Raw_Header
User's Manual

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Raw_Header USER'S MANUAL

Raw_Header
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1 The Raw Header Program

The TomoVision's libraries can recognize a large number of medical image format. Unfortunately, it can not recognize all of them. Raw_Header provide a mechanism to help read some of the image format that the libraries would otherwise be unable to read. As long as the image data is uncompressed, Raw_Header should help you to make some sense out of it.

In order to read the image, we need to generate a new header that will enable the libraries to understand the image data. Raw_Header creates this header. The image file is not modified, a second file, with the extension ".hdr", is created instead containing the new header information.

Raw_Header can also be used to modify the information from images that can be read by TomoVision's libraries. If you create a new raw header for these images and access these images through the new header, the information from these new headers will be used.

The Section Tabs

| File Format | Image Format | Image Geometry | Patient Info |

The raw header is composed of 4 sections: The File Format, The Image Format, the Image Geometry and the Patient Info. The Image Format can be defined either numerically or graphically. The 4 tabs will control which of these sections you are manipulating.

The Program controls

| Open File | Current File: ◁ | unknown-data | ▶ |
| Apply to All Files | Write Headers | Exit |

At the bottom of the window are tools present in all sections.

Open File Call a Window's "File Open" interface to open one or more new images in the Raw_Header program. Alternatively, you can drag and drop files in the Raw_Header window to open new images.

Current File Select the current image from a list of all the opened images. The image list cycles through the images that have been opened in the program. The File Format, Image Format, Image Geometry and Patient information sections enable you to change the header of the current image.

Apply to All Files You can apply the File Format, Image Format, Image Geometry and Patient Info. of the current image to all the other images presently opened in the program. The program will assign origins to the images to create a 3D data set according to the information provided in the Image Geometry section. Care should be

taken that the images are opened in the same order as the order specified with the "Image Ordering" buttons of the Image Geometry section.

Write Headers The program will create 1 new header for each opened image. The header will have the same name as the opened image but with the ".hdr" extension.

Exit Exit the program.

At typical ".raw" file look like this:

```
magic:RAW_DATA
x:512  y:512  z:1
pixel_size:16
pixel_plane:1
pixel_sign:0
pixel_swap:0
pixel_pading:-32769
file_offset:3072
image_offset:0
file_name:ct1
inc_x:0.4375
inc_y:0.4375
inc_z:5.0000
thickness:2.5000
org_x:-2.2000
org_y:-5.7254
org_z:89.8273
dir_h_x:0.0000
dir_h_y:-1.0000
dir_h_z:0.0000
dir_v_x:-1.0000
dir_v_y:0.0000
dir_v_z:0.0000
axis_syst:0
axis_trust:1
slice_orientation:Axial
serie_num:"289"
image_num:"12804"
patient_name:"Anonymous"
patient_id:"123456"
hospital:"St Glinglin Hospital"
physician:"Anonymous"
```
Sample ".raw" header file

1.1 The File Format tab

This section is split in 4 regions: Image Format, Pixel Format, Image Format Suggestions and an Image preview.
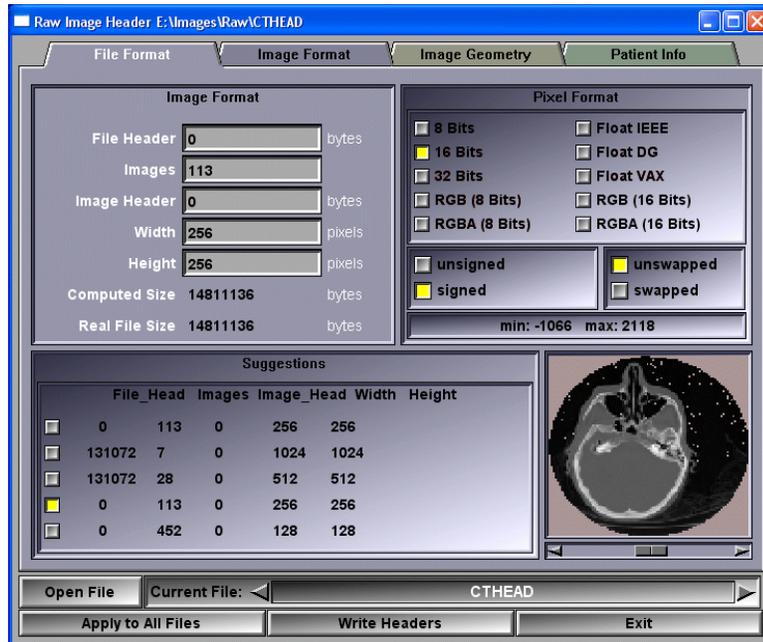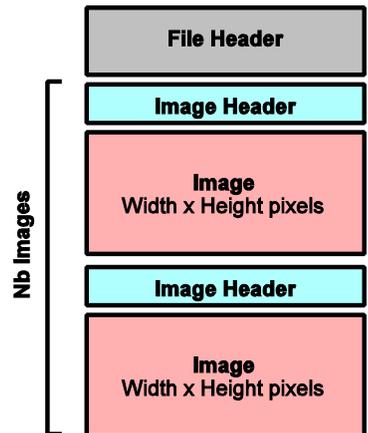

Image Format In this region, you can change the image file structure information. The image file is composed of a file header, followed by a series of images. Each of these images has an image header followed by the image itself. The image is Height by Width pixels. This region also provides information on the file size computed from the information and the actual file size. If the computed size is in red, this means that the number of bytes needed to create the image specifies by the structure is larger than the actual number of bytes in the file!

Pixel Format In this region, you can specify how each pixel is stored in the image. Each pixel can be stored as an integer value using 8, 16 or 32 bits, or a float value using 32 bits (the program can recognize 3 float formats: IEEE, Data General or VAX), or a color value using 3 or 4 components of 8 or 16 bits each.

1. For 8, 16 and 32 bit integer values, the value can be either signed or unsigned.

2. If the pixel is 16 or 32 bits integer values, the bytes representing the pixel can be LITTLE ENDIAN (unswapped) or BIG ENDIAN (swapped).
3. If the pixel is a float value, then the byte order of the value can be ABCD, DCBA, CDAB or BADC.
4. If the pixel is created with 3 color components, then the image can be represented by Width x Height color pixels of 3 bytes each, or by 3 planes of Width x Height pixels, each plane constituting a separate color. The order of the colors components can be either RGB (unswapped) or BGR (swapped).
5. If the pixel is created with 3 color components, then the image can be represented by Width x Height triplets of colors, or by 3 planes of Width x Height values, each plane constituting a separate color.
6. If the pixel is created with 4 color components, then the image can be represented by Width x Height color pixels of 3 bytes each, or by 3 planes of Width x Height pixels, each plane constituting a separate color. The order of the colors components can be either RGBA (unswapped) or ABGR (swapped).
7. If the pixel is created with 3 color components, then the image can be represented by Width x Height triplets of colors, or by 3 planes of Width x Height values, each plane constituting a separate color.
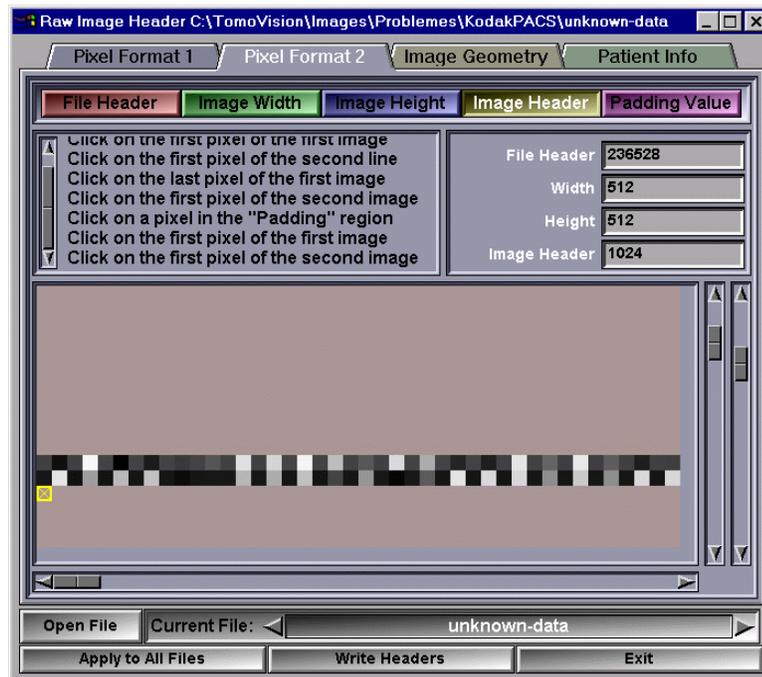
To help finding the correct combination, the minimum and maximum values of the pixels is computed. The combination that yield the lowest dynamic range is usually the correct one.

Suggestions Once the program knows the pixel format, it can make a few guesses about the image format. The program assumes that the images are square, that they have dimensions that are powers of 2 and that the images are at the end of the file. From that it creates a list of suggestions. Clicking on one of these suggestions will fill out the Image Format region with the corresponding values.

Image Preview Using the Image and Pixel Formats, the program displays a preview of the image in this region. If the file has more than 1 image, a slider at the bottom of this window will enable you to view all the images.

1.2 The Image Format tab

It is sometime difficult to find the correct image format using only a numerical interface. This section enables you to specify the image format graphically. The interface of this section is composed of: a list of buttons for the current parameter, a text feed-back region, a numerical image format input region and a graphical input region.

Current Parameters These buttons are used to specify to the program which of the parameters you want to fix. The mouse wheel can be used to change the value of the currently selected parameter.

Text Feedback The text in this region should help you fix the parameters

Numerical Input Once you fix a parameter graphically, its value will be displayed here, inversely, you can enter the numerical value of the parameter and see the results in the graphical input region. These values are shared with the Pixel Format section.

Graphical input This region is composed of a graphic window, a vertical and horizontal scroll bar, and a scale slider (extreme right). The scale slider is used to scale up or down the image in the graphic window. If the image does not fit entirely in the graphic window, the vertical and horizontal scroll bars can be used to scroll the image.

The image will show you a representation of all the pixels in the file. Each byte from the file that is not used to create the "image" is represented by a black & white pixel. The colors range from black for a byte of value 0 and white for a byte of value 255. If there is an uncompressed image in the file, it should be easy to discern its pattern. You then have to click on the different pixels of the image:

File Header
You click on the first pixel of the image. This will fix the size of the file header. Note that the first image actually starts after the file header and the first image header. As long as the image header is not known, it is assumed to be 0. To help in the image information identification, the pixels following the file header will be displayed using the "Pixel Format" defined in the Pixel Format section.
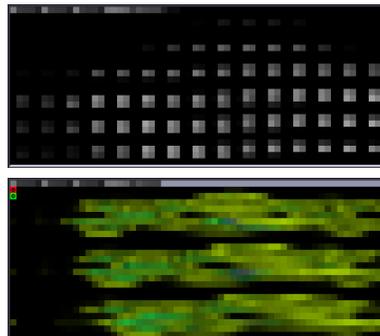
Image Width
You click on the first pixel of the second line of the image. This will fix the width of the images.

Image Height
You click on the last pixel of the image. This will fix the images height.
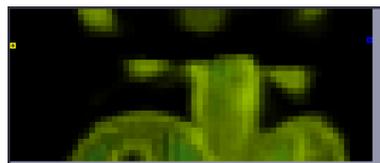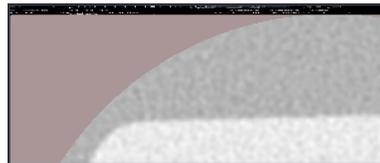
Image Header
You click on the first pixel of the second image. If your file has more than 1 image, this will fix the size of each image's header.
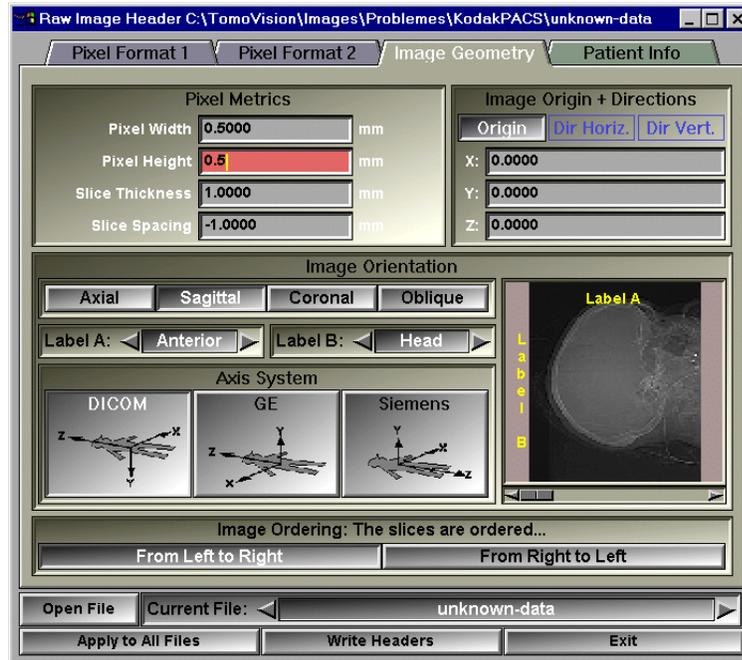
Padding value
You click on a pixel inside the padding region of the image. For some image modality like CT, the actual image is surrounded by a "padding" to make the image square. The pixels from this padding will usually mess up some image computation like histograms and dynamic range.

x

1.3 The Image Geometry tab

In this section, you will be able to specify the physical dimensions and orientations of the image. This section is composed of 4 regions: the Pixel Metrics, the Image Origin, the Image Orientation and the Image Ordering.

Pixel Metrics
This region will specify the physical dimensions of a pixel in the image. We need its width and height in mm, the slice thickness, and if you want to create a 3D data-set, you need the spacing between each slice. This value will be used to fix the other image's origin if you use the "Apply to All Files" button. The sign of the slice spacing is affected by the axis system and the image ordering information.

Image Origin
This region is used to specify the position of the bottom left corner of the image. The values are specified in the patient's 3D coordinates system. If the image orientation is oblique, we will also use this region to specify the horizontal and vertical orientation of the image.

Image Orientation
The image can be either Axial, Sagittal, Coronal or Oblique. The "Label A" is the label at the top of the image, the "Label B" is on the left side of the image. Their values can be one of: "Unknown", "Anterior", "Posterior", "Head", "Feet", "Left", "Right". You also have to select the axis system that you want to use for this image. You have a choice among the 3 most popular axis systems for medical scanners.

Image Ordering   The image ordering, in conjunction with the slice spacing, will be used to compute the image origin of the other opened images if you click on the "Apply to All Files" button.

1.4 The Patient Info

This section will enable you to add (or edit) the patient information to the image. It has 2 regions, one to enter the study, series and image numbers of this image, the other to enter the textual information associated with the image.

2 The Header File Format

The Header file format is loosely based on the university of Waterloo IM format.

The header is entirely composed of lines of ASCII text. Each line is terminated by the characters <CR> and <LF> (0x0D and 0x0A).

Everything on a line following a "*" or a "#" will be considered as comments and can be disregarded by the program.

The header is composed of a series of keywords value pairs. The keyword and values are separated by ":". Each pair of keyword and values are separated by one or more separation characters. The recognized separators are: " " (space), "," (comma), "\t" (tab) or "\n" (new-line). If a value contains a space, it should be placed between quotes.

Example: file_name:"file name with spaces in the name"

You can use lowercase or uppercase indifferently in the keywords, the program converts all the keywords characters to uppercase before parsing the header. However, the values are case sensitive.

The first keyword/values pair should always be:

magic:RAW_DATA

The recognized keywords and their permitted values are:

From the File Format page

x:	Horizontal resolution (in pixels)
y:	Vertical resolution (in pixels)
z:	Number of images in the file.
pixel_size:	Number of bytes per pixels. The accepted values are 8, 16 and 32
pixel_plane:	Number of pixel planes. The accepted values are 1 for B&W images, 3 for RGB images and 4 for RGBA images.
pixel_sign:	0 if the pixel values are unsigned, 1 if they are signed.
pixel_config:	Used only for float and color pixels. If pixel plane is 1, then a value of 1 is used for IEEE floats, 2 for Data General floats and 3 for VAX floats. If pixel plane is 3 or 4, then 0 means that each pixel is created from 3 (or 4 for RGBA) consecutive

	values and 1 means that the pixels are represented by color planes.
pixel_swap:	For 16 and 32 bit integer pixels, 0 means a LITTLE ENDIAN pixel value, and 1 is BIG ENDIAN. For float values the 4 configurations of the 4 bytes used to create the float value are possible: 0=ABCD, 1=DCBA, 2=CDAB and 3=BADC.
pixel_pading:	This is the value used to fill out any portion of the image outside the field of view.
file_offset:	Number of bytes to skip at the beginning of the image file
image_offset:	Number of bytes to skip at the begnning of each image in the image file.
file_name:	Name of the file containing the pixel data. This file must be in the same directory as the header file.

From the Image Geometry page

inc_x:	Horizontal distance between each pixels
inc_y:	Vertical distance between each pixels
inc_z:	Distance between each slice
thickness:	Thickness of each slice
org_x, y and z:	Position in coordinate system of the center of the upper left pixel.
dir_h_x, y and z:	Components of the horizontal direction vector (from left to right).
dir_v_x, y and z:	Components of the vertical direction vector (from top to bottom).
axis_syst:	0=DICOM system, 1=GE system, 2=Siemens system
axis_trust:	1 if the left and top label have been defined
slice_orientation:	The accepted values are: Axial, Sagittal, Coronal and Oblique

From the Patient Info page

study_num:
serie_num:
image_num:

patient_name:
patient_id:
patient_age:

patient_sex:
patient_weight:
hospital:
physician:
radiologist: