digipaX

Viewer Version 1.3.4

User's manual

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1 Start

The software "digipaX Viewer" will start automatically when you insert the CD, unless the auto-start option in Windows is not disabled. You can start the software by running the file "dpView.exe" manually.

2 Screen Layout

Thumbnails: shows all images of a selected patient as a preview (tree structure with the examinations and series)

Image space / viewer: shows an image or more selected images next to each other and one below the other

Movable bars for changing the image division or hiding the windows

Toolbars with the functions

Toolboxes with the functions for processing images (divided into different tabs)

Histogram of the active image

Baseboard with the informations on selected patients

Screen layout and splitting

2.1 Image region / viewer

On the left bar the thumbnails are shown, in the middle area the selected images are presented in a large format and on the right bar the functions for processing images are available. Furthermore, there is a histogram for the current image below the image view.

2.2 Baseboard

On the baseboard the informations off the patient are shown. If more patients are selected, there are number of patients and this at the moment active patient displayed, so the one who the active image concerns.
This baseboard is seen in all parts of the program.

2.3 Toolbars

On the toolbars the different functions are available, like mouse functions, settings for zoom and overlay, also for image division.
On the monitors in the portrait mode the toolbars are automatically arranged in vertical positions. This setting can be also set up manually in the configuration (category Others).

2.4 Split bar

Between the display spaces adjustable split bars are placed. By dragging these bars to the left or to the right or to the top or to the bottom the image panes can be adapted. Also, windows can be hidden in this way completely.

By using small switches the image regions can be moved to the top or to the bottom (or to the left of or to the right), by pressing the button they can be closed and restored by pressing the middle button. Modification of window panes remain saved after the end of the program.

3 Viewing images / viewer

The component of viewing images covers the areas of screen selection, image display and image handling or manipulation on image.
Both gray scale and colour images are supported. These can be presented uncompressed, RLE- or JPEG-COMPRESSED.
For gray scale images the informations on presentation, like window adjustment, rotation and image annotations, are stored as Grayscale soft CoPy Presentation State (DICOM file). At the next opening of an image these are automatically used again.

3.1 Image selection

The image selection follows in a board on the left edge of a display. This is alterable and also completely hideable in its size (width) by the window divider.

The view is changeable between DICOM tree structure and list view.
In the DICOM tree structure the examinations of the selected patients are presented. The patients form in each case a superordinate node. The nodes of the examinations can be opened and closed and as subnodes are the pertinent series contained. Within the series nodes the thumbnails are displayed.
In the list view also information on each selected patient is displayed in a superordinate node. A list of all available images for this patient is arranged underneath of it (in each case nodes with caption and thumbnail), independently from their affiliation to series and examinations. The criterion for the sorting, the sorting direction and the text, which can be displayed in the node, can be set in the configuration (default: date and time of the image).
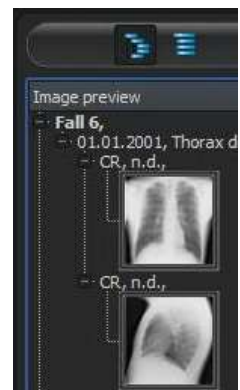
The thumbnails are marked by a red framework, even if this image is displayed in a large image view.
By stops of the mouse over node (patient, examination, series or image) in the tooltip window information on this is displayed.
The size of the thumbnails is adjustable by using two switches Plus and Minus below the tree structure. The size of the images is stored and used at the next program start.

By a double-click on a thumbnail this image can be loaded into the viewer. If there is an image window still free in the viewer (by splitting images in the display area of the viewer in for example 2x2 images, more images can be displayed next to each other in the viewer), then it is displayed in this free image window. If no image window is free, then the image is replaced in a current image window.

By drag & drop the thumbnails can be dragged into image window of the viewer. Also within the viewer the image can be exchanged with drag & drop in the image windows. So the user can divide very flexibly the images on his display.

3.2 Image display

The viewer divides into 1 to n image windows and overlying toolbars (if necessary on the left). The active image is marked by a red framework.

3.2.1 Mouse functions

| Moving image | | Loupe |
| Windowing | | Dragging on zoom rectangle |
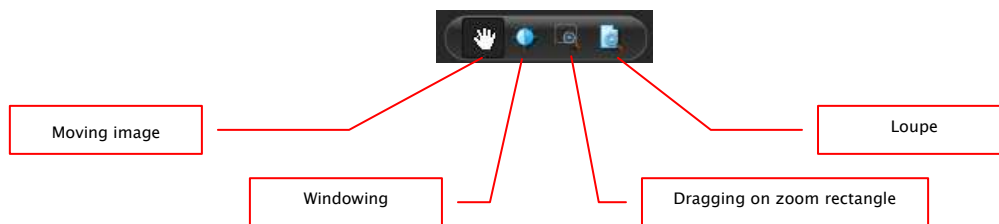
In this toolbar the action for the left mouse button can be selected:
- moving (if display size is larger than image window) – this is a default setting
- windowing (brightness/contrast)
    - ➔ horizontal mouse moving: modifying window center
    - ➔ vertical mouse moving: modifying window width
    In the configuration (category Others) these moves can be also modified
- zoom rectangle
- loupe

The function can be influenced by the following combinations of keys:
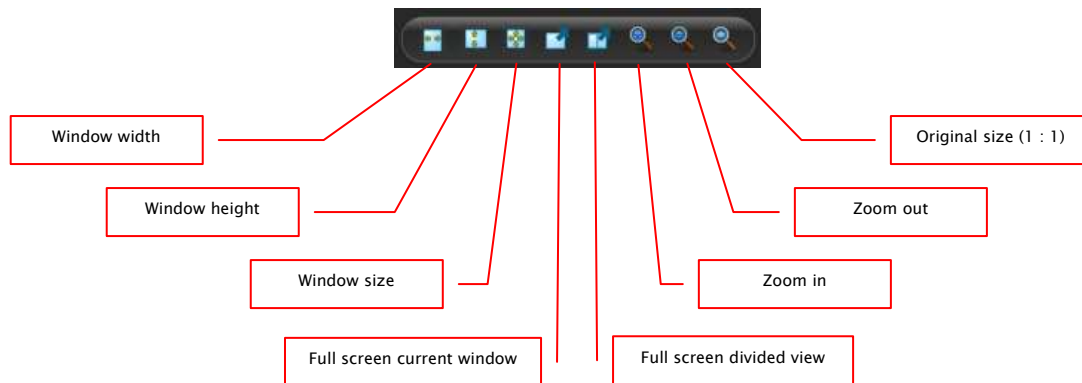- Alt + left mouse button: windowing
- Alt + Shift + left mouse button: dragging on zoom rectangle
- Alt + right mouse button: loupe

Further mouse functions:
- Shift + left mouse button: marking image
- Strg + left mouse button: drag & drop for exchanging the images between the image windows
- right mouse button: zoom in / zoom out (during vertical mouse moving)
- middle mouse button or pushed scroll: windowing

▪ rotating scroll: next or previous image of the images series, examination or the patient (for each setting), if existing

3.2.2 Zoom

Window width

Window height

Window size

Full screen current window

Full screen divided view
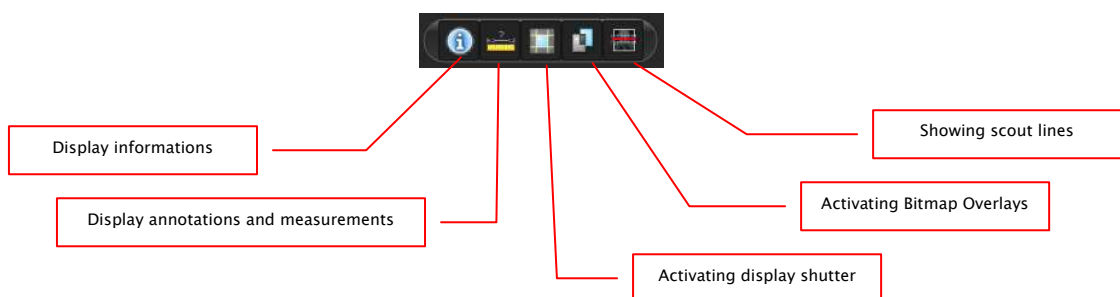
Original size (1 : 1)

Zoom out

Zoom in

The options for zooming images refer in each case to currently active image. According to the standard the image display in a window is initialized in this way, that the image is scaled to the window size. If the size of the window changes in this option, e.g. by division of the image, the zoom factor is adapted accordingly, so that always the full image is seen.

With the exchange of the images between two windows by drag & drop, the zoom factors of the image stay the same.

By using the switches for full screen the full screen mode can be activated. The current image or all presented windows (by division of images) are scaled to the full screen size. The full screen mode can be quitted by using the Esc key.

3.2.3 Overlay

Display informations

Display annotations and measurements

Activating display shutter

Showing scout lines

Activating Bitmap Overlays

Overlay divides in the following areas:
▪ informations (in the image corners),
▪ annotations + measurements (e.g. measured sections or angles),
▪ „display shutter" (blanking everything outside the selection),
▪ bitmap overlays (overlay images)
▪ scout lines (presentation of the position of particular sectional images in CT und MRT series)

For each of these areas there is a switch in the toolbar, with which the area can be unhidden or hidden.

If an image is opened, in which a selection was set, or if a selection range is set by user, then the switch for "display shutter" is automatically set, so on, and user can turn this off or on using the switch.
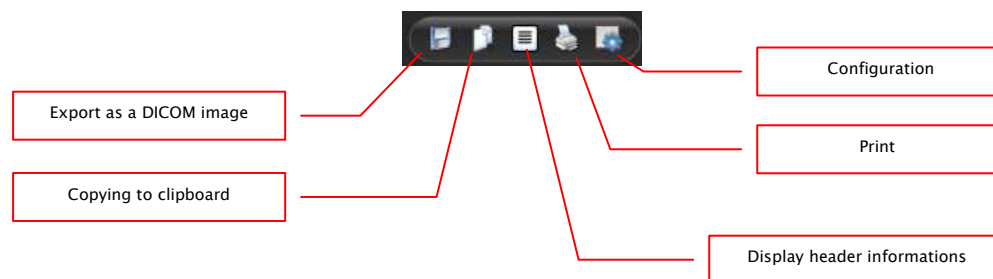
3.2.4 Image splitting
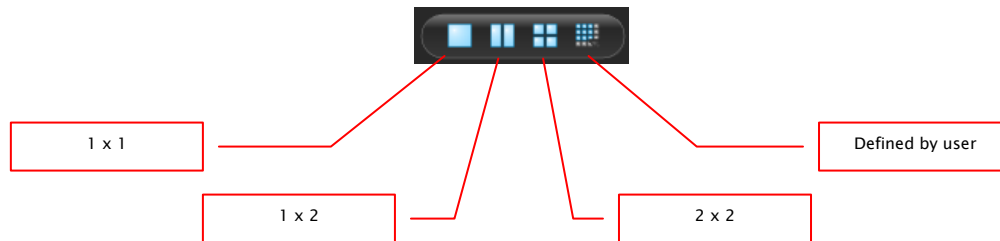
Large image display can present one or more images. How many images will be displayed, this can be selected by using these switches on the toolbar above the image display (1x1, 1x2, 2x2). Additionally the setting defined by user to maximum 6x6 can be selected by using the last switch, which also opens the small window.
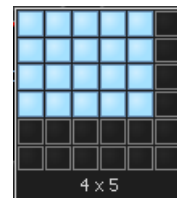
3.2.5 Other functions

3.2.5.1 Exporting images

The current image can be also saved as a DICOM file. Select this switch and afterwards the target place in dialogue for saving. The file will be saved at the desired point.

3.2.5.2 Clipboard

By using the switch for clipboard the current image in the current presentation form can be copied to clipboard. This means that the overlay objects (informations on image, annotations and measurements as well as display shutter) will be copied in the image too, provided that they are unhidden. If clicking this button is accompanied by coevally press on the Shift key, the image will be copied in its original size to clipboard.

3.2.5.3 Header informations (DICOM dump)

By using a switch on the toolbar a dialogue can be opened, in which the DICOM informations (tags) of the current image are displayed. These tags are sorted in groups for a better overview.

All tags, also private, are shown.

A modification of the values is not possible.

3.2.6 Marking images

In the right top of each image a small red field is placed. By clicking into this field (or Shift + left mouse button into the image), a red point appears there or disappears again, if it already existed. Each image with a red point is considered as a marked one. Additionally the marking is clarified by a shading over the entire picture, since the small red point is seen sometimes badly (e.g. if more images are presented or also on diagnostic monitors). Hiding the shading can be deactivated in the configuration (category Others). At the selection of images, e.g. for printing, all marked images can be used.

The marked image can be recognized on image selection bar on the left by a small red point, right in the top of the thumbnail.

3.2.7 Image protection (lock)

Moreover, a yellow field is also displayed under each red field. By clicking into this area the images can be protected (locked). Manipulations on images, as described here in this user's manual, do not affect the protected images. A lock symbol in the yellow field informs if the image is protected.

Protected image cannot be recognized in image selection.

3.2.8 Context menu

By right-clicking with the mouse into the image a context menu with important functions can be activated:

- mouse function: moving the image, windowing, dragging on the zoom rectangle, loupe
- zoom: window width, window height, window size, activating or quitting the full screen, zooming in, zooming out, original size (1:1)

- overlay: displaying informations, displaying annotations and measurements, activating display shutter
- examinations: list of examinations of the patients and, as a submenu, each time the image series of this examination (the first image of this image series is activated by activating the menu item)

3.3 Manipulation on images

To the right of the image display there is a window for image processing. Due to large number of image processings these are shared on the tabs, where these are arranged vertically and sorted according to the topics.

For CT and MRT images, the operations on images are automatically applied for the entire image series, otherwise each time for the active image.

Below the tabs there are switches for undoing the last actions and restoring the undone actions. Thereby the actions are displayed as text in tooltip. The actions refer each time to the active image. I.e., if the image is changed, one cannot undo the actions for it considering the circumstances and the switches therefore are deactivated.

For gray scale images the modifications on the images are stored.
For colour images the modifications are not stored, but they are only temporary. I.e., if you close the program, the adjustments/modifications on a colour image are getting lost.

By using the last switch „restore original image" all made modifications are deleted after a confirmation question and thus the original image is restored, as it is in the image archive.

3.3.1 Transformations (rotating, reflection, inverting)

The images can be rotated at the touch of a button 90° to the left, 90° to the right or 180°. They can be reflected horizontally and vertically and also inverted.

Each operation can be undone as well as redone by using both arrows in the bottom.

3.3.2 Windowing

Windowing is a usual method for the preparation of grey scale images. For colour images, windowing is deactivated. By entering window center and window width, the grey scale range will be selected, which is to be presented. These values are adjustable each time by using the sliders or input fields. Furthermore, the settings can be used quickly from the list of presets.
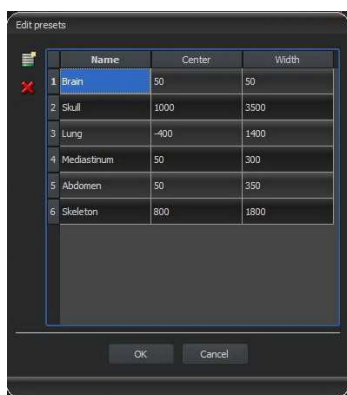
The modification of these presets or adding the presets defined by user is possible thereby via dialogue, which appears after the button „Edit presets…" has been pressed on.

Also the contained default settings therein can be modified or deleted by user (they are not write protected).
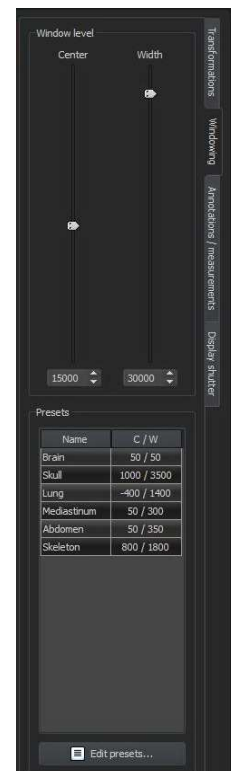
3.3.3 Annotations / measurements

The misalignments of length and angle measurements may be caused by modality or image acquisition!
Default calibration can be always only as exact as the length evaluation of the imaging modality. Therefore, the length evaluation must be verified for connecting a modality.
However, the misalignments may be also caused by an exposure – particularly if conventional radiography (CR), i.e. of pelvis or ilium is considered. The distance of the exposured part of the body from the imaging plate skews the presentation of length on a 2D radiograph. Also if scale (sphere) is withal x-rayed, there is a misalignment, insofar as the scale at the exposure is not exactly at the same level with the measured part of the body.

Under the annotations come lines, arrows, rectangles, ellipses, polygons and text. Thereby the rectangles, ellipses and polygons can be also drawn filled out. Explanations how the objects are to be drawn using the mouse, are each time displayed after the selection is made, i.e. after clicking the switch below the buttons.
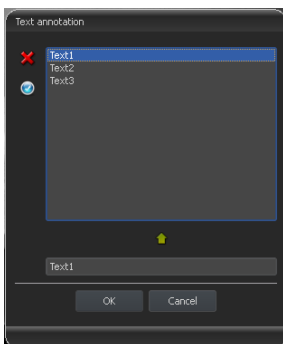
After the text is selected, first a dialogue appears, in which new texts can be added to the list of standard texts (enter text in the input field and then press a green arrow) or the text from this list can be selected (double-click or click and Ok) or desired text can be entered (enter text in the input field and press Ok), which will be then used and placed on the image. You can specify yourself a standard entry which is then already activated, after you activate the dialogue.

Under measuring comes measuring of the sections and angles as well as measuring of the content of the area of rectangles, ellipses and polygons.
The measuring of an angle can follow thereby by entering 3, 4 or n points. For n points, the n angles will be measured.
By clicking the switch „Rectangle", „Ellipse" or „Polygon" at the bottom of the measuring range while pressing the Shift key the densities can be measured. Thereby, an actual average grey scale value from the original pixel values as well as minimum and maximum grey scale value will be required. For colour images, the normal area measurement will be performed.

User can delete the drawn in annotations and measurements with the switch „Delete all" from the overlay of the image. Deleting or subsequent modifying of particular objects is not possible.
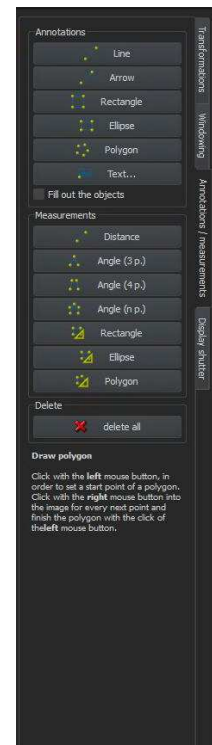
Settings for drawing the graphic objects in the overlay can be set in the configuration, category Overlay.

3.3.4 Display shutter

For each image, the different selections zones in the form of a rectangle, ellipse or polygon can be defined. Thereby, for each type exactly one object is possible, whereby the types can be also used together. Explanations for drawing using the mouse are displayed below the buttons, after the adequate button is pressed on.

Setting up the selection zone of a certain type replaces a potentially already existing selection zone of this type.

Everything outside this zone, which has been defined in this way, can be hidden and unhidden by using the switch in the toolbar („Display shutter" in the overlay options).

The objects can be individually deleted again.
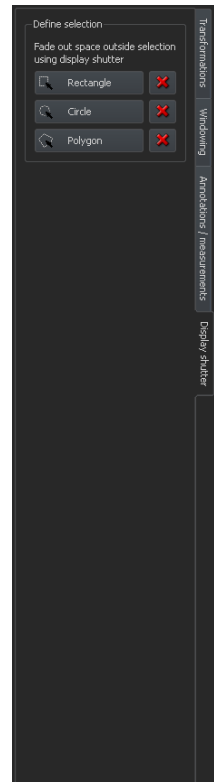
3.4 Scout lines

By the scout lines (localizer), there is position of particular sectional images of the CT and MRT series presented. The position of images of any other image series in relation to the active image is thereby visualized.

Before you open a series, you should modify the image splitting so that you can view the particular series next to each other. Then open each series in a field. If the presentation of scout lines is activated, the scout lines will be shown automatically. Click in a series and scroll with the mouse wheel through the images of this image series. The position of the current image is shown in another series as a projection line or as a plane. You find the settings for the presentation of scout lines in the section Overlay / Scout lines in the chapter 5 Configuration.

3.5 Histogram

Below the image or the images, there is a histogram window, which displays always the histogram of an active image. By shutting down the histogram window can be also completely hidden.
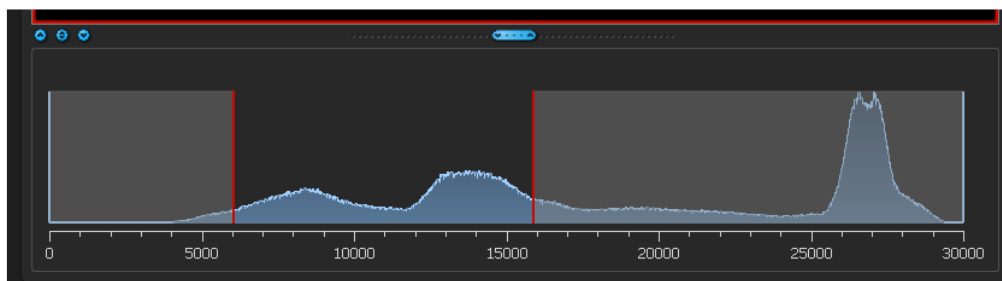
For colour images, a red, green and blue curve for the channels R, G and B of the image are displayed. For grey scale images, a blue curve (like presented on the image above) for spreading of grey scale values is displayed.

In the histogram for the grey scale images the current setting for windowing is always displayed and can be here also modified. The left and right zones of the visible window space are thereby lightly coloured, so that this is clarified. The red lines show the edges and are coincidentally the sliders, for modifying window edges. The performance of windowing can be improved with a higher histogram smoothing. The smoothing can be changed in the configuration page histogram. See section 5. The window can be completely moved by clicking with the mouse into the space between the red lines and then moving using the mouse.

A zoom rectangle for zooming in the histogram can be dragged on by dragging with the mouse with Shift + left mouse button. With the right-click into the histogram the full size can be displayed again.

Settings for work with the histogram can be set in the configuration, category Histogram.

4 Printing
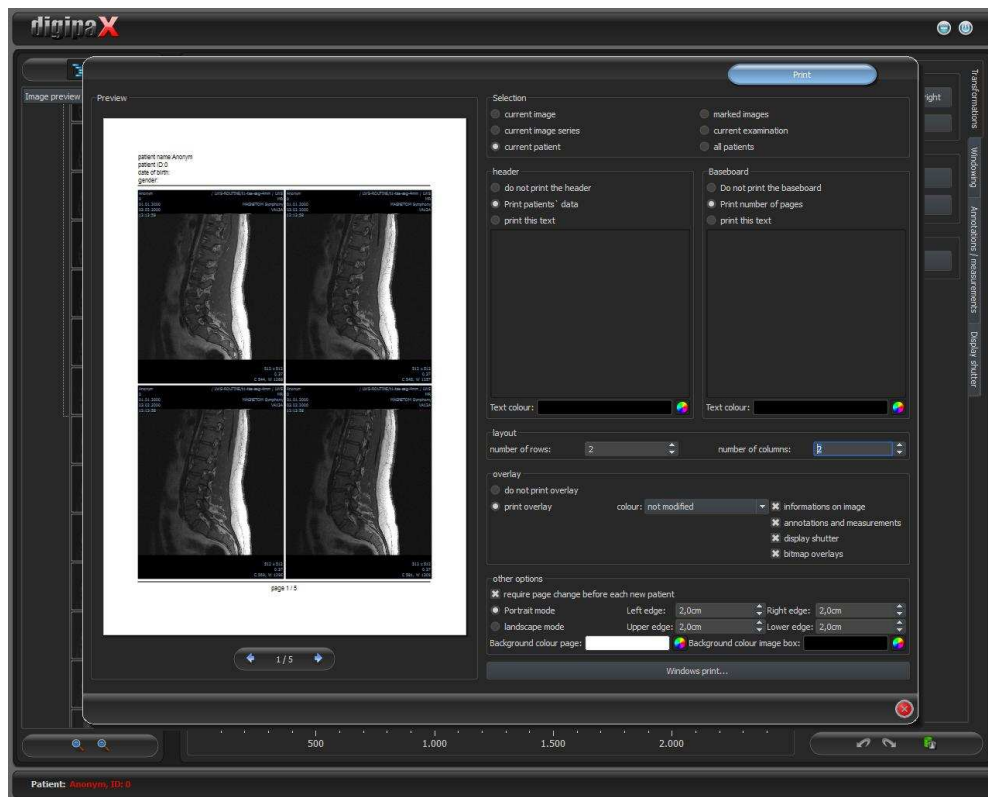
If about printing, current image and many images can be printed at a time as well. This is determined in the group „Selection".

The header row, if activated, will be always printed at the top edge of the page, in a fixed defined size and fixed defined font type. These cannot be modified. Standard image informations with the patient data can be printed as well as self defining text. Colour of the text is selectable.

If activated, the baseboard will be always printed at the lower edge of the page in a fixed size and in a fixed type of font. Those also cannot be changed. The number of pages or a self defined text can be printed. Here also colour of the text is selectable.

Many images per page can be printed. Number of rows and columns can be set thereby in the group „Layout".

For overlay it can be selected, whether this is to be printed over the image or images, or not. Overlay objects can be possibly difficult seen if printed, so it can be selected, whether overlay is to be printed black, white or unmodified. Unmodified means hereby that overlay will be printed in such way, like it is presented on the monitor. Display shutter will be always presented in the set colour (configuration). Bitmap overlays will be presented in the same colour like on the screen.

If the images of different patients are to be printed, the changing page before each new patient can be required (recommended). In this way, it cannot come to mistaking as patient data of the patient, which belongs to the first image on the page, are always displayed. Thus on each page the correct patient data are shown.

Furthermore, the page alignment and the page edges can be defined in other options as well as the colour of background of a page or background of image boxes into which the images are to be integrated.

All modifications made on the right side of settings, act immediately on the presentation on the left side of the preview. Number of pages is always updated too. You can navigate with the arrow-switches between the pages. All settings are stored, so that these settings will be used equally at the next selection of printing components (also after restarting the program).

With the button „Windows-Print…" follows the printout on a usual Windows printer. This can be selected in the following thereafter print dialogue and also the pages that are to be printed can be defined optionally if the print job contains more pages.

During the preparation and transferring print data a progress bar is displayed. If many pages are to be printed, this process can be cancelled with the button „Cancel". After the print order is ready, an adequate message appears.

5 Configuration
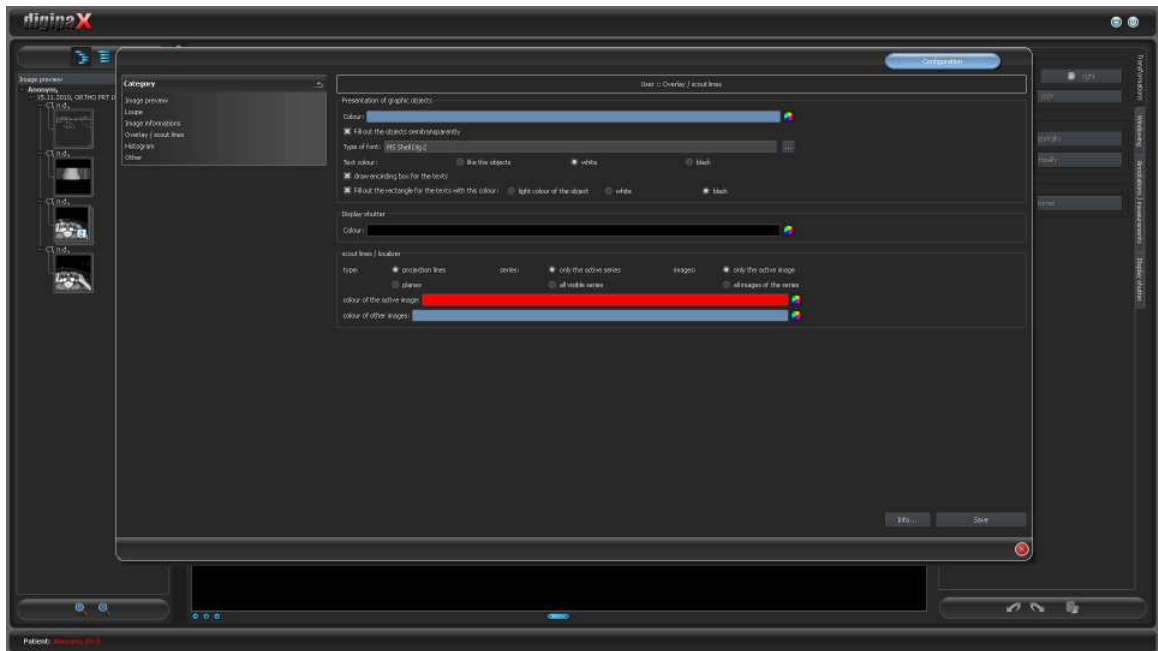
There is a central place for the program configurations with a page for each program group. By using the switch „Info…" the informations on product can be displayed.

Following settings can be made in the configuration:

▪ **image preview**
List view preview tree: selection of tags, according to which the images are to be sorted, sorting direction and definition of a displayed text in image nodes (the same principle as for informations on image)
The following tags can be used for sorting or displaying:

0x0008, 0x0016	SOPClassUID
0x0008, 0x0018	SOPInstanceUID
0x0020, 0x0013	InstanceNumber
0x0008, 0x0023	ContentDate
0x0008, 0x0033	ContentTime
0x0028, 0x0008	NumberOfFrames
0x0008, 0x0022	AcquisitionDate
0x0008, 0x0032	AcquisitionTime
0x0028, 0x0002	SamplesPerPixel
0x0028, 0x0010	Rows
0x0028, 0x0011	Columns
0x0028, 0x0101	BitsStored
0x0008, 0x0008	ImageType
0x0054, 0x0400	ImageID

Display mode image series: alternatively, all images of one image series are displayed in a preview tree or only one image of the series is displayed (this is adjustable separately

for each type of image) – first select on the left an adequate modality, i.e. CT, and then on the right, which settings for this type of image are to be applied (all images or only the first, middle or last image of the series)

- **Loupe**

Rectangle: usage of a rectangle loupe in the viewer with the specified pixel measures or automatic size

Circle: usage of a circle loupe in the viewer with the specified diameter or automatic size

Automatic size: width and height of the rectangle or diameter of the circle will be set for a third of a current window width or window height of the image window, depending on that which value is smaller

Zoom factor: zoom factor for the image cutout, which is presented in the loupe (referring to original image)

- **Informations on image**

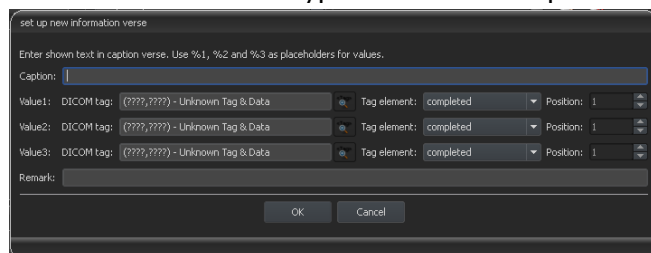*Text colour*: colour with which the informations in the image corners are to be shown

Font type: font type for presentation

Zoom factor: with it font type can be adapted (font size adapts also automatically to window size)

Shaded: the writ can be possibly poorly seen on the images with the white background, so with this option a shadow can be backed – if the images are black or dark, this is not hardly seen

Group elements: for each type of image (modality) you can determine which informations are to be shown in the overlay corners. First select the desire type and next the option „use these settings", if the default settings are to be used. Click into the desired box, in order to determine the corner of the displaying and next the switch „new entry in active field", in order to add an element to this box. In the caption row you can enter any desired text, which should appear on the images. Use %1, %2 and %3 as „Variables" (place holders). These will be exchanged by the defined DICOM tags in the display. You can also let display only a part of the tags if needed, i.e. a part of the person name or the value at the determined place for tags, which allow many values (multiplicity). By a double-click into the entry in the list fields or with the switch „process active entry" you can delete these. Use the switch „delete active entry", in order to remove this from the list. If you want to move or copy the entries within a list field or between the list fields, you can move these with the pressed left mouse button (drag & drop). For this, hold the Shift key pressed on, in order to move the entry. Without Shift this will be copied.

Overlay / scout lines

Presentation of graphic objects:

Colour: the colour for drawing the graphic objects

Fill out the objects semitransparently: while drawing filled out image objects, these will be drawn semitransparently, if this option is activated, so that you can recognize the image behind it, otherwise they will filled out fully with the above colour

Font type: font type, which is to be used for text objects

Text colour: with the above selected colour, white or black

Draw encircling rectangle for texts: if this option is activated, an encircling rectangle for the texts in the above selected colour for graphic objects will be drawn; thereby these can be better read in certain circumstances

Fill out rectangle for text with this colour: if this option is activated, the encircling rectangle for text objects will be filled out with the selected colour (the above selected semitransparency will be also used), otherwise the rectangle will not be filled out an the image will be seen; the same colour can be used like fort he objects (lighter), white or black

Display shutter:

Colour: the colour, with which the hidden areas are to be overlaid

Scout lines:

Type: "Projection lines" – with this option, only intersection lines of the images resp. projections of edges are presented; "Plane" – with this option the images are shown as sectional plane three-dimensionally.

Series: "Only active series" – with this option, only projection lines resp. planes of an active series are shown; "All visible series" – with this option projection lines resp. planes of all visible series are shown – **Note:** This option works not until the option "All images of the series" is activated.

Images: "Only active images" – with this option, only projection lines resp. planes of an active image are shown; "All images of the series" – all projection lines resp. planes of the series are shown.

Colour: colour, with that the active image, and colour, with that other images are presented.

- **Histogram**

  Shorten left and right: with this options, the values in the left and right edge of the histogram will be set on the maximum value between them, so that the display of the whole histogram is well possible in the window. If the important areas will be thereby cut off or the values between these limits are still presented too small, the size can be accordingly reduced or enlarged.

  Sooth histogram for display: smoothes the histogram for displaying with the set number of runs. The images will be not smoothed thereby. This is used only for better presentation of the histogram.

  Values: on the x-axis only the values will be shown, which are actually used in the image, or all values, which could appear based on the colour depth of the image

- **Others**

  User interface: different possibilities for presentation

  Position of toolbars: for the monitors in portrait mode the placing on the left is recommended – this happens automatically or can be determined explicitly

  Toolbox height (window placing): for the monitors in portrait mode a short toolbox and wider bottom working bar (histogram) is recommended – this happens automatically or can be determined explicitly

  Mouse function windowing: synchronic with the below displayed histogram or transposed, in order to retain the usage from another system

  Scroll mode images: images can be changed with mouse scroll. This setting specifies,

whether thereby only one image series can run, change also over the limits of an image series can follow and therefore all images of an examination can run or even over all images of a patient, so over the limits of an examination to the next examination

Presentation of zoomed images: if this option is activated, the pixels will be zoomed in and no smoothing follows (the images operate pixelated, details can be seen better in certain circumstances); if the option is activated, the strongly enlarged images will be smoothed (the images operate milder; details can blur in certain circumstances)

Presentation of marked images: showing or not the blur for marked images (if not, only a red point in the top right corner)

Informations / messages: for some actions the tips in a small window in the bottom right monitor edge are output – display duration can be set here or these messages can be deactivated completely

6 Others

6.1 Tooltips

The most buttons, data or configuration fields contain so called „tooltips". If you move the mouse over a field without clicking it, after short while a small help–window at the mouse position appears. In this way you receive the informations on this field – action, which can be performed via this field or meaning of the configuration possibilities.

6.2 Exiting the program

You exit the program with the symbol ⏻ in the top right corner of with Alt + F4.