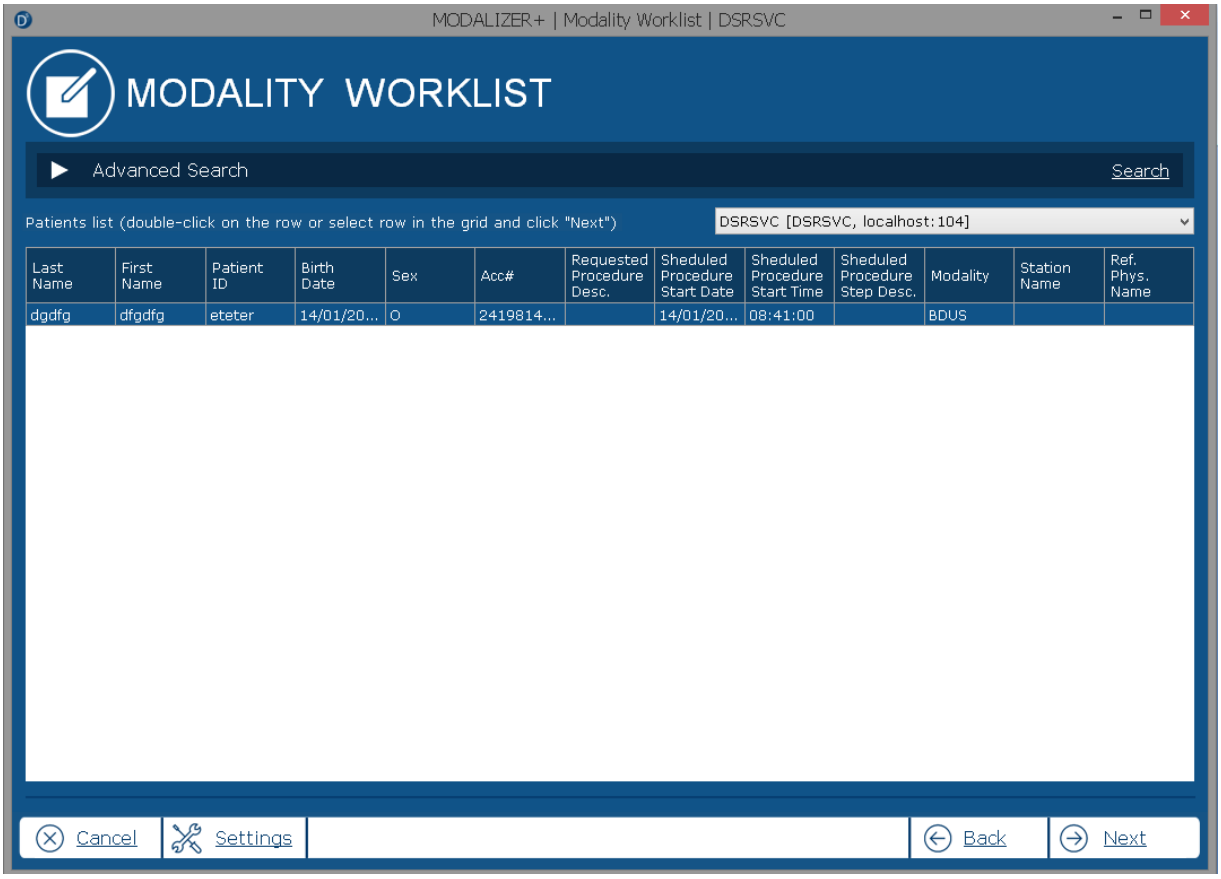
How to send the same study to multiple destinations

[2] Some PACS May not allow storing JPEG Compressed DICOM Images.
[3] JPEG Compressed Images usually take less disk space and may be faster to store and restore from the PACS.

5.3. Modality Worklist Query

In order to use the Modality Worklist Service configure a Worklist Server.

Click “Modality Worklist” in the main menu:



The basic search is done by the patient name or by patient ID. If you are not sure in patient’s name spelling you can use wildcard characters “**?**” and “***”. “?” is used to represent a single character and “*” represents any number of characters. Click “Advanced Search“ to present additional search options like a range of days when the study has been created or by the accession number. Clicking “Search” with no search parameter set will list all the existing studies. This is not recommended and it may take a very long time.

Search also can be started by pressing "Enter" in any text box in the Advanced Search area.

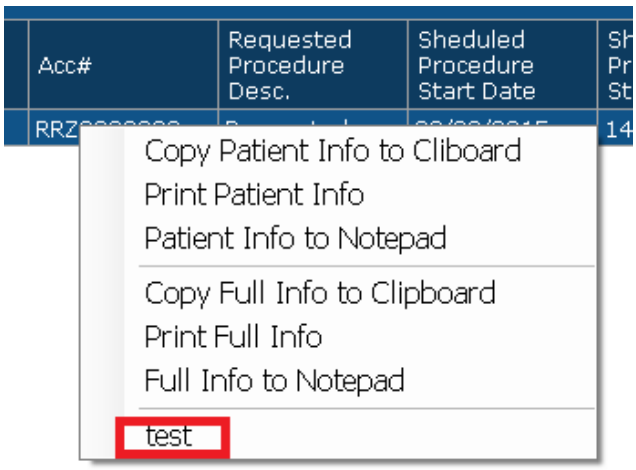
A default search filter can be set in the settings screen for “today” and for a specific scheduled AE title. To enable this mark the appropriate check-boxes in the “Worklist Server” settings panel.

On screen opening query will be sent to the default MWL server (one currently selected in the settings screen) but you can switch to another server by selecting it from the list located under search panel.

MODALIZER+ uses the attributes received from the MWL Query in the new study Images and report.

Double click on the row from the list of results or clicking the “Next” button will lead you to document the study by creating images and adding a report.

Right click on the row opens menu allowing to copy/print patient and study info or execute some custom action using selected data ("test" in the below image):

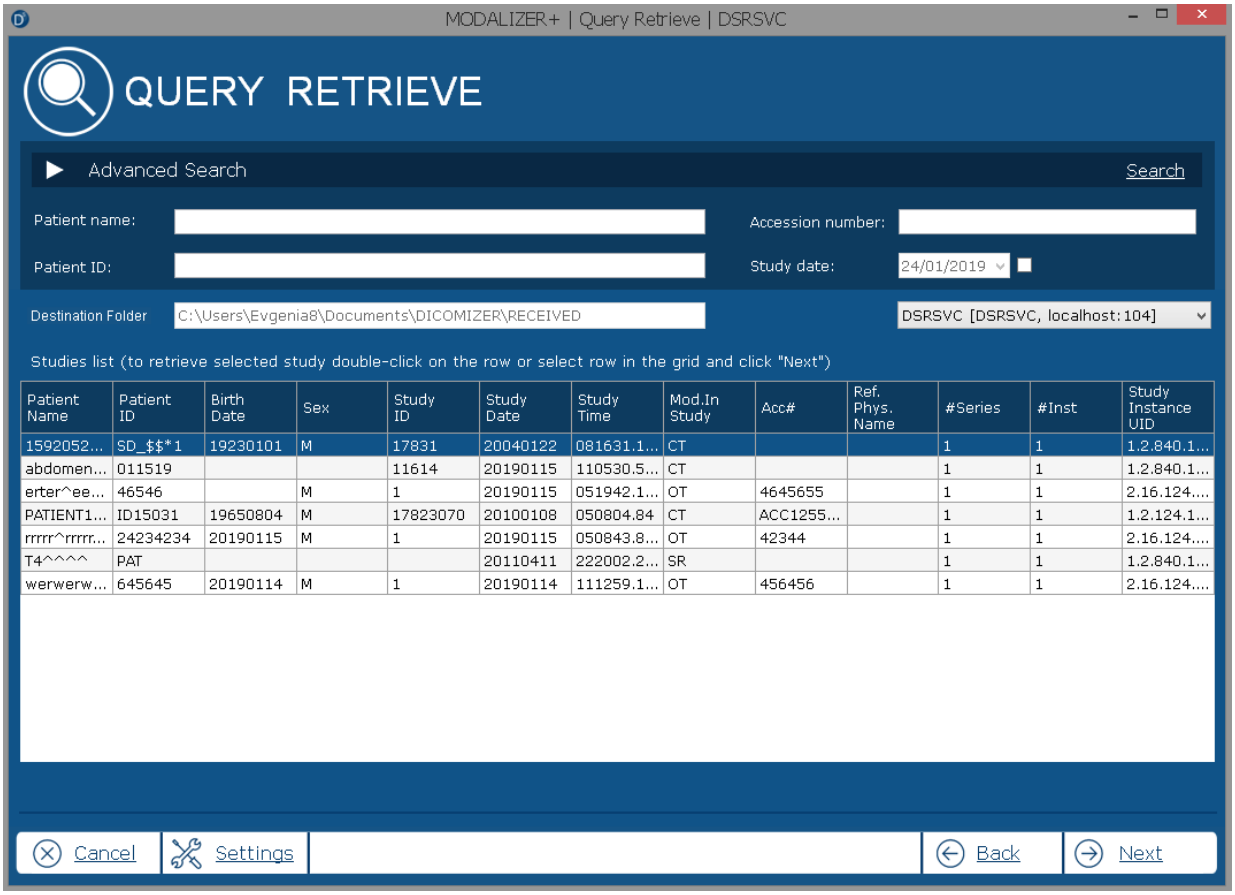


How to configure Customs Actions.

5.4. Query/Retrieve - Searching the PACS

Query/Retrieve (Q/R) is a DICOM Service that allows to search for DICOM objects in a PACS using search criteria (patient name, date of creation of the images, modality etc.) and retrieve them for viewing or other purposes. To use Q/R you configure a Storage Server.

Select “Query Retrieve” from the main screen.



Patient Name	Patient ID	Birth Date	Sex	Study ID	Study Date	Study Time	Mod.In Study	Acc#	Ref. Phys. Name	#Series	#Inst	Study Instance UID
1592052...	SD_$$*1	19230101	M	17831	20040122	081631.1...	CT			1	1	1.2.840.1...
abdomen...	011519			11614	20190115	110530.5...	CT			1	1	1.2.840.1...
erter^ee...	46546		M	1	20190115	051942.1...	OT	4645655		1	1	2.16.124....
PATIENT1...	ID15031	19650804	M	17823070	20100108	050804.84	CT	ACC1255...		1	1	1.2.124.1...
rrrrr^rrrrr...	24234234	20190115	M	1	20190115	050843.8...	OT	42344		1	1	2.16.124....
T4^^^^	PAT				20110411	222002.2...	SR			1	1	1.2.840.1...
werwerw...	645645	20190114	M	1	20190114	111259.1...	OT	456456		1	1	2.16.124....

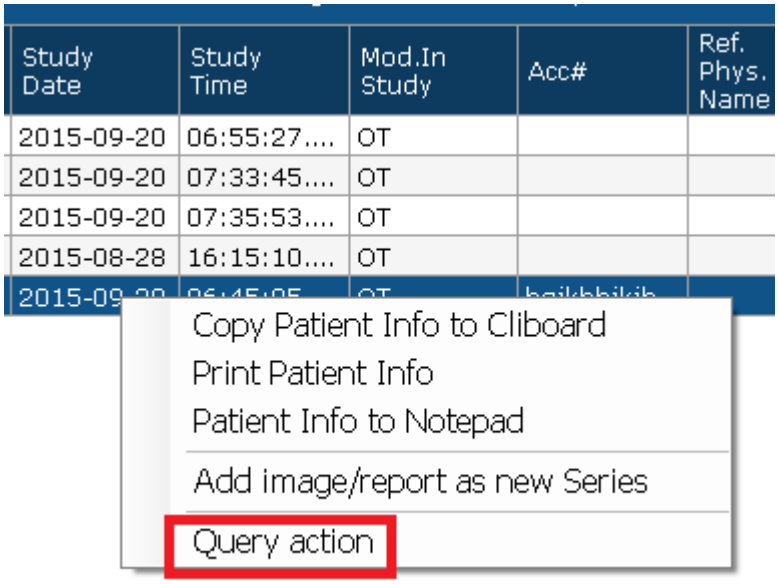
Once the search criteria are set click “Search”. Clicking “Search” with no search parameter set will list all the existing studies. This is not recommended and it may take a very long time.

Search also can be started by pressing "Enter" in any text box in the Advanced Search area.

On screen opening query will be sent to the default Storage server (one currently selected in the settings screen) but you can switch to another server by selecting it from the list located under search panel

Double click on the row from the list of results or select the row and click “Next” –the matching DICOM files will be stored in the destination folder and then displayed in the DICOM viewer.

Right click on the row opens menu allowing to copy/print patient and study info, add a new series to an existing study or execute some custom action using selected data ("Query action" in the below image):



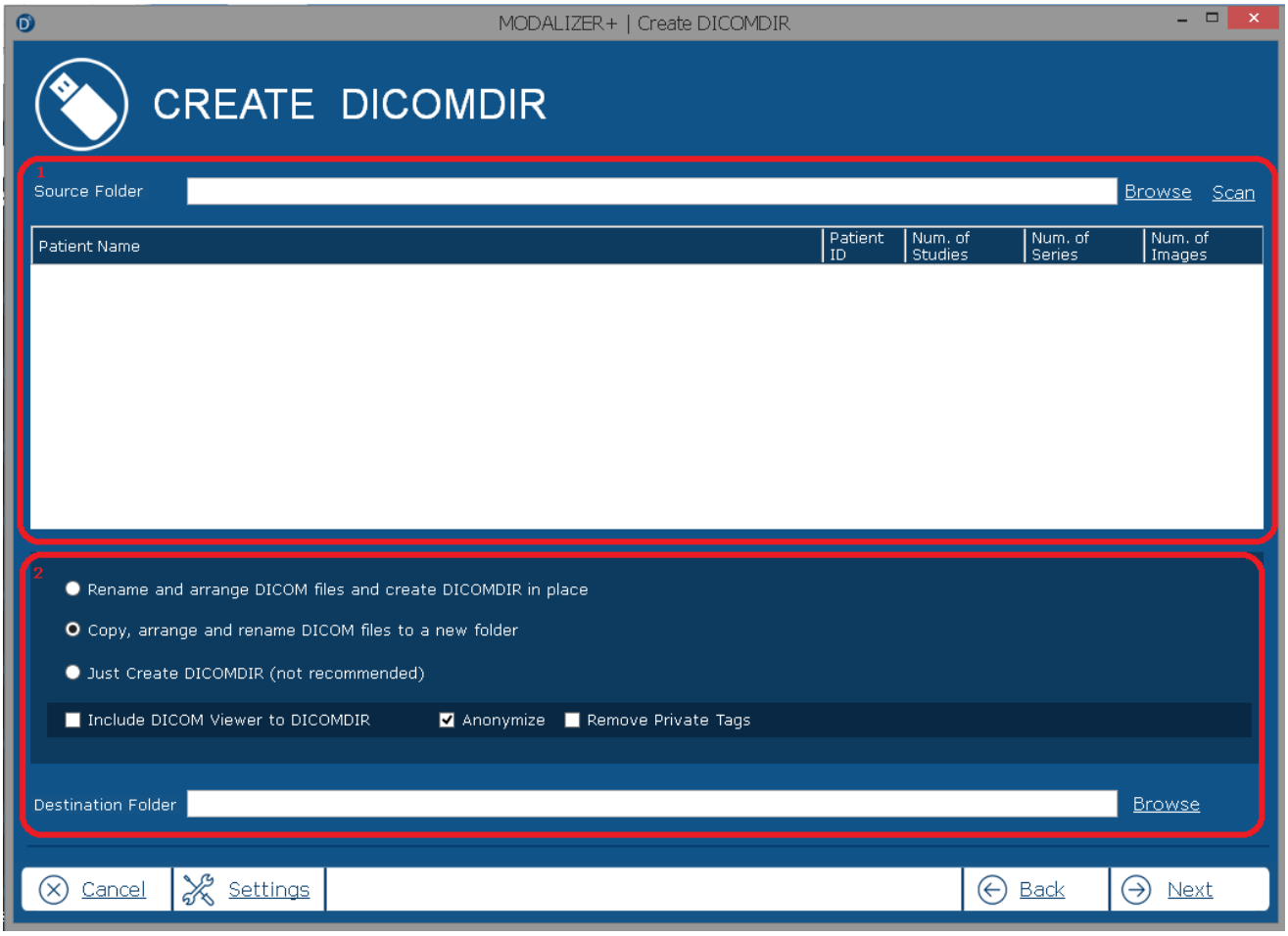
How to configure Customs Actions.

5.5. Burn CD/DVD

MODALIZER+ allows creating a complete and portable medical record with specific studies and reports, and an embedded DICOM Viewer.

Select “Create DICOMDIR” from the main screen.

In order to prepare a Standard DICOM Media, MODALIZER+ prepares the media files using standard filenames in Patient-Study-Series-Image hierarchy and creates a DICOMDIR file.



The “Create DICOMDIR” screen consists of two areas:

- Part #1:
  - Source Folder - click “Browse” to select the folder with files to burn
  - Study Details Table - click “Scan” to verify the study’s details (if no valid DICOM files found no details will be presented)

- Part #2:
  Select the appropriate option from the list:
  - Rename and arrange DICOM files and create DICOMDIR in place - the original DICOM files will be renamed according to the standard and arranged hierarchically and DICOMDIR file will be created in the root folder.
  - Copy, arrange and rename DICOM files to a new folder - the DICOM files will be copied and arranged hierarchically and DICOMDIR will be created in the folder that you define.
  - Just create DICOMDIR (Not recommended) - this option only create DICOMDIR file in the same folder with DICOM files. If the filenames are not according to the standard, they will not be renamed. This option may not comply with all the standard requirements.
  - Destination Folder - define the destination folder for the option “Copy, arrange and rename DICOMDIR in folder”

Notes:

- In order to include the Viewer of MODALIZER+ to the created DICOMDIR check the option “Include DICOM Viewer to DICOMDIR”.
- In order to anonymize/de-identificate DICOM files in the destination folder check the option “Anonymize”. This option is available only if " Copy, arrange and rename DICOM files to a new folder" was selected. Also you can select an additional option to remove all private tags (DICOM attributes that are not defined in standard, but are custom data specific for your organization)

Click “Next”. Select the drive for the media to be burn. Click “Burn to disc” option.

6. Reporting

MODALIZER+ features two options for creating reports:

1. DICOM Structured Reporting (SR) - The purpose of the DICOM SR specifications is to improve the documentation of diagnostic images by defining semantic reports that can both readable for software and also can be rendered for display. While this method is recommended by the DICOM standard committees, there's no option to control how the report will be displayed by the PACS. If preserving the looks of the report (such as font, colors, logo and other graphic features) is important to you, consider using DICOM Encapsulated PDF Report.
2. Formatted Report Templates – Create PDF reports using the standard DICOM Encapsulated PDF class definition. This option enables controlling the graphic design of the report. MODALIZER+ features a unique templates mechanism to automatically fill the case info into existing template documents.

6.1. Formatted Report Templates

Formatted Report Templates automates the process of filling the report with case attributes such as patient identification (e.g. Name, ID, Birth Date and Sex), study information and other attributes.

A report template is saved as RTF Document with placeholders for values that are automatically filled while following the new patient wizard. You can create your own templates and select from multiple templates depending on the performed procedure.

The special '$' surrounded placeholders are automatically replaced by the actual attributes values for every new report. The following attributes can be used:

Patient Name	$PatientName$
Patient ID	$PatientID$
Patient Sex	$PatientSex$
Patient Birth Date	$PatientBirthdate$
Accession Number	$AccessionNumber$
Study Date	$StudyDate$
Study Time	$StudyTime$
Modality	$Modality$
Requested Procedure Description	$RequestedProcedureDescription$

Scheduled Procedure Step Description	$ScheduledProcedureStepDescription$
Station Name	$StationName$
Referring Physicians Name	$ReferringPhysiciansName$

Read more about how to configure the report templates.

6.2. DICOM Structured Reports (DICOM SR)

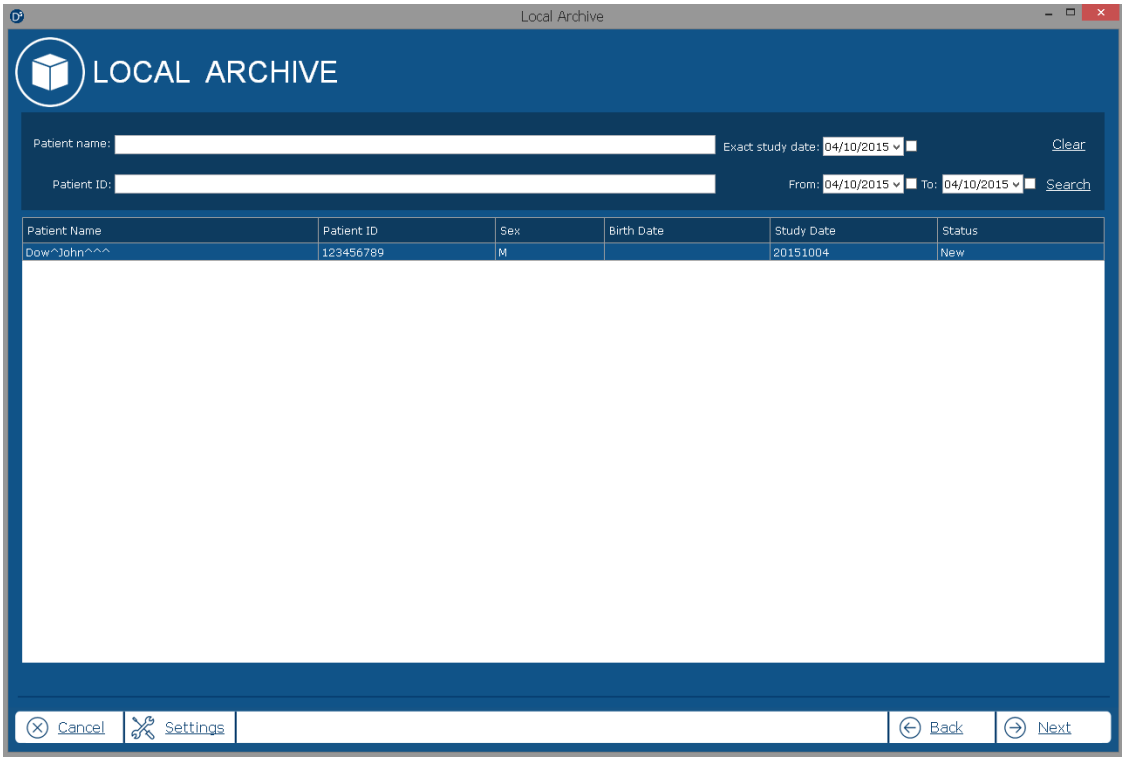
Create a DICOM Structured Report by typing text in the report text panel on "Acquisition" screen and selecting "DICOM SR" option in "Create report as" section on "Convert to DICOM" screen. DICOM file containing SR will added to a destination folder automatically as separate series. You can load report to Viewer, it will be displayed as HTML page.

7. The Local Archive

Local Archive is a built-in Compact SQL data base and hierarchically structured storage place (Root folder/Study folder/Series folder/DICOM files). All converted/retrieved from PACS DICOM files are stored in this storage place if "Use local archive" option is marked in Settings screen. You are able to search, view, export, delete stored files and add new DICOM files to an existing study using "Local Archive" screen.

See in "Settings" how to configure the Local Archive.

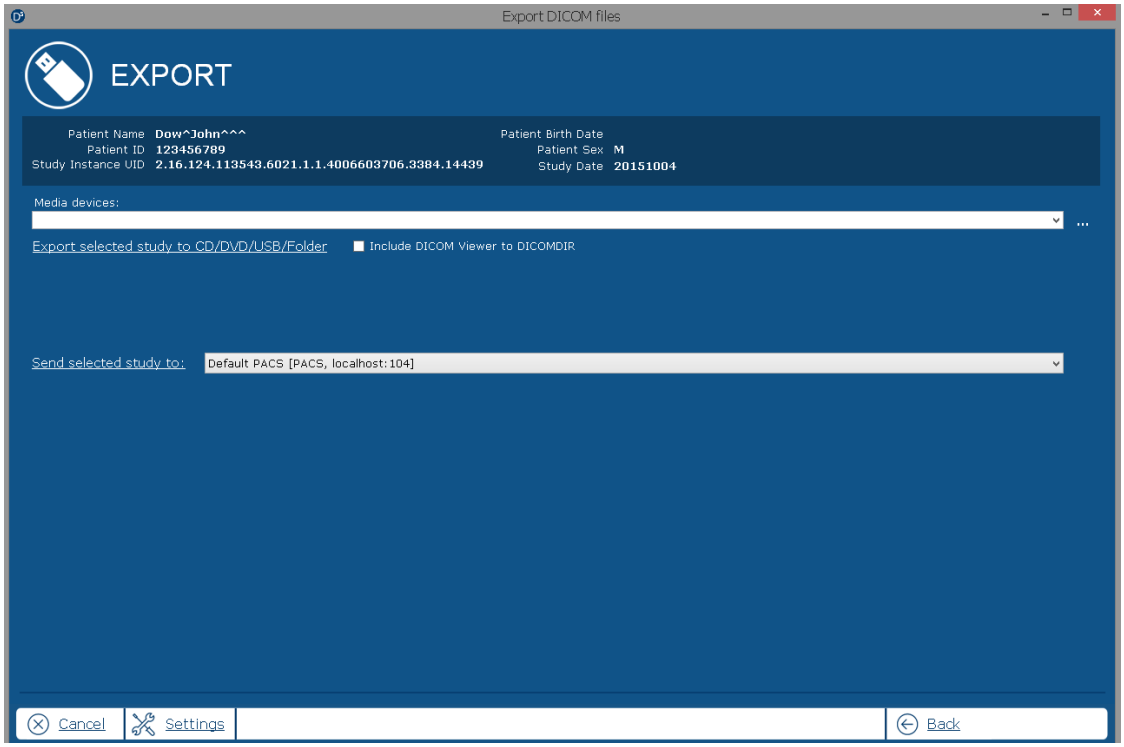
Select "Local Archive" from the main screen:



Once the search criteria are set click "Search". Double click on the row from the list of results or clicking the "Next" button will lead you to Viewer screen displaying images of the selected study.

Right click on the row opens menu allowing to export/delete selected study or add a new series to it:

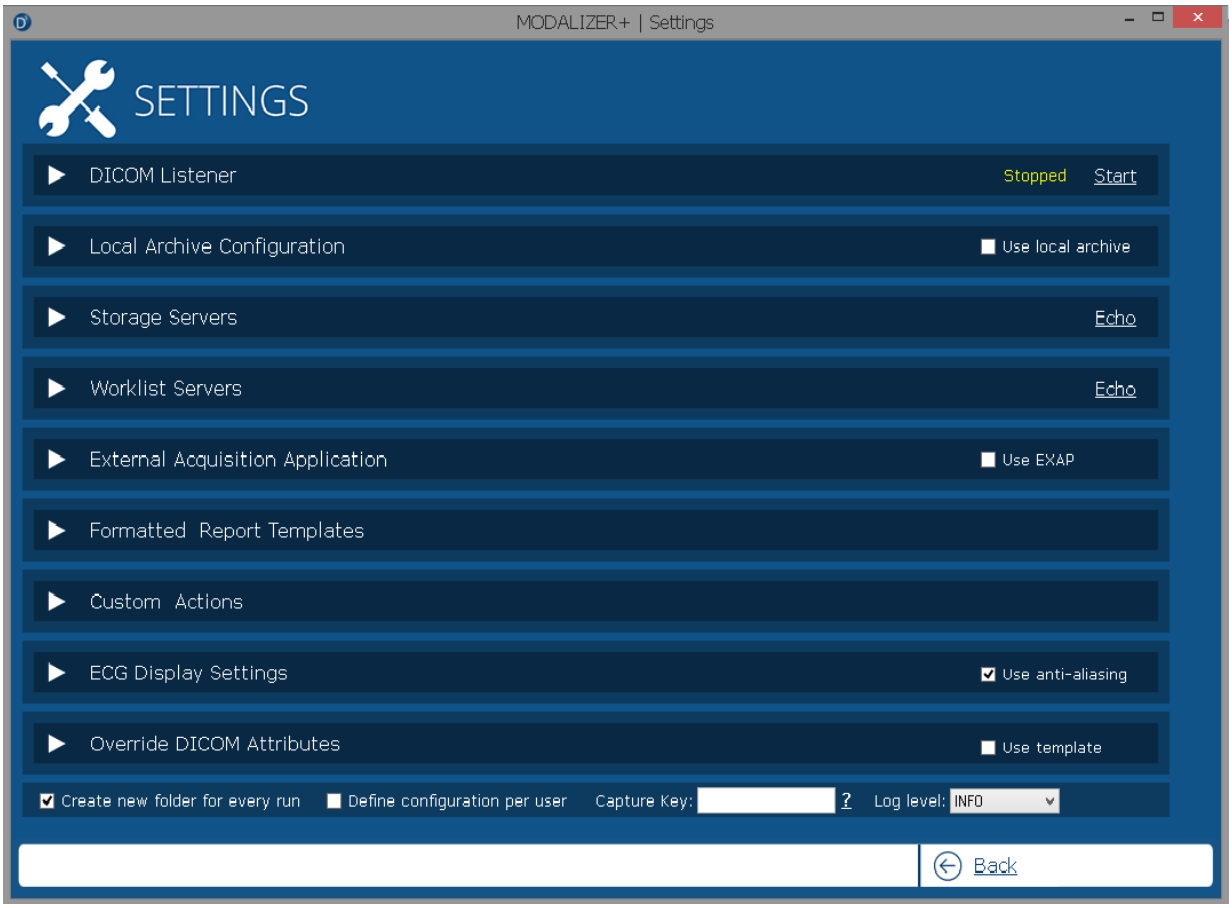
Click on "Export' opens next screen:



Here you can send images to the required PACS server or store them as DICOMDIR on external media (as DVD or Flash drive) or in some folder on your computer (about building DICOMDIRs see Creating Standard DICOM CD/DVD Exports)

8. MODALIZER+ Settings

You can enter the “Settings” screen by clicking the “Settings” link in the main menu or by clicking the “Settings” button in the bottom left corner of any screen. Here you can set the Listener, Storage and Worklist servers, configure Local Archive, Formatted report templates and Custom Actions, change the conversion process configuration and define how to display ECG files in the Viewer



The DICOM nodes (workstations, PACS systems) can communicate if they know each other. That means, each system must know the AE Title, the IP address or hostname and the IP port of the other system. After setting these parameters you will be able to use Storage, Modality Worklist and Query/Retrieve.

8.1. DICOM Listener configuration

MODALIZER+ can receive DICOM files sent from another applications id if its built-in DICOM Listener is started. Current listener status is displayed in the right upper corner of the Listener tab.

First set your listener AE Title and port. You can always start/stop listener by clicking "Start"/"Stop" button next to status label.

To change folder where listener stores received files - click "Browse" button.

When "Use local archive" on Local Archive configuration tab is selected:

a. Local Archive folder will be used as listener Storage path and "Browse" button will be disabled.
b. Info about all DICOM files received by listener will be inserted to DB automatically

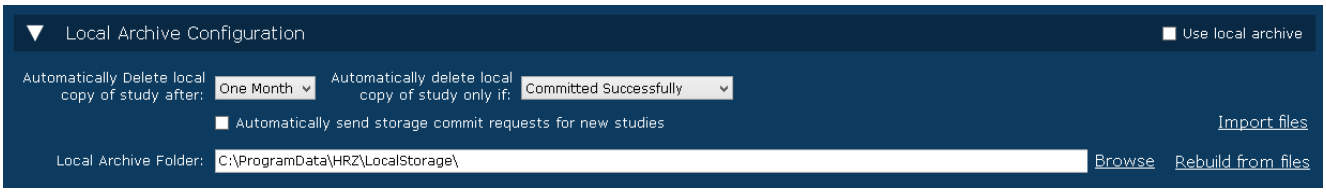
You can decide to start listener each time when MODALIZER+ starts by marking "Start listener when application stars" checkbox.

If you want to minimize MODALIZER+ to tray on closing application by "X" (so that listener keeps running) - mark "Keep running when listener is on" checkbox. To restore MODALIZER+ to view - right click on tray icon and select "Open". To exit MODALIZER+ which is collapsed to tray - right click on tray icon and select "Exit"

NOTE: If one MODALIZER+ instance is already running, all other instances you'll try to start will be opened in "Viewer only" mode. In such case check for another MODALIZER+ instance collapsed to the system tray.

8.2. Local Archive configuration

All converted/retrieved from PACS DICOM files can be stored in hierarchically structured storage place (Root folder/Study folder/Series folder/DICOM files); info about these files is stored in built-in Compact SQL data base. To use this option, mark "Use local archive" checkbox on the "Local Archive Configuration" tab.



To change root folder where archived studies are stored - click "Browse" button.

Set required clearing mode by selecting options from "Automatically delete local copy of study after" and "Automatically delete local copy of study only if" lists.

You may need to re-fill DB by info about DICOM files stored in root folder, for example if you want to switch to another storage folder. You can do it by selecting required path and clicking "Rebuild from files" button. Current archive folder will be scanned and found studies inserted into DB.
This operation is executed in separate task with displaying its progress while running. You can stop this operation by clicking "Cancel" button.
Log file RebuildFromFiles.log will be created containing follow data:

- The name of every folder that is scanned
- The name of every file that is opened (full path)
- Whenever new study is added with Study Instance UID.

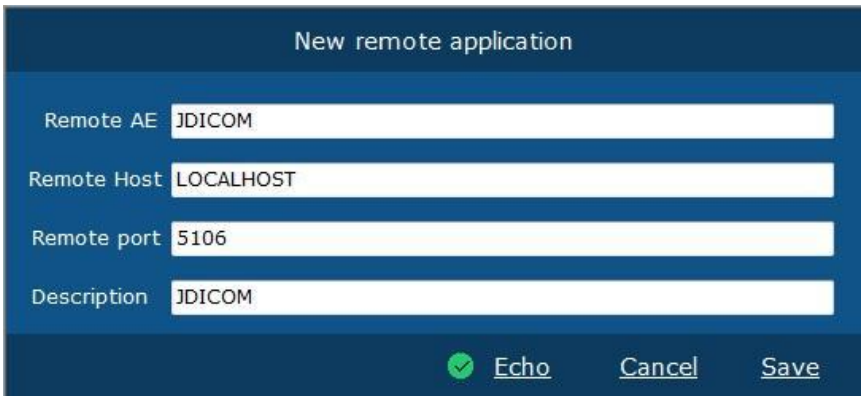
You can also import DICOM files from the folder by your selection. To do it click "Rebuild from files" and select required folder. This folder will be scanned, valid files will be copied to archive folder and found studies will be entered into DB.

8.3. Storage Servers configuration

Note: You should configure at least one server.

- First set your Local Application Entity Title:
  - Local AE - The DICOM AE Title of this installation of MODALIZER+. This must match to the MODALIZER+ AE Title configured in the PACS.
  - Local port - define the port number that MODALIZER+ listens on for incoming connections (The default port is 5108)
  - Timeout - the purpose of a server timeout is to prevent from endlessly waiting for a server to respond. The recommendation is to keep the default, if there are known connection problems increase the value.

- The next step is to define a new server. Click "Add new ":



Set the data for your Storage Server. Click the "Echo" button to verify that the settings are correct. If red X icon is displayed, verify that the settings are correct and the server is running. Click "Save" to apply the settings for a new Storage Server or "Cancel" to exit the settings. Check the log file lastEcho.log in MODALIZER+ installation folder (C:\MODALIZERPLUS).

Important: To complete this step you must also configure your Storage Server (PACS) with Your MODALIZER+ AE Title (the value you set for "Local AE"), the hostname (or IP address) of your computer and the IP port (the value you set for "Local port").

Note #1: Ask your System/PACS Administrator for the Storage Server parameters.

Note #2: MODALIZER+ is compatible with most DICOM PACS providers. Please advise your PACS software help file about AE configuration of your PACS server or ask your System Administrator.

8.4. Worklist Servers configuration

The Worklist Server must be configured in order to use Modality Worklist query.

Configure the parameters for your Worklist Server. Click the “Echo” button to verify that the settings are correct. If red X icon is presented verify that the settings are correct and the server is running. Click “Save” to apply the settings for a new Storage Server or “Cancel” to exit the settings.

Automatic MPPS - check this option to use MPPS.

Note: Don’t check this option if the Worklist Server you work with doesn’t support MPPS.

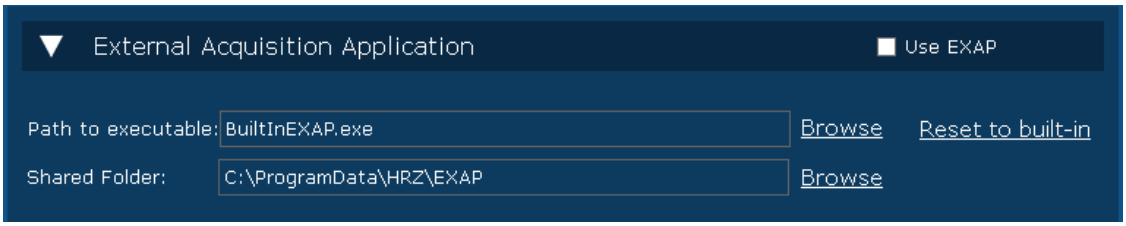
Timeout - The recommendation is to keep the default, if there is known connection problem increase the value.

Two more options in the Worklist Server panel refer to Worklist Query filter. You can define that the search results will present only the studies that scheduled for today and/or for a specific Scheduled AE Title. To do this mark the appropriate check-boxes in the “Worklist Server” panel.

Note: Ask your System Administrator for the Worklist Server parameters.

8.5. External Acquisition Application configuration

User has an option to use some external application to acquire images for converting to DICOM. For example - some application receiving images from medical device as CT etc. This application must receive as input parameter path to some "exchange data" file containing patient data (name and ID) and save acquired file in the parent folder of this file.
To use this option follow parameters have to be defined in Settings screen:



1. **Path to executable**: full path to EXE file starting external application (by default it is built-in example working exactly as Acquisition screen). To select EXE - click "Browse" button in the same line. To return to built-in example - click "Reset to built-in" button
2. **Shared folder:** full path to a folder in which exchange file (XML, txt, json etc.) will be stored. To select folder - click "Browse" button in the same line.

In order to use EXAP - select **"Use EXAP"**

When "Use EXAP" is selected - external application will be started when user clicks "Next" button on "New patient"/ "Modality Worklist" screen or on adding new series to existing study from "Local Archive'/"Query Retrieve" screen.

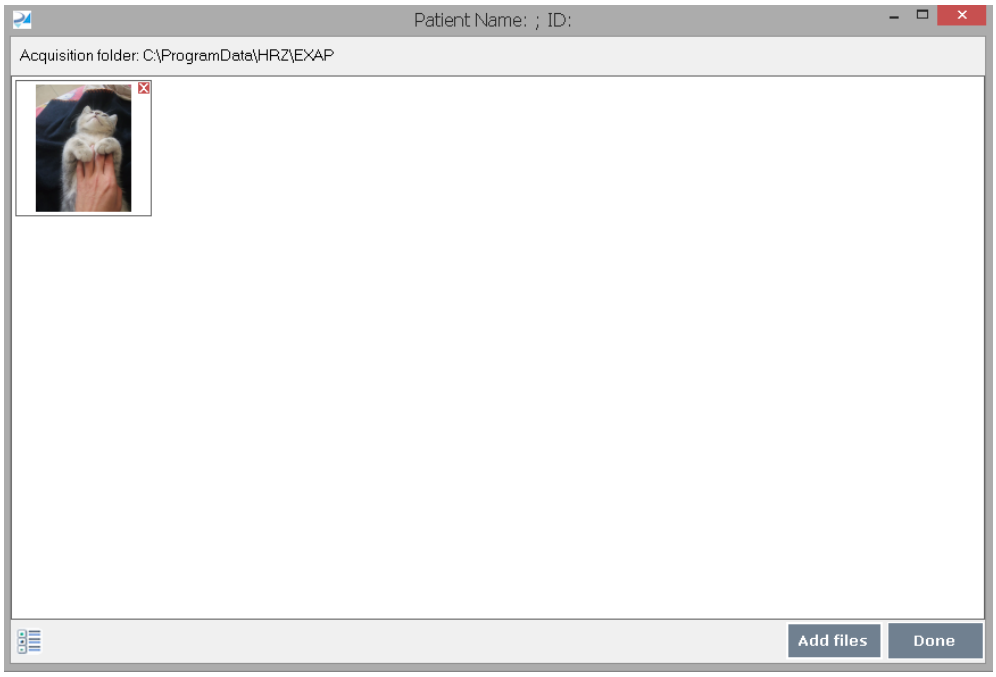
MODALIZER+ will fill the exchange file with case attributes such as patient identification (e.g. Name, ID, Birth Date and Sex), study information and other attributes.
Template file (located in MODALIZER+ installation folder and named **PatientDataTemplate.xml**) can be of any text format - XML, txt, json, even RTF. By default it's XML containing ALL available fields:

```
<?xml version="1.0" encoding="utf-8" ?>
<PatientData>
 <PatientName>
        $PatientName$
 </PatientName>
 <PatientId>
        $PatientID$
 </PatientId>
 <PatientSex>
        $PatientSex$
```

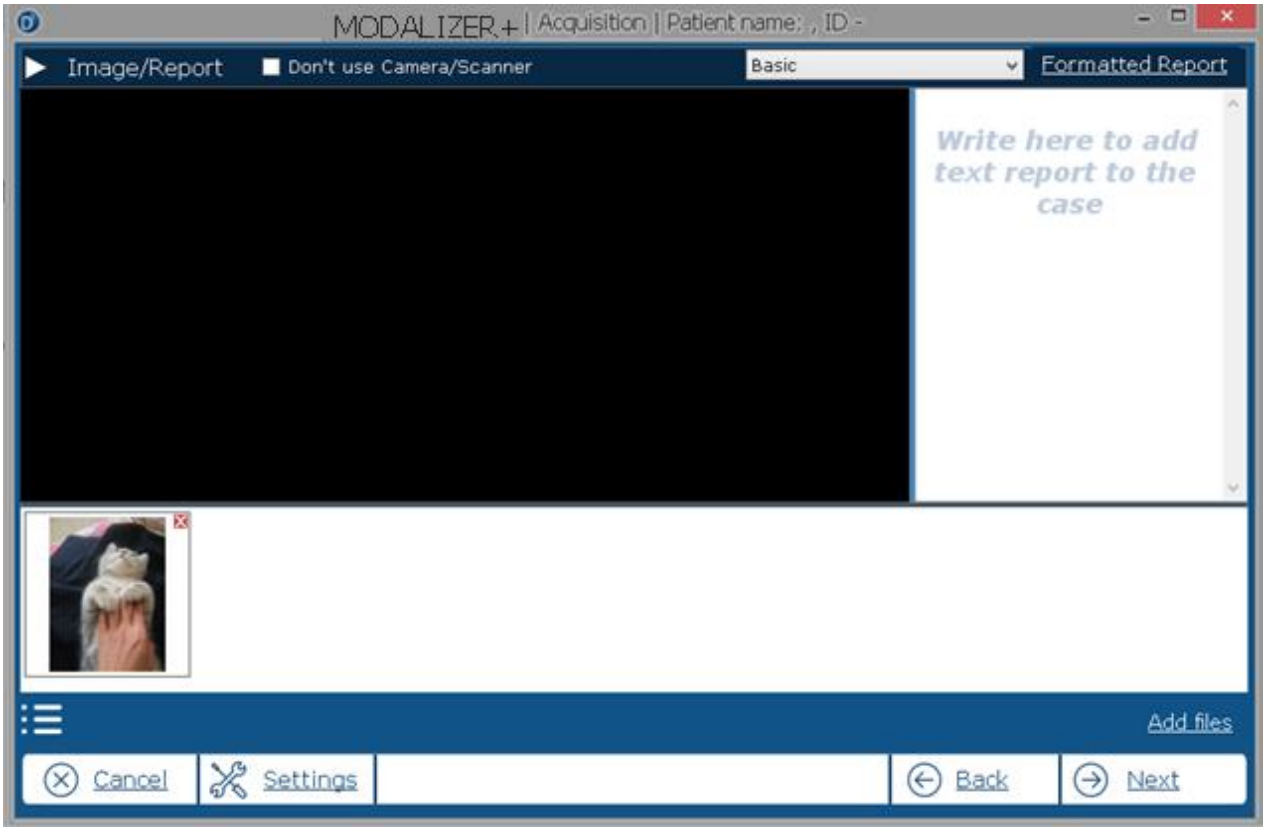
```
  </PatientSex>
  <PatientBirthdate>
        $PatientBirthdate$
  </PatientBirthdate>
  <AccessionNumber>
        $AccessionNumber$
  </AccessionNumber>
  <StudyInstanceUID>
        $StudyInstanceUID$
  </StudyInstanceUID>
  <StudyId>
        $StudyId$
  </StudyId>
  <StudyDate>
        $StudyDate$
  </StudyDate>
  <StudyTime>
        $StudyTime$
  </StudyTime>
  <Modality>
        $Modality$
  </Modality>
  <RequestedProcedureDescription>
        $RequestedProcedureDescription$
  </RequestedProcedureDescription>
  <ScheduledProcedureStepDescription>
        $ScheduledProcedureStepDescription$
  </ScheduledProcedureStepDescription>
  <StationName>
        $StationName$
  </StationName>
  <ReferringPhysiciansName>
        $ReferringPhysiciansName$
  </ReferringPhysiciansName>
</PatientData>
```

Output file is saved as PatientData.xml in the shared folder so your EXAP application is able to load required data from it.
The special '$' surrounded placeholders are automatically replaced by the actual attributes values for every new exchange file.

MODALIZER+ is installed with built-in EXAP application as example:

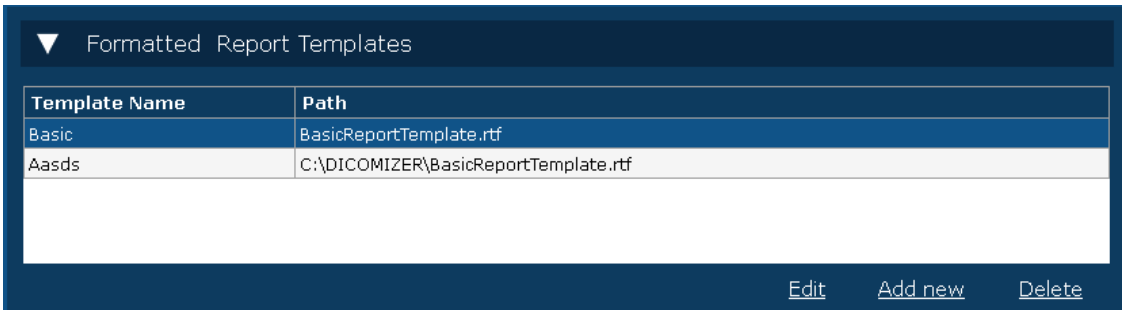


After user added files and clicked "Done" (or executed custom actions in external application and closed it) - "Acquisition" screen will be opened with acquired files added to the list:

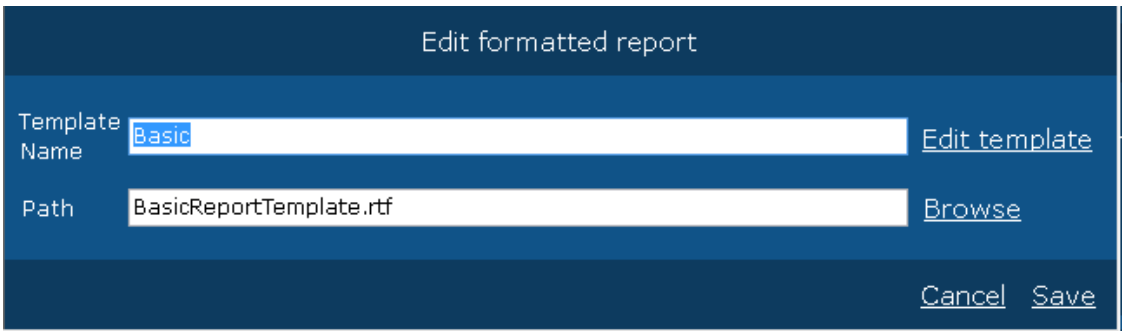


8.6. Formatted Report Template configuration

About formatted reports structure see Reporting section.



Select required template in the list and click “Edit” to edit the template properties:



You can change templates name which is displayed in the list of templates on "Images" screen, select another RTF file or open RTF file itself to edit its content by clicking "Edit template" button (you can edit the header/footer of the template, edit text and add Logo).

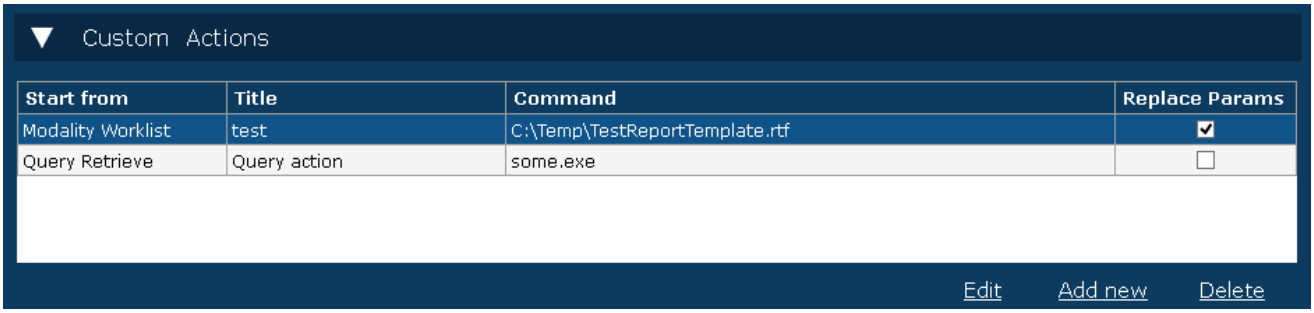
If you want to create a new template - click "Add new" and select path to your custom RTF file.

To delete existing template - select it in the list and click "Delete"

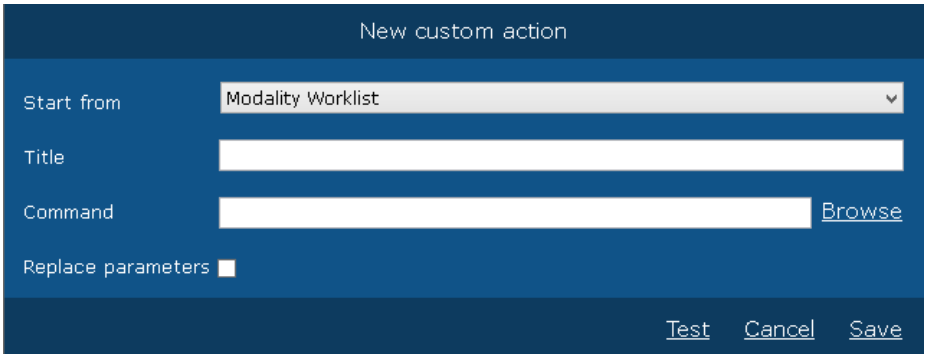
NOTE: At least one template must exist so you cannot delete last one.

8.7. Custom Actions configurations

"Custom Action" is a some operation you can execute using data from one MWL entry (see Modality Worklist Query) or Query entry (see Query/Retrieve - Searching the PACS)



To create new custom action click "Add new" button:



Select a screen where you want to see new action (Modality Worklist or Query Retrieve), give action a title which will appear in the list and define some command you want to execute - path to some file (as .TXT, .RTF, .EXE or .BAT) .

Mark "Replace parameters" checkbox to make application replace pre-defined parameters inside command file by data from MWL/Query (as in formatted report)

When you select custom action from the row on MWL/QUERY screen - defined file will be opened (with replaced parameters if needed) as separate system process.

To edit existing custom action - select it in the list and click "Edit" button.

To delete existing custom action - select it in the list and click "Delete" button.

You can test your action by clicking "Test" button (parameters will be replaced by some random data).

Types of the custom action:

1.Start EXE without parameters.

2. Open document template , TXT or RTF for example, containing placeholders **(** $PatientID$ **etc.)** to replace (like formatted reports). Place holders will be replaced, files stored in [MyDocuments]\MODALIZERPLUS\ACTIONS folder and opened as separate process (Notepad, Word etc.)

3. Start EXE with parameters. To pass parameters to EXE you need to do follow:

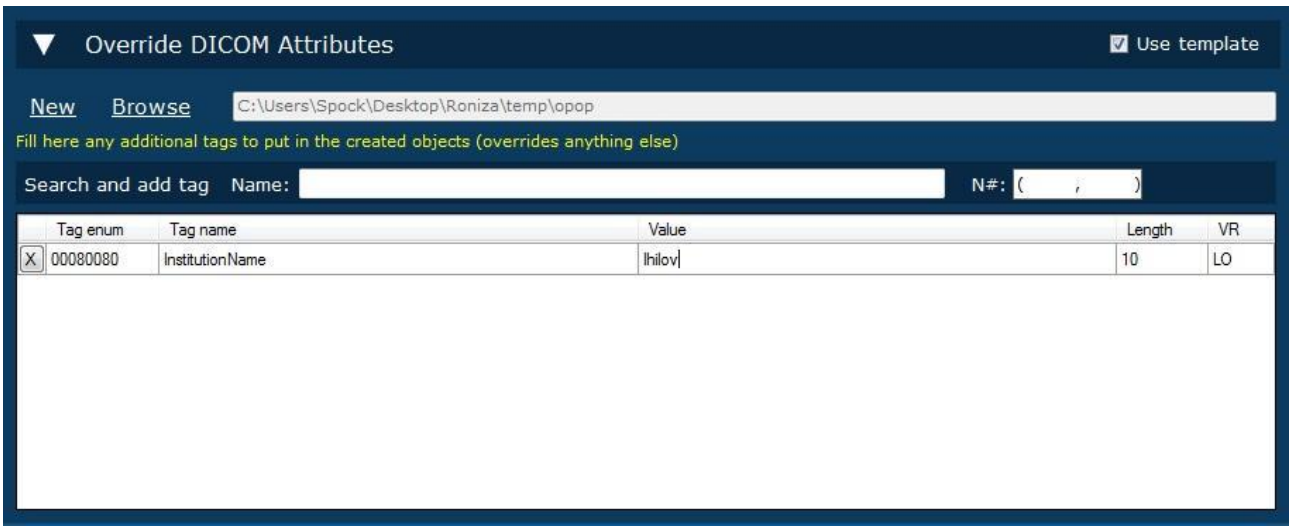
a. Create batch file containing path to your EXE and parameters, for example MyCustomAction.bat file which content is "C:\MyFolder\EXE.exe $PatientID$ $PatientName$ "
b. Select MyCustomAction.bat as you custom action.
c. Select "Replace parameters" check box.

Available parameters are:
$PatientName$
$PatientID$
$PatientSex$
$PatientBirthdate$
$StudyDate$
$AccessionNumber$
$StudyTime$
$Modality$
$RequestedProcedureDescription$
$ScheduledProcedureStepDescription$
$StationName$
$ReferringPhysiciansName$

8.8. Override DICOM Attributes

DICOM attributes are stored in a file that you can edit or replace. In order to use the attributes as they're defined in the template mark "V" in the check-box "Use Template".

Important! The override attributes are applied after all other conversion steps were made. Make sure not to override any image attributes (group 0028).



To create your own DICOM attributes template click "New", in the opened window select the file location and give it a name. Click "Save". The created file will be automatically loaded in MODALIZER+ and you can edit the attributes. You can find the attribute by its name - start typing to get a drop-list of the appropriate attributes or search by the attribute's tag enumeration. Click "Add" to present the value in the table. Enter the new value in the attribute's row in the "Value" column. Clicking "X" in the left column will remove the attribute from the template.

If you want to use another DICOM attributes template click "Browse" and select.

8.9. ECG Display Settings

See Displaying ECG in Viewer.

8.10. Misc configuration

At the bottom of the configuration screen there are three additional options:

3.1.1 File System Directory Organizations

Create new folder for every run - in this way each study will be stored in separated folder (Recommended).

When Local Archive is disabled the converted images destination folder can be manually set (see New Patient).

When "Create new folder" is enabled, every study is stored in a newly created directory.

3.1.2 Per-User Configuration

When per-user configuration is checked, every user (from the windows operating system) has its own configuration file.

3.1.3 Capture Key

Define key combination to capture image from the currently selected TWAIN/WIA device when in the capture screen

1. click inside the “capture key” text box
2. Hold the keys combination to use for image capture.

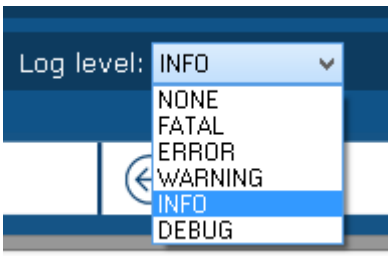
Valid keys:

- Combinations of control/alt/shift keys and characters (Ctrl-A, Alt-Z, Ctrl-Shift-F etc.)
- The function keys (F1, F2, ...)

Enter/Return and Space keys are not recommended as they may interfere with standard UI functionality.

To disable the capture key, click in the text box and then press the delete key.

3.1.4 DICOM Log level for operations as "Send ECHO", "Get Query" etc.



Default value is "INFO"

9. Completing tasks with MODALIZER+

9.1. Viewing DICOM Images

MODALIZER+ is a powerful DICOM Workstation that lets you display DICOM Files from your local computer, from CD/DVD/USB and from any PACS.

There are a few ways to present the files - you can Drag-and-drop the items or to click “Open Files” to browse for a folder and select the files to view. In order to present all folder’s content use “Open Folder” button.

9.2. Using CD/DVD DICOM Viewer

DICOMZIER automatically adds a DICOM CD Viewer to every burned CD/DVD so patients and physicians can view their studies and reports anywhere. Double click the DICOM Viewer application in the CD/DVD root folder to view the CD/DVD content.

9.3. Viewing PDF file in DICOM format

To extract a PDF from a DICOM Encapsulated PDF file, click PDF icon in the Viewer – the file will be converted to PDF and displayed using your system default PDF viewer.

9.4. Attaching scanned documents to the patient folder

MODALIZER+ will automatically identify compatible camera or other imaging device connected to your computer. If there are more than one device connected choose the one you’d like to use through the drop-list in the upper left corner of the Image/Report panel.

Capture an image by clicking on the red button. The icon of the captured image will be presented in the panel below the Image/Report panel.

9.5. Sending the same study to multiple destinations

Once an operation is completed you can send a copy of your study to others DICOM applications by using the “Send to” option in the operation completed screen. Select the destination from the drop-list next to the “Send to” button. If the destination DICOM application is not in the list, enter settings and add new Storage Server.

9.6. MPPS (Modality Performed Procedure Step)

Modality Performed Procedure Step is a complementary service to Modality Worklist.

Once the procedure was started via Modality Worklist Query the modality creates a new MPPS that references the Study.

MPPS has 3 statuses:

- IN PROGRESS – this means that the procedure has been started
- COMPLETED – this means that the procedure is finished.
- DISCONTINUED – if the procedure was stopped in the middle

10. Troubleshooting

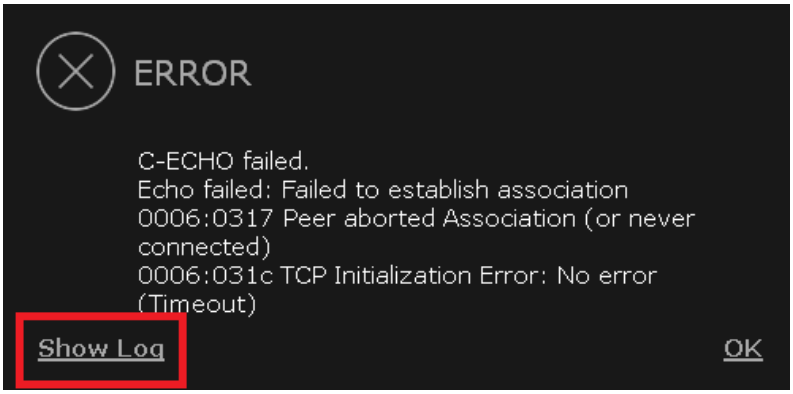
10.1. Log Files

MODALIZER+ Log files are stored in the directory: C:\Users\<User>\Documents\ MODALIZERPLUS \LOGS.

MODALIZER+ keeps the last log for every DICOM operation:

- LastEchoToStorageServer - the log on Echo to PACS action
- LastEchoToWorklistServer - the log on Echo to Worklist Server action
- LastMove - the log on copying a study to PACS
- LastMPPSCreate - the log on MPPS creation
- LastMPPSSet - the log on setting MMPS
- LastQuery - the log on Query Retrieve operation
- LastSend - the log on the send to PAXS operation
- LastWorklistQuery1 - the log on Worklist Server search operation

When operation fails, message will be displayed with an option to open correspondent Log file:



Appendix A

How to start MODALIZER+ from command line with parameters

When launched with specified command line parameters MODALIZER+ will start directly in the Q/R screen and send a query according to the parameters. Query parameters appear in the query screen when results are retrieved from PACS and could be editable for additional query.

Also there is command line parameter allowing to get "snapshot" of the current image from the MODALIZER+ viewer.

Command Line options

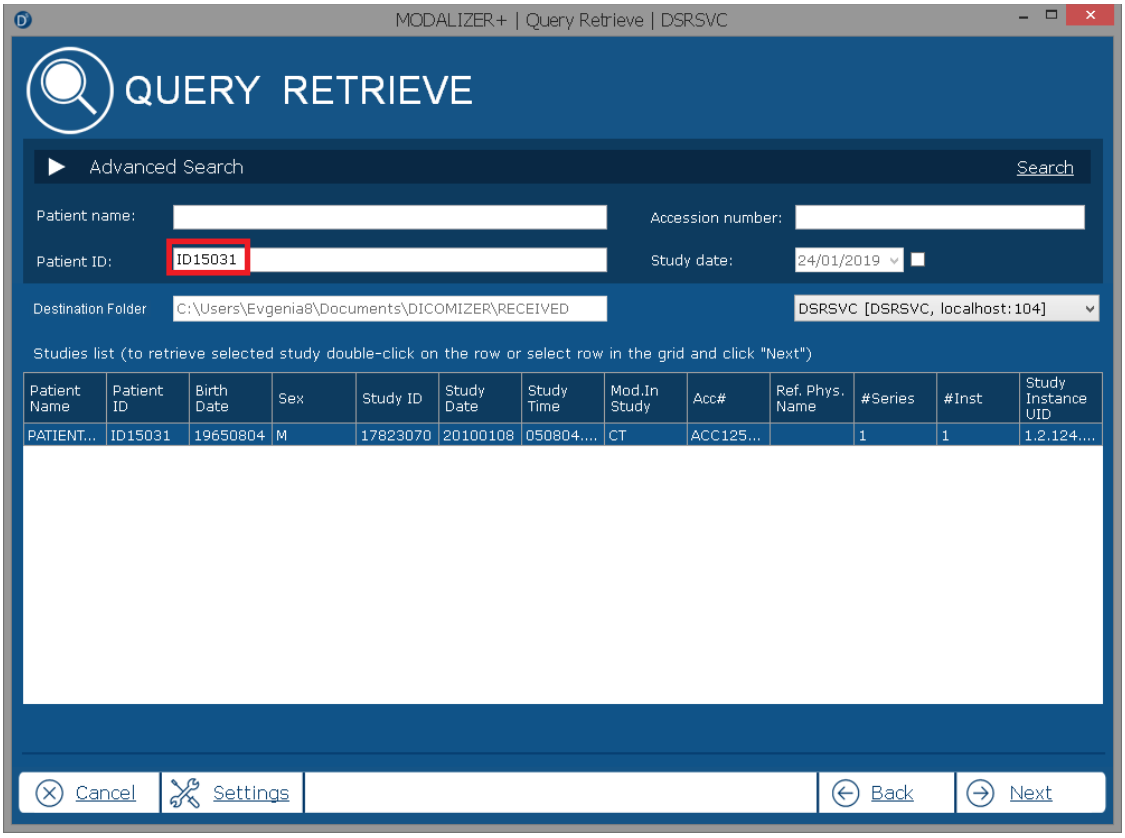
-q or -Q	Start MODALIZER+ in the query screen and send a Query.
-o or -O	Set the output path for Send as references. This option overrides the EXAP shared folder name.

Query parameters
0 or more query parameters can follow the -Q option. Every parameter should be of the form:
tagName=”value”
Double quotes are optional for cases where the value contains whitespace characters (space).
The allowed tags are all the ones that are displayed in the Q/R screen including the advanced search. The tag names should be according to RZDCX’s DICOM_TAG_ENUM.

Option	Tag Name	Tag	Comments and examples
patientName	Patient Name	(0010,0010)	
patientId	Patient ID	(0010,0020)	
PatientBirthDate	Patient Birth Date	(0010,0030)	Exact date in DICOM format (YYYYMMDD) Example: “20170821”
PatientSex	Patient Sex	(0010,0040)	Valid Values: M/F/O or Male/Female/Other (both accepted).
AccessionNumber	Accession Number	(0008,0050)	
StudyDate	Study Date	(0008,0020)	Exact date in DICOM format

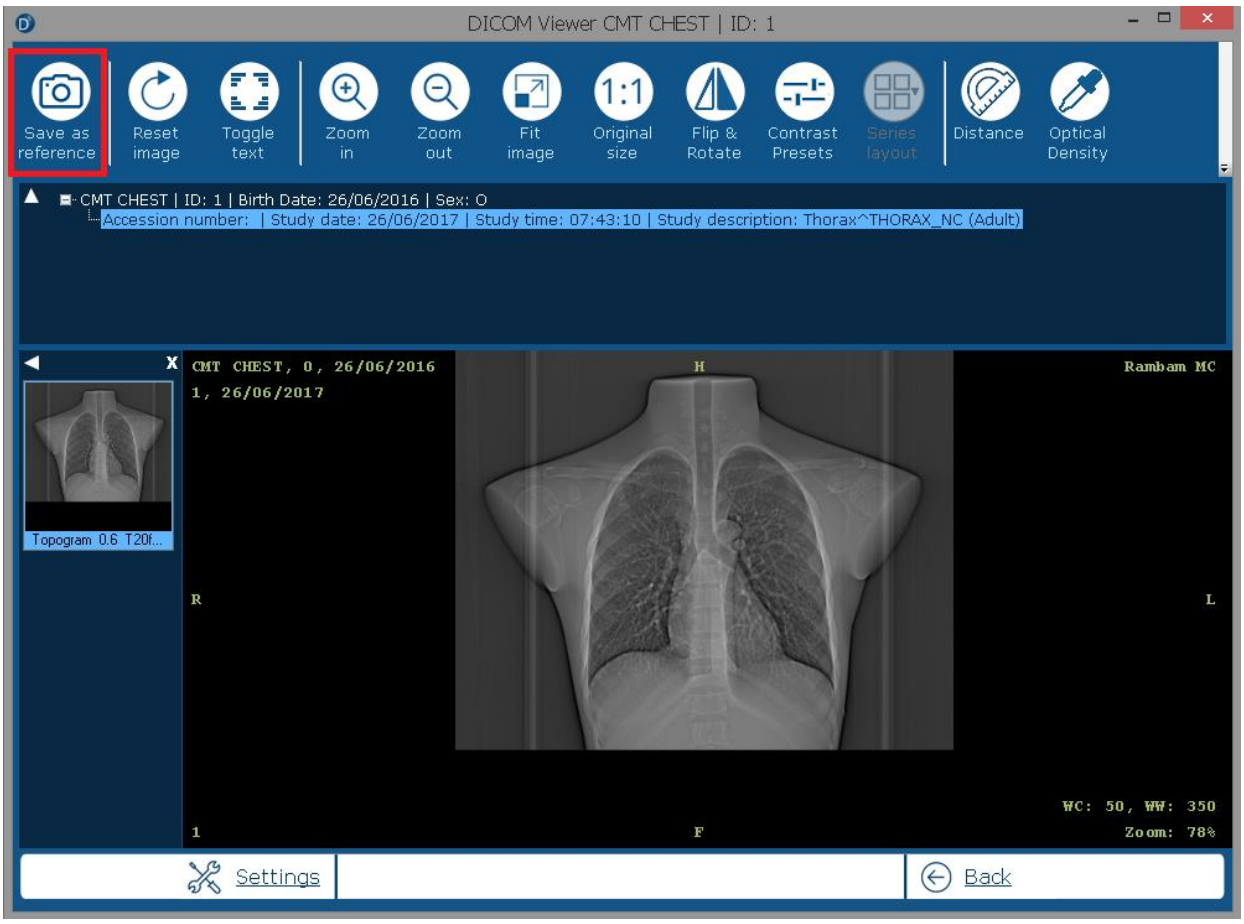
			(YYYYMMDD) including ranges. When value is a date range double quotes must be used to prevent parsing it as command line option. Examples: “20170821” (exact date) “-20170821” (to date). “20170812” (from date). “20170812-20170911” (date range)
ModalitiesInStudy	Modalities in Study	(0008,0061)	

Example: MODALIZERPlus.EXE -q patientId=”ID15031” will start the directly to the Q/R string and start a query:



Send as reference button

When the -O command line parameter is used, the Send as reference button shall be displayed instead of the three buttons on the left (open file, open folder and history) :



Clicking the "Send as reference" button will save the currently displayed and selected image using the current VOI LUT to the path provided as the value of the option. For example if the MODALIZER+ started with the command: *MODALIZERPlus.EXE -O "c:\taken Send as references"* then the files will be saved in *"c:\taken Send as references"* .
The Send as references will be saved in PNG format in the full resolution of the DICOM image (i.e. according to the Rows and Columns tags (0028,0100) and (0028,0101).

Next to the PNG file, the original DICOM file will be saved:

The Send as reference save files will have the following filename pattern:
<destination-folder>\SOP Instance UID.png
<destination-folder>\SOP Instance UID.dcm

<destination-folder> is the value from the -O command line parameter. If -O is not set, application uses the EXAP shared folder from configuration.

If the provided path is not empty, and there is already a file with that name, the file shall be replaced without asking the user.

Start MODALIZER+ with "-help" or "-h" parameter to open popup windows with the description of command line parameters.