*GE Medical Systems*
*Kretz Ultrasound*

# User Manual

**Direction KTI105960**
**Revision 1**

# 4DView Version 4.x

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**User Documentation**

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# Revision History

Table i-1: Reason for Change

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|---|---|---|
| Rev.1 | 13.12.2004 | First Release |
| | | |
| | | |

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# Chapter 1

# Safety Regulations

## 1.1 Safety Regulations

The software package 4D View has been developed for use on a PC under the operating system Microsoft® Windows 2000®. GEMS Kretztechnik is not liable for any defects if 4D View is installed on any other operating system than Microsoft® Windows 2000®.

**ATTENTION!**

Under conditions of patient contact, if the data transfer takes place directly from the ultrasound scanners Voluson® 730 series to the PC, or the PC is connected to the Voluson® 730 series ultrasound scanner, the following safety precautions must be considered:

The limits for leakage currents of the complete system (PC and Voluson® 730 series machine) must comply with the requirement of IEC 601-1/UL 2601-1.

Additionally, if the Voluson® 730 series ultrasound scanner is connected to a computer network, an isolated signal link, according to IEC 601-1/UL 2601-1, must be used.

GEMS Kretztechnik is not responsible for improper use of this product or its installation in combination with other software applications.

For safety instructions concerning measurements see *"Calculation Method and Accuracy"* (Section 13.3) in the help file.

The user (physician or hospital) is responsible for compliance with these safety regulations.

CAUTION: UNITED STATES FEDERAL LAW RESTRICTS 4D VIEW TO SALE BY OR ON THE ORDER OF A PHYSICIAN.

GEMS Kretztechnik is not responsible for proper functionality of the operating system Microsoft® Windows 2000® and PC hardware components.

## 1.2 Sicherheitsbestimmungen

Das Softwarepaket 4D View ist für den Betrieb auf einem PC unter dem Betriebssystem Microsoft® Windows 2000® entwickelt worden. GEMS Kretztechnik ist nicht verantwortlich für mögliche Probleme die durch die Installation von 4D View auf einem anderen Betriebssystem als Microsoft® Windows 2000® entstanden sind.

**ACHTUNG!**

Erfolgt die Datenübertragung direkt von dem Ultraschalldiagnosegerät der Voluson® 730 Serie zum PC, oder ist der PC mit einem Ultraschalldiagnosegerät der Voluson® 730 Serie mit Patientenkontakt verbunden, ist folgendes zu berücksichtigen:

Die Grenzwerte für die Ableitströme der Norm IEC 601-1-1/UL 2601-1 müssen eingehalten werden. Die Trennung vom Versorgungsnetz muss entsprechend IEC601-1/UL 2601-1 ausgeführt sein.

Zusätzlich muss beim Anschluss eines Computernetzwerkes an das Ultraschalldiagnosegerät der Voluson® 730 Serie eine isolierte Signaltrennung entsprechend IEC601-1/UL 2601-1 verwendet werden.

GEMS Kretztechnik übernimmt keine Verantwortung für die unsachgemässe Verwendung dieses Produktes oder für die Installation zusammen mit anderen Programmen.

Für Sicherheitshinweise zum Thema Messen siehe *"Calculation Method and Accuracy"* (Section 13.3) im Hilfetext.

Der Arzt oder das Krankenhaus ist als Betreiber für die Einhaltung der Sicherheitsbestimmungen verantwortlich.

4D VIEW DARF AUSSCHLIESSLICH VON AUSGEBILDETEN AERZTEN UND VON IHNEN EINGEHEND GESCHULTEM PERSONAL ANGEWENDET WERDEN.

GEMS Kretztechnik übernimmt keine Verantwortung für das ordnungsgemässe Funktionieren des Betriebssystems Microsoft® Windows 2000® und der PC-Hardwarekomponenten.

# Chapter 2

# Introduction

## 2.1 Introduction to 4D View

Thank you for buying 4D View. It is recommanded to read the following pages before using or installing 4D View on the system.

4D View can be used to view and work with data produced with the GEMS Kretztechnik ultrasound scanning machines from the Voluson® 730 series. These data are saved to files of a special format, the GEMS Kretztechnik volume file format.

A series of volume files are included on the setup CD-ROM disc as *demo cases* (Section 4.1) for a first evaluation of the possibilities of 4D View. Additionally, demo cases in the GEMS Kretztechnik volume file format can be downloaded from "http://www.sonoportal.net."

For transferring volume files from a Voluson® 730 series ultrasound machine to a PC with 4D View there are three possibilities:

- Sending via a *DICOM* (Section 3.7) connection with *Storage SCP* (Section 23.7) as DICOM storage server.
- Save the volume file on the Voluson® 730 series machine, *export it using SonoView*$^{TM}$ (Section 22.3.8) and load it with 4D View.
- Save the volume file on the Voluson® 730 series machine, then make a *backup using SonoView*$^{TM}$ (Section 22.3.9) and *restore this backup* (Section 22.3.10) on a PC with 4D View. In this case it is important not to mix data from more than one Voluson® 730 series machines, because volume files and images might be assigned an erroneous Patient ID.

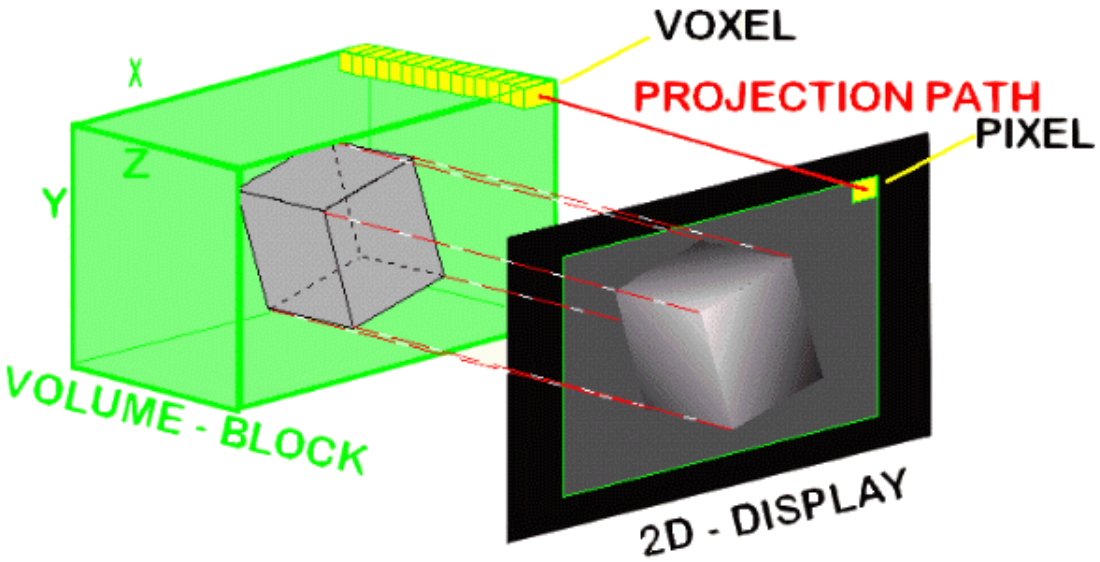
# Chapter 3

# Principle Explanations

## 3.1 What is Volume Rendering

Volume rendering is a calculation process for visualizing certain 3D structures of a scanned volume by means of a 2D image. The gray value for each pixel of the 2D image is calculated from the *voxels* (Glossary) along the corresponding projection path (analyzing beam) through the volume.

The render (calculation) algorithm - surface, transparent or color mode - determines in what way certain 3D structures are visualized.



## 3.2 What is Interactive

Interactivity means that the effects of every operation/adjustment influencing the result of the rendering process can be seen in real time.

Fast hardware and intelligent software enables the calculation of about 25 volumes per second depending on the size of the render box.

After any operational step, the initial result is rendered at a lower resolution in order to accelerate interactive feedback. As soon as no new operation is performed, the result is rendered at a high resolution.

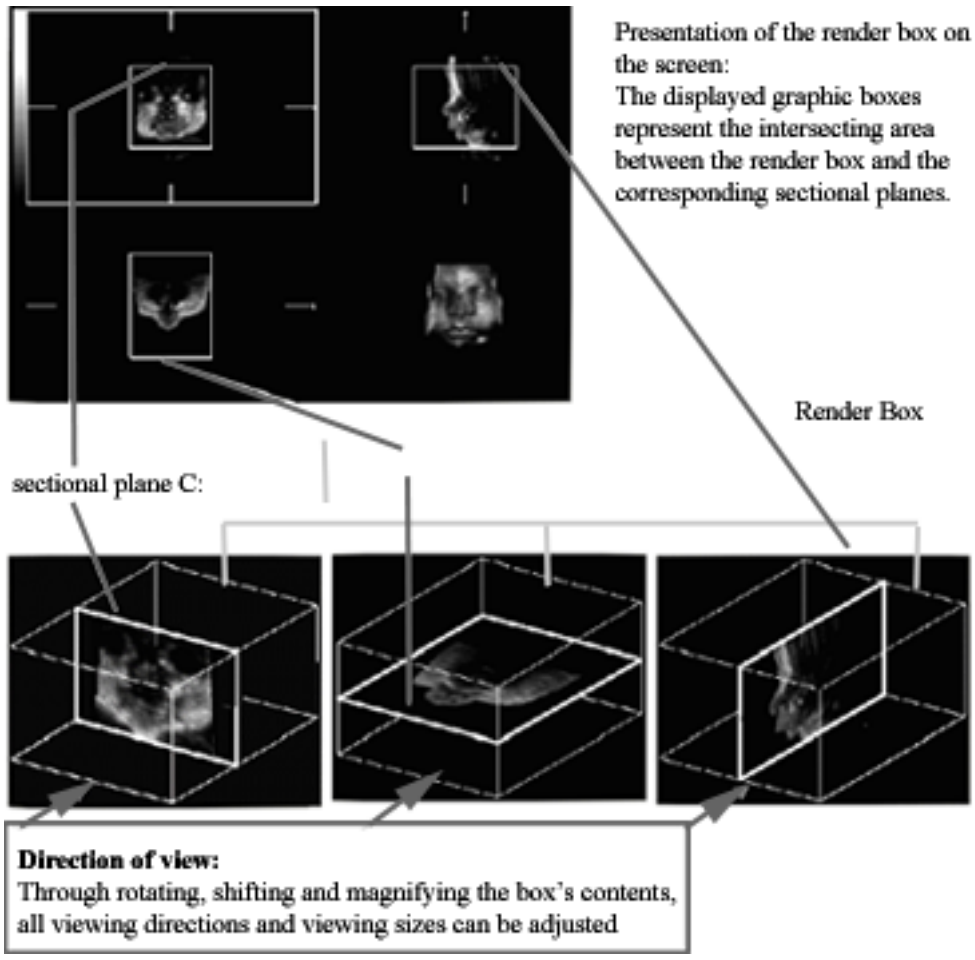
## 3.3 The Render Box (Region of Interest - ROI)

The following three points are very important for a good 3D image (similar to photography):

- The direction of view.
- The section/size of the view.
- Free visibility at the object (surface mode).

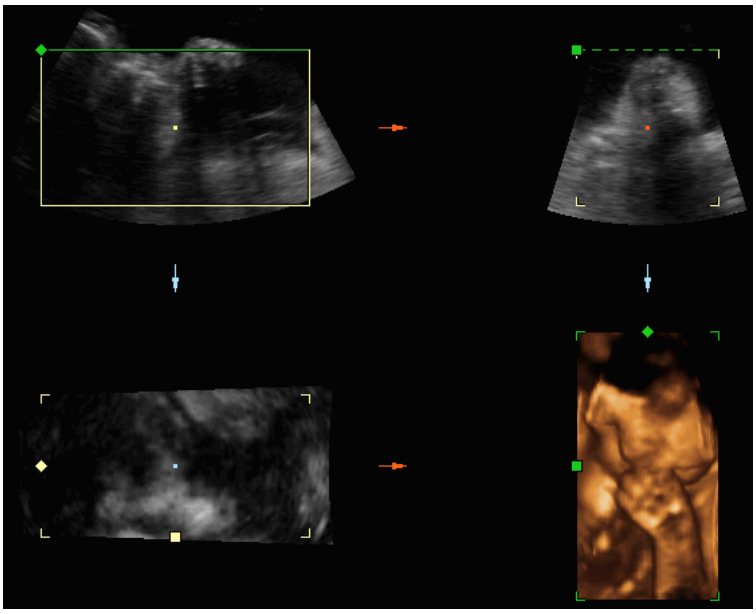
The correct adjustments are made using the render box. The render box determines the contents of the volume box which will be rendered. Therefore, objects which are not inside the render box will not be included in the render process and cut off (it is important to cut off objects which interfere with free visibility in surface mode). The positioning of the box within the scanned volume is done with the help of the orthogonal sectional planes A, B and C, which slice the box in the middle in all three directions.

Study the following diagram in order to understand how the render box determines the direction of view:

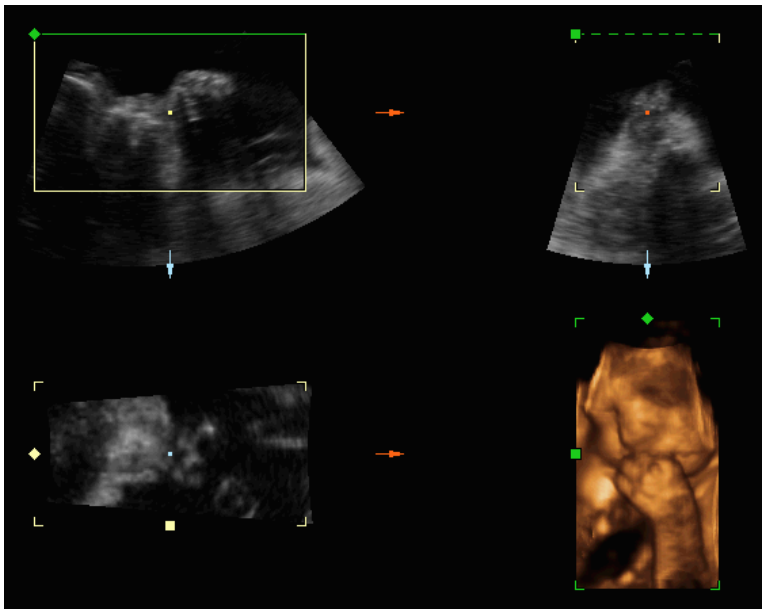


Study the following two sample images in order to understand how the render box determines the appearance of the rendered volume:

1. Original appearance, the skin of the hand is cut off and the bones of the hand are rendered.



2. Render box position changed: the skin of the hand is rendered now.



For more information, review *"How to Position the Render Box"* (Section 7.2).

## 3.4 Render Algorithms

### 3.4.1 Surface Modes

*For a good 3D surface image please note the following application remarks:*

Adjust the render box in order to have free visibility from the render start area (green line) at the surface to be processed. Surface imaging with *"Gray" Render Mode* (Section 8.2)depicts hyperechoic structures and requires hypoechoic structures (e.g., fetus in amniotic fluid) between the render start area and the surface to be displayed. Surface imaging with *"Inversion" Render Mode* (Section 8.3) depicts hypoechoic structures (e.g., the fetal heart) themselves. By using the control "Th. Low" (Threshold Low), echo structures surrounding the surface, can be eliminated if their gray values are much lower than the gray values of the actual surface structures. It is also used for eliminating signal noise.

**Surface(texture)**

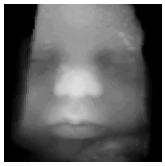
The surface is displayed in "texture" mode.

**Texture** The gray values of the surface are identical to the gray values of the original scan. A texture of speckles from the ultrasound beam reflections is seen.

**Surface(smooth)**

The surface is displayed "smoothed" in "texture" mode. See also *Surface(texture)* (Section 3.4.1)

**Light Mode**



The surface is displayed in "light" mode.

**Light** Structures closer to the viewer are displayed brighter than structures distant to the viewer, which are displayed darker. The nose and the lips of the baby can be seen with a

bright light.

#### Gradient Light Mode

The surface is displayed in “gradient light” mode.

**Gradient Light** Structures with a surface oriented towards the viewer are displayed bright. Structures less oriented towards the viewer are displayed darker.

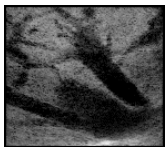
### 3.4.2 Transparent Modes

#### Maximum Mode

The maximum gray values of the *ROI* (Glossary) are displayed.

**Application** Presentation of bony structures.

#### Minimum Mode



The minimum gray values of the *ROI* (Glossary) are displayed.
See Livervessel.avi.

**Application** Presentation of vessels or cystic structures.

**Note** The objects of interest (vessels, cysts) should be surrounded by hyperechoic areas. Avoid dark areas within the *ROI* (Glossary), as large parts of the 3D image will be displayed dark. Shadows caused by attenuation can lead to erroneous dark tissue presentation.

#### X-Ray Mode

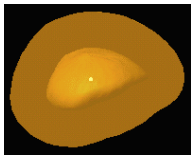
Presentation of all gray values (mean values) within the *ROI* (Glossary).

**Application** Tissue block with tumor or similar structures..

**Note** For a good 3D impression, transparent mode rendering needs a certain number of varying views, which are shown in a *3D Rotation Cine sequence* (Glossary). The increment/step angle should be set to approximately 5 degrees. The 3D impression results from the movement of structures due to rotation.

### 3.4.3 Contour Modes

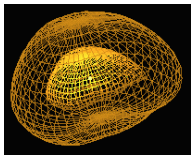
#### Skin



Presentation of the shell geometry as an illuminated surface.

**Application** Visualization of tumor or lesions. The contour must be generated with *VOCAL*$^{TM}$ *II* (Glossary) first.

#### Wiremesh



Presentation of the shell geometry as a wiremesh.

**Application** Visualization of tumor or lesions. The contour must be generated with *VOCAL*$^{TM}$*II* (Glossary) first.

## 3.5 How to Produce Well-Rendered 3D Images

### 3.5.1 B-Mode

- Poor quality of the volume scan will lead to a poor quality 3D image.
- For good 3D image quality, adjust the high contrast of the structure of interest in B-mode before starting the volume scan.
- Only the ultrasound data within the *ROI* (Glossary) will be calculated and displayed.
- The correct placement of the *ROI* (Glossary) is essential for a good result, because the *ROI* (Glossary) determines the view of the object of interest.
- **Surface Mode:**
  Note that the surface of interest must be surrounded by hypoechoic structures, since the system is unable to define the surface otherwise. With the function "Threshold" (Th. Low, Th. High) echo structures surrounding the surface can be eliminated if their gray values are much lower than the gray values of the surface structures.
- **Minimum Mode:**
  Note that the objects of interest (vessels, cysts) should be surrounded by hyperechoic structures. Avoid dark areas (shadows caused by attenuation lead to dark tissue presentation) within the *ROI* (Glossary), because large parts of the 3D image will be displayed dark otherwise.
- **Maximum Mode:**
  Avoid bright artifact echoes within the *ROI* (Glossary), as these artifacts are also displayed in the 3D images.
- **X-Ray Mode:**
  Note that all gray values within the *ROI* (Glossary) are displayed. Therefore, in order to increase the contrast of the structures within the *ROI* (Glossary), the depth of the *ROI* (Glossary) should be adjusted to be as low as possible.

### 3.5.2 Color Mode

- Poor quality of the color image in 2D mode will lead to poor image quality of the 3D color image.
- In power Doppler (angio) mode, a high-sensitivity flow display without directional information is given. In velocity mode (CFM), the flow is display including directional information:
  - Flow towards the probe is red.
  - Flow away from the probe is blue.
- Use a small VOL-BOX and a small sweep angle to reduce acquisition time.

- An activated “High-Persistence Filter” (“Rise and Fall” in 2D image) leads to smoother display of the flow and a good color 3D display of vessels (e.g., filtering of high-pulsatility vessels). Disadvantage: The higher the filter setting, the longer the acquisition time.

- **Surface Mode:**
  Presentation of color information: gray values in front of the vessels are ignored (for vessel presentation).

- **Maximum Mode:**
  Power Mode: The highest intensity value along the viewing direction is displayed.
  Velocity Mode: The “Surface Mode” dominates the “Maximum Mode” as follows: depending on the calculated surface color (red or blue), the highest red or blue intensity value is displayed in order to enable a mixture of “Surface” and “Maximum Mode.”

- **X-Ray Mode:**
  This means a calculation of the mean value along the viewing direction. The “Surface Mode” dominates the “X-Ray Mode” as follows: depending on the calculated surface color (red or blue), the corresponding red or blue mean value is displayed in order to enable a mixture of “Surface” and “X-Ray Mode.”

- In case of combined display of gray and color values, higher priority for color or for gray values can be selected. A combined image displaying color and gray values is shown.

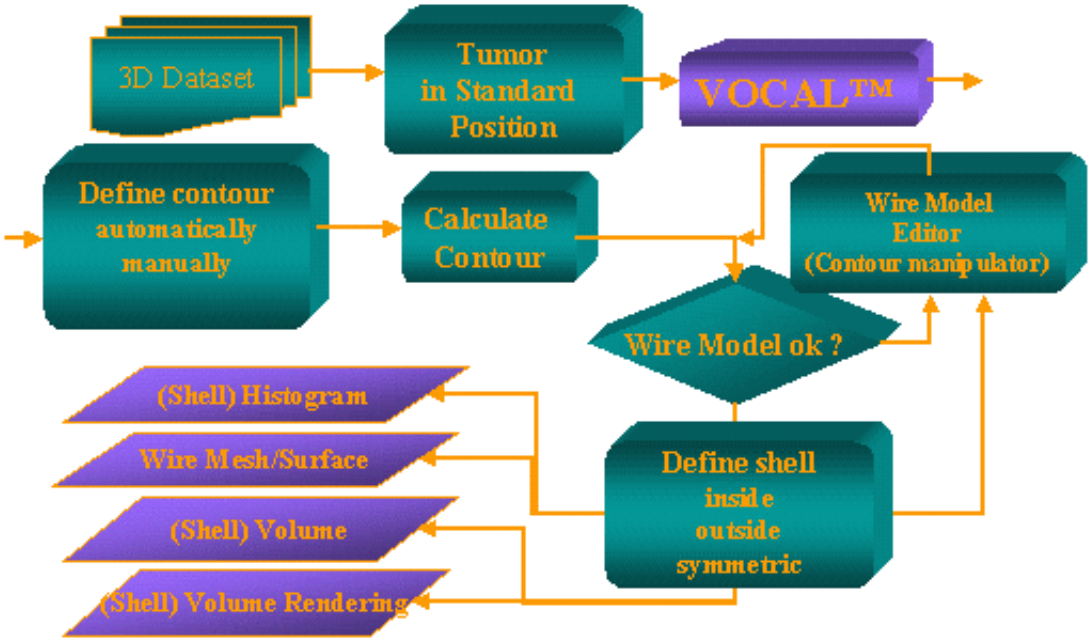
## 3.6 The VOCAL II Concept

The basic idea behind *VOCAL™II* (Glossary) is the combination of 3D ultrasound tissue, presented as *voxels* (Glossary), and the geometric information of surfaces in a 3D dataset.

The main interest of *VOCAL™II* (Glossary) is:

- Surface characterization (definition) of tumors or lesions
- Automated and accurate asymetric and spherical volume measurements
- Automatic color or power-Doppler histogram.

The principle operation steps are given in the diagram below:



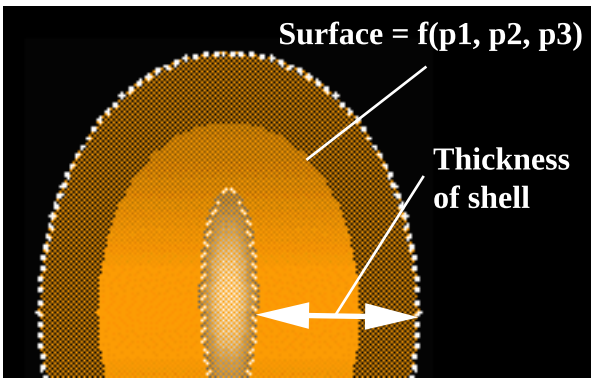

### 3.6.1 Definition of the Surface Geometry

The **Surface Geometry** is defined by the rotation of an image plane around a fixed axis (main contour axis) and the definition of 2D contours in each plane. The 2D contours can be defined automatically or manually. The rotation step for each contour plane can be selected from the range between 6 and 30 degrees (30 - 6 contour planes).

The **Surface Geometry** is defined by 3D triangularization of the 2D contours, meaning each point of the 2D contour in a plane is connected via a triangular mesh to corresponding points in the neighboring planes.

### 3.6.2 Definition of a Shell Contour (Geometry)

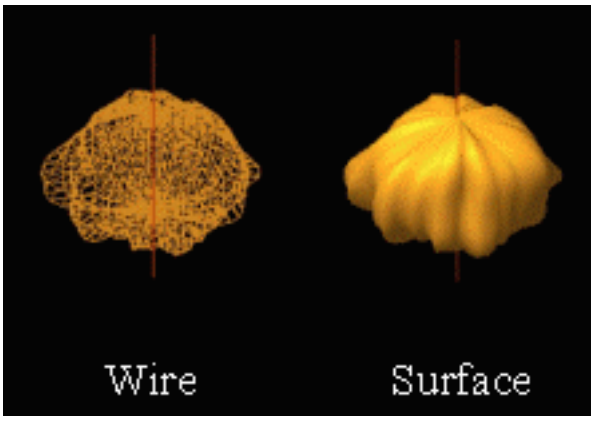
The idea behind a **Shell Contour** is to define a "thickness" of the "reference" surface geometry.




The "parallel" contours shown in the image above define the "parallel" surface geometries (describing the shell). The "parallel" contours are either defined symmetrically to the reference contour or limited to one direction, inside or outside. The **Shell Geometry** consists of one outside and one inside surface. Therefore, it is possible to distinguish between points enclosed by the shell geometry and points outside. A **Shell Contour** represents all points enclosed by the inner and outer surface geometry. If no **Shell Contour** is defined explicitly, the Shell Geometry consists of the reference surface (outside surface) and an inner point (inside surface is degenerated).

### 3.6.3 Display of a Shell Geometry (Contour Rendering)

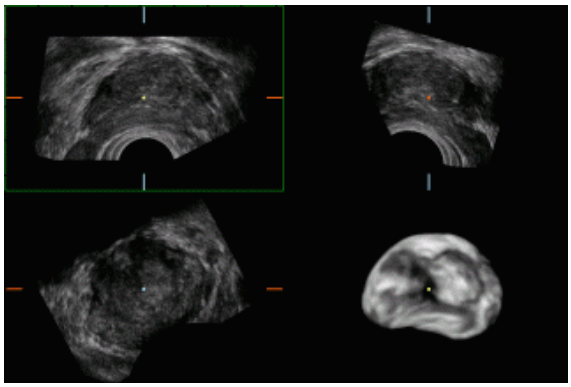
The shell geometry can be visualized as a surface or a wiremesh object. The "parallel" contours are either defined symmetrically to the reference contour or limited to one direction.




The image above illustrates the different visualization techniques.

### 3.6.4 Volume Rendered Display of a Shell Contour

The shell contour is used to define which *voxels* (Glossary) in the 3D ultrasound dataset are part of the shell geometry and which are outside. *Voxels* (Glossary) outside the shell contour are not displayed in the *volume rendered* (Section 3.1) image.



### 3.6.5 (Shell) Volume Calculation

The (shell) volume is defined as the difference between the volume defined by the outer surface (of the shell geometry) and the volume defined by the inner surface (of the shell geometry).

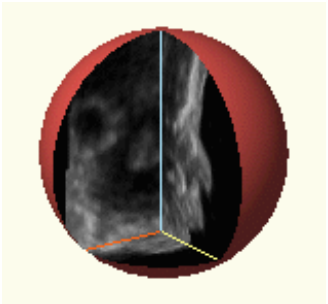
### 3.6.6 (Shell) Histogram

The histogram is calculated using all points inside the shell contour.

### 3.6.7 (Shell) Niche Presentation

The niche presentation allows the visualization of slices and the shell contour in one image.

The presentation gives a 3D overview of the orientation of the slices and the shell contour.



### 3.6.8 Summarized Definitions

**Surface Geometry** A closed triangle mesh of 3D contour points.

**Shell Geometry** A defined inner and outer surface geometry.

**Shell Contour** Points inside the inner and outer surface of the shell geometry.

**Shell** Generic term for shell contour and shell geometry.

## 3.7 What is DICOM

The DICOM (**D**igital **I**maging and **Co**mmunications in **M**edicine) Standard was developed by a joint committee of the American College of Radiology (ACR) and the National Electrical Manufacturers Association (NEMA). The purpose was to "facilitate the open exchange of information between digital imaging computer systems in medical environments."

Since its initial completion in 1993 (Version 3.0) it is gaining increasing popularity. More and more products are advertising DICOM conformance and more and more customers are requiring it.

DICOM defines data structures (e.g., Ultrasound Image Object), service classes (e.g., Verification, Storage, ...), protocols for data exchange over networks, media storage formats (e.g., for CD/DVD-ROM storage) and so on.

The so-called "DICOM Conformance Statements" describe what parts of the standard are implemented. They must be consulted in order to determine interoperability between "DICOM Applications" e.g., ultrasound scanner and PACS (Picture Archiving and Communication System).

For an overview of the DICOM services that can be used in 4D View, see *DICOM Configuration* (Section 23.1).

# Chapter 4

# Demo Cases

## 4.1 4D Image Cine

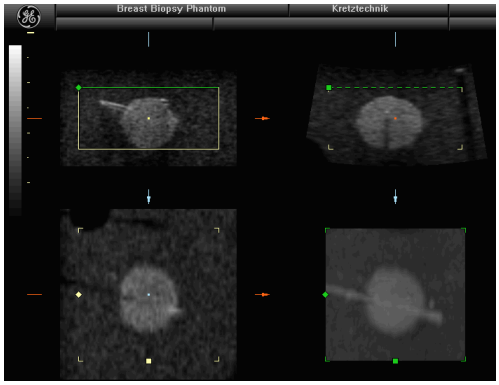
*Demo cases can be found on CD in the directory "Demo Cases \ 4D_Image_Cine." Review each file together with the descriptions in this chapter.*

### 4.1.1 Breast Biopsy Phantom

`Filename: Breast,Biopsy,Phantom.vol`

This is a *4D Image Cine sequence* (Glossary) of the biopsy of a lesion in a tissue-mimicking breast phantom. On the top left side is the sagittal plane (according to the 2D plane). The top right side shows the transverse section, the bottom left image is a coronal section (the "birds eye view," not possible with 2D scanning) and the bottom right part of the image displays a transparent rendering of the region of interest. The needle is already quite close to the lesion. After the last small corrections the needle accurately penetrates the center of the nodule.

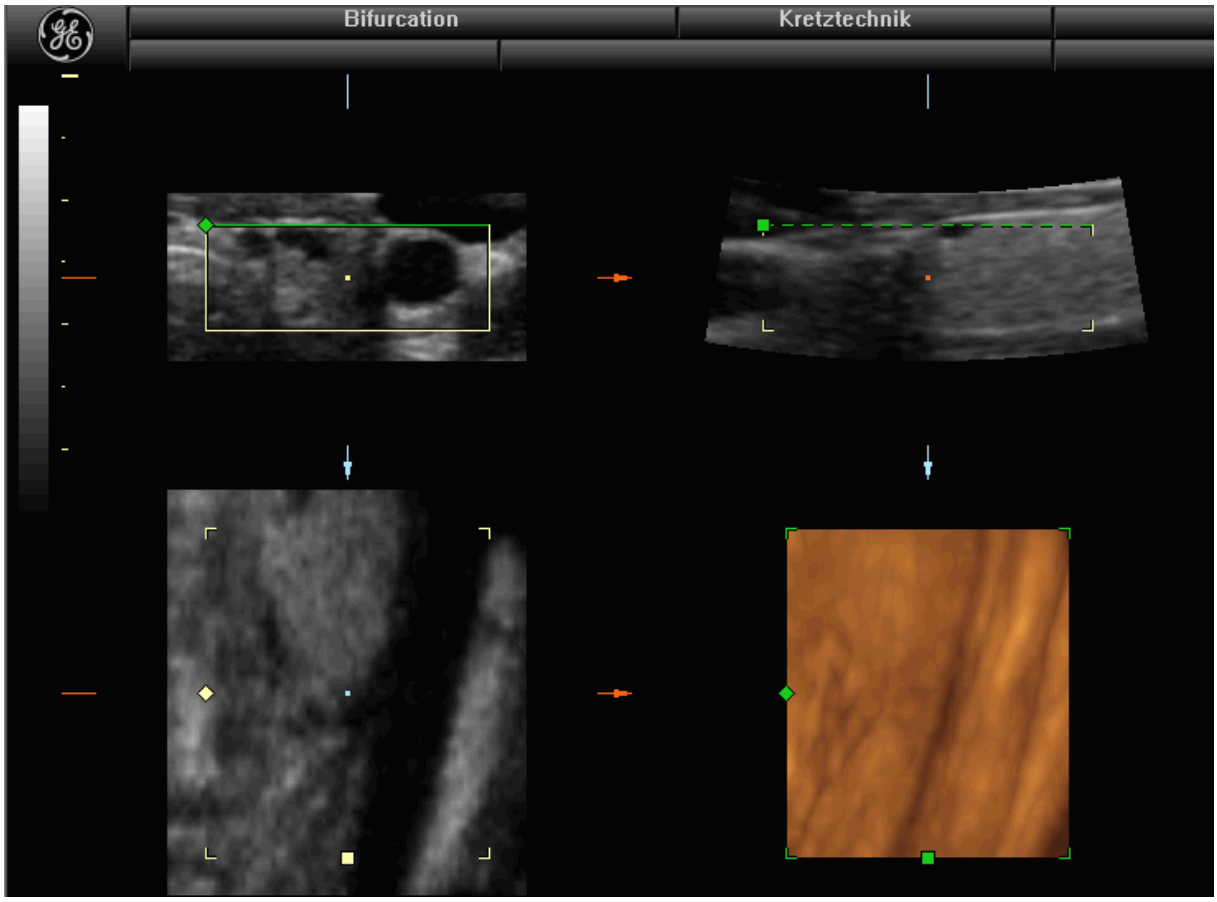
4D allows precise control and exact placement of a needle into a small lesion.



### 4.1.2 Carotid Bifurcation

`Filename: Carotis,Bifurcation.vol`

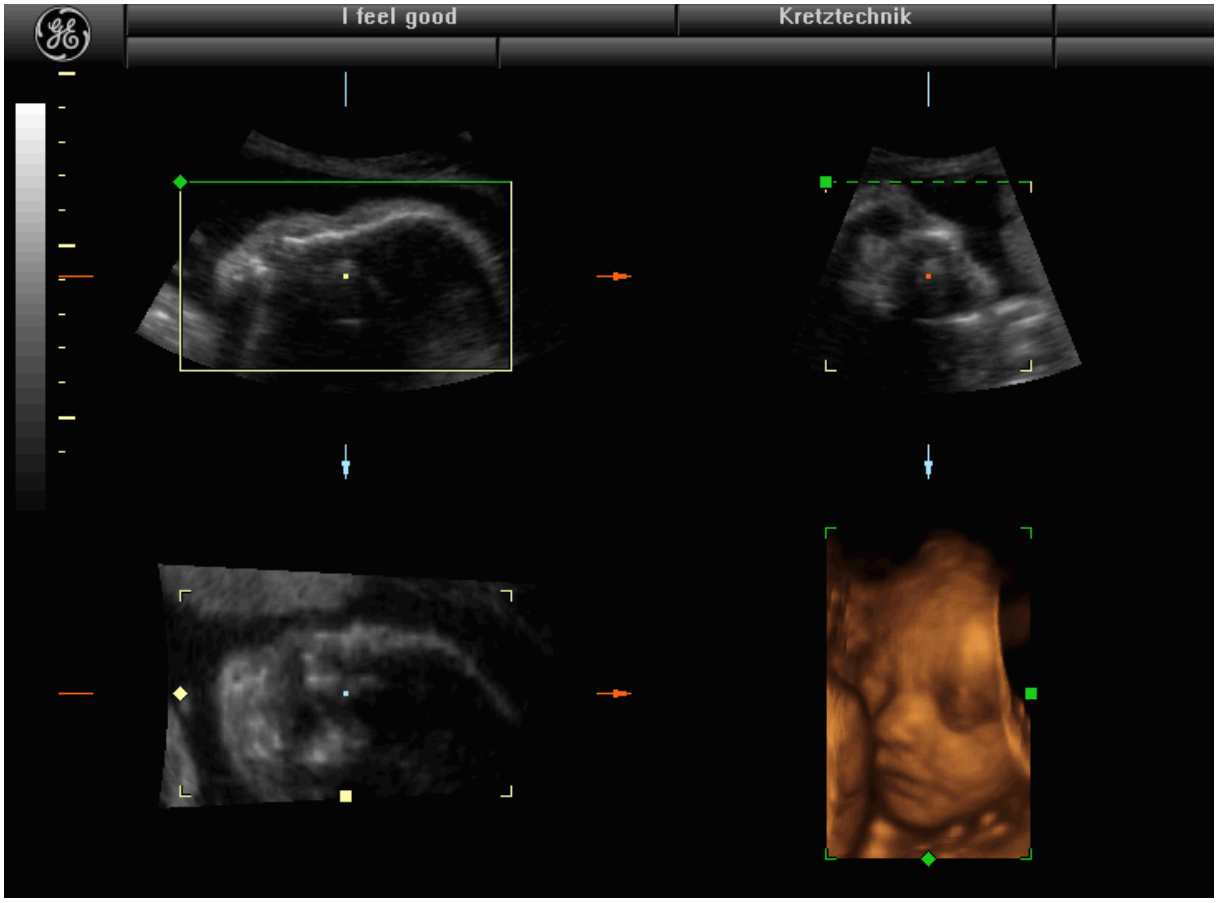
This is a *4D Image Cine sequence* (Glossary) of the carotid arteries. Starting at the bifurcation, the transducer is slowly moved caudally. In addition to the multiplanar slices, is a transparent surface-rendered view of the ROI.



### 4.1.3 Fetal Face

`Filename: I feel good.vol`

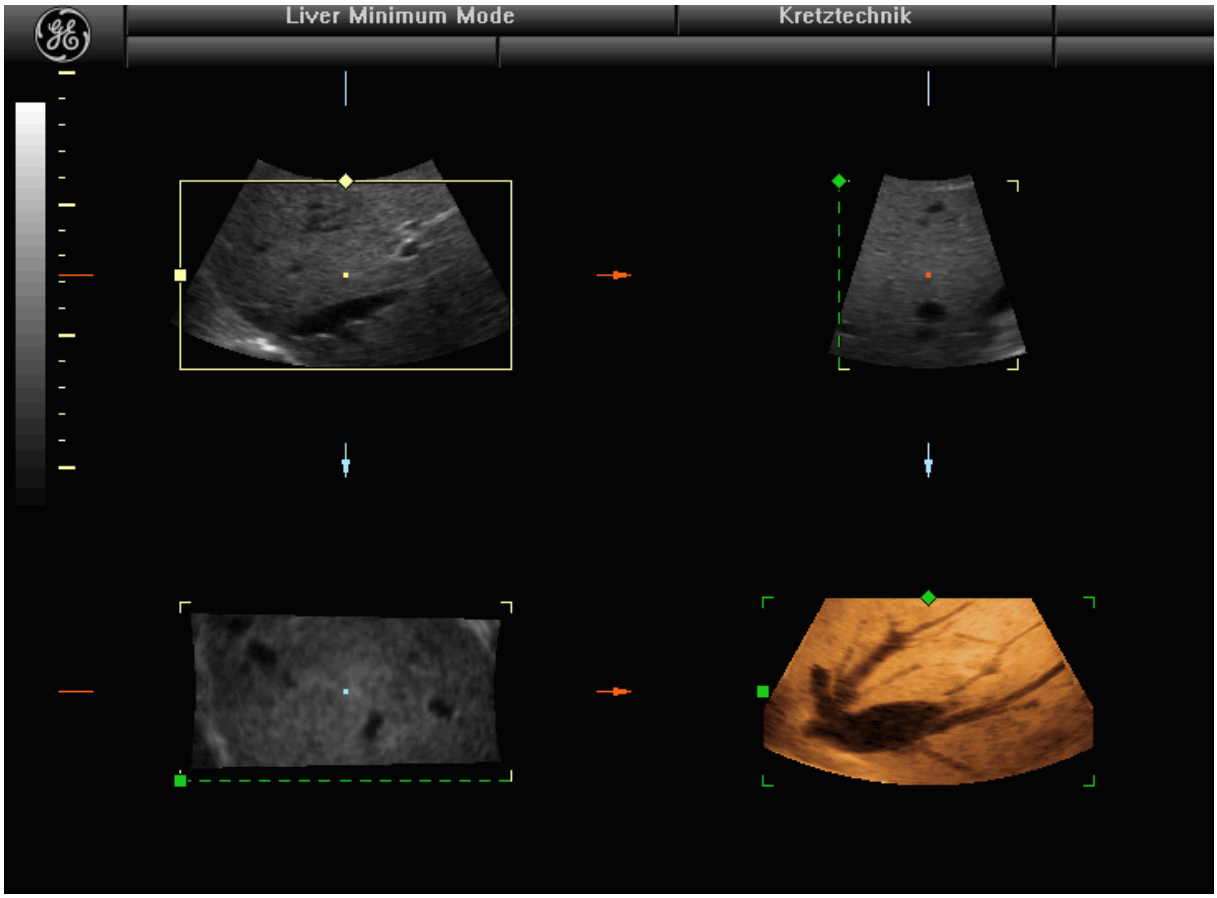
This is a fetal face seen in a *4D Image Cine sequence* (Glossary). The fetus is yawning and moves its hand across its face.



### 4.1.4 Liver - Minimum Mode

`Filename: Liver.vol`

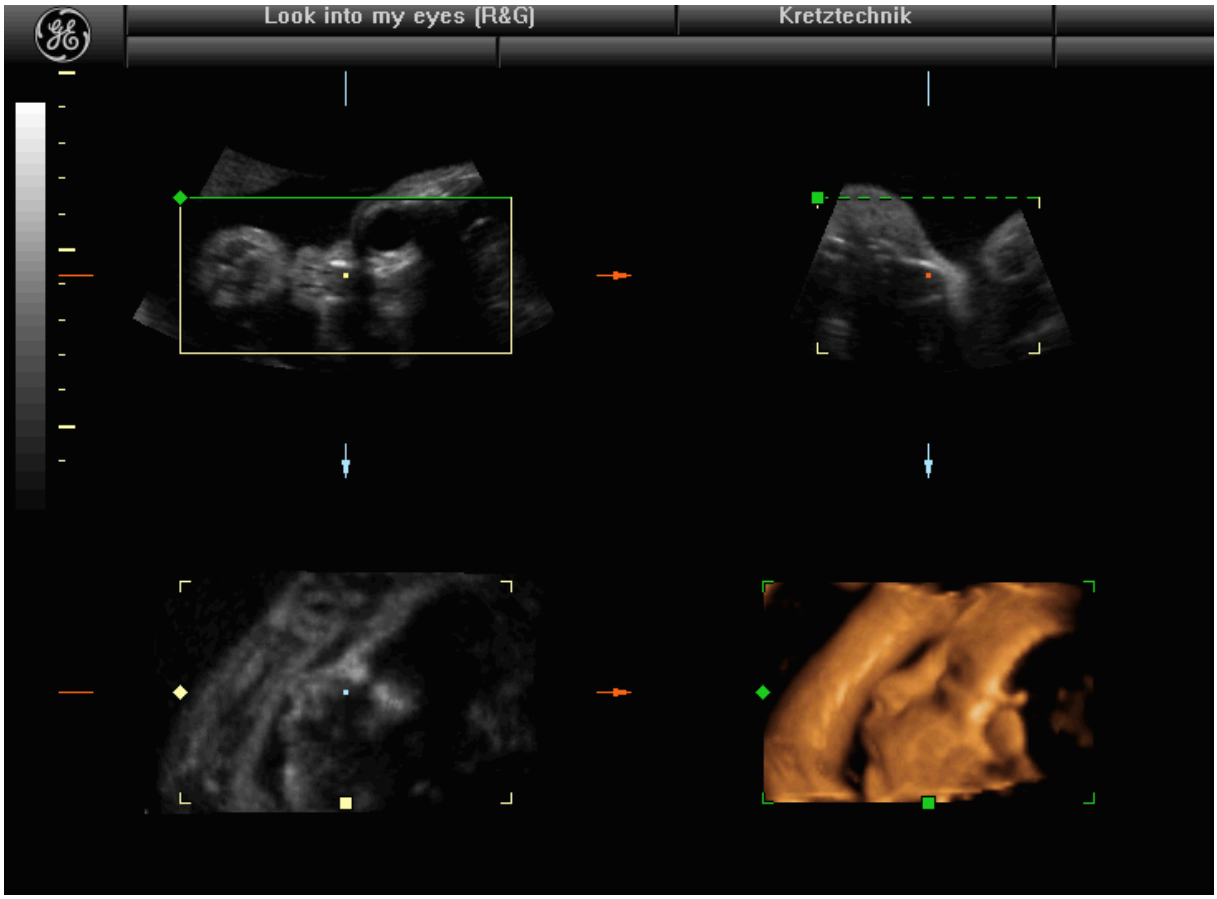
This is a 4D scan of liver tissue. In addition to the multiplanar display, a the rendered image can be seen at the bottom right side of the screen. It shows a transparent-minimum visualization of the entire field of view.



### 4.1.5 Fetal Profile

`Filename: Look into my eyes.vol`

Here is seen the profile of a fetal face. Watch the fetus open and close its eyelid in the beginning of the Cine sequence. This is a perfect presentation of fetal mime.



## 4.2 4D Volume Cine

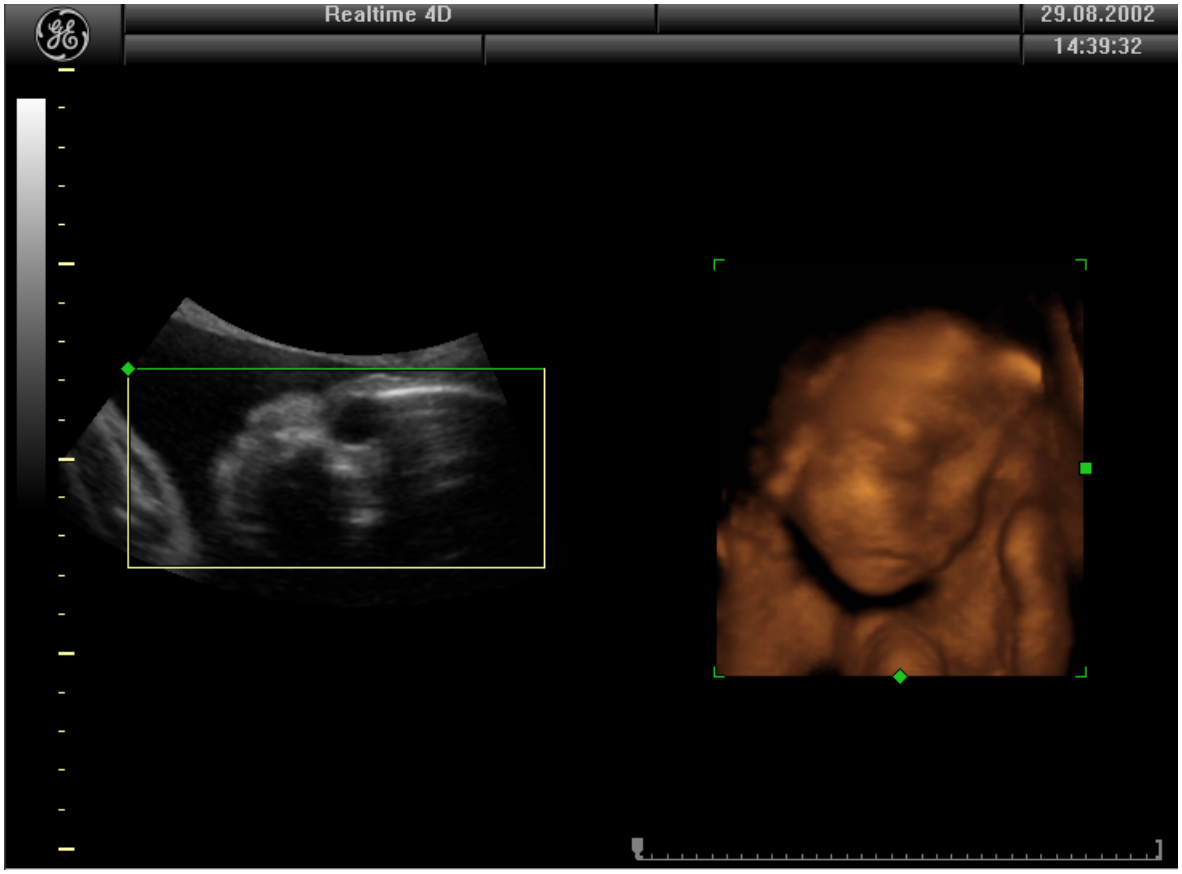
*Demo cases can be found on CD in the directory "Demo Cases \ 4D_Volume_Cine." Review each file together with the descriptions in this chapter.*

### 4.2.1 Realtime 4D Volume Cine (Fetal Face)

`Filename: RealTime4D.vol`

This 4D Volume Cine shows a fetus at the end of the second trimester. 4D allows the observation of fetal movements in three-dimensional quality. Apart from the evaluation of extremities it also allows to watch fetal behavior.

**NOTE:** Change render box position and size, and perform rotations.



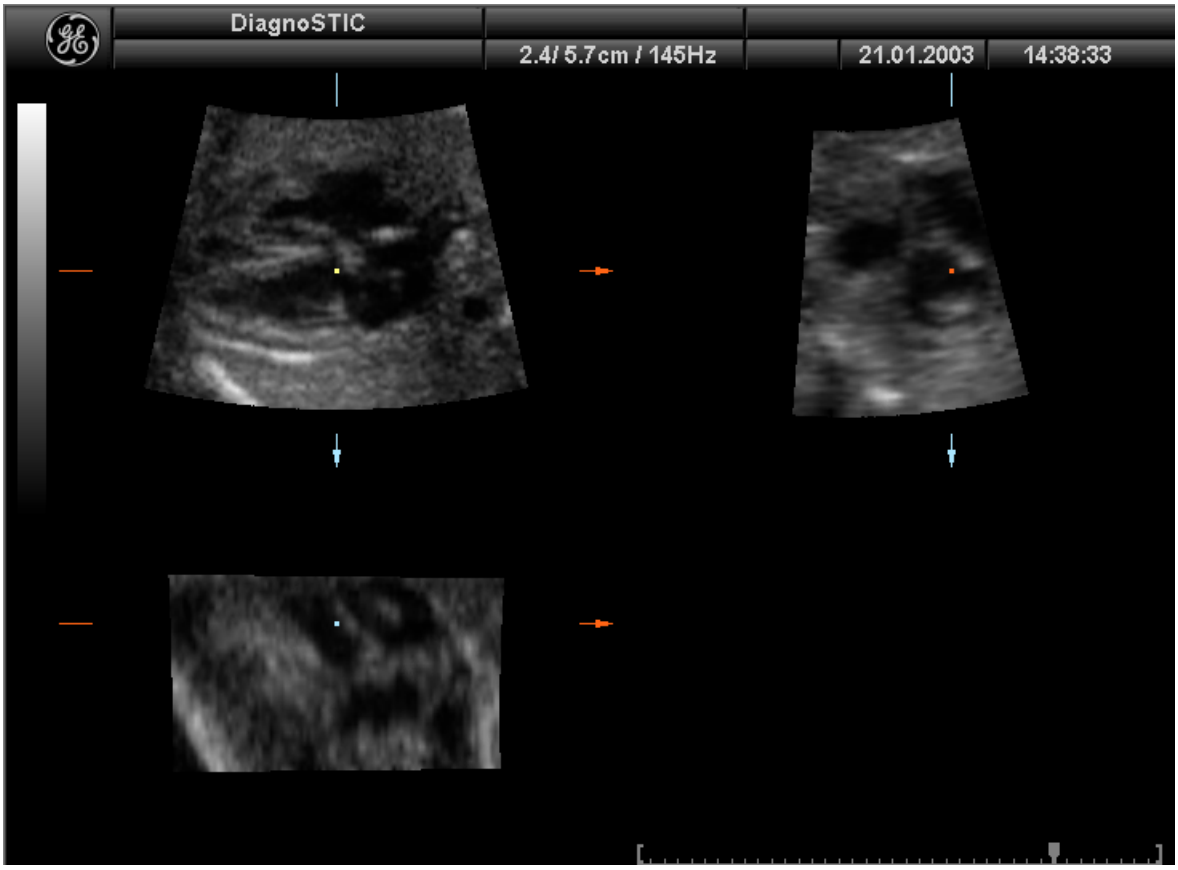
### 4.2.2 STIC

`Filename: STIC.vol`

Fetal Heart, 27 weeks GA:

This is a normal heart. The scan was performed from a long axis position, which is recommanded to evaluate the septum. The top right image shows a short axis view.

**NOTE:** Pick the dot in the center of the A image (top left) using the left mouse key and navigate through the heart. Use the "Ref. Slice" slider (ref image A) and move from front to back and vice versa to see the croossing outflow tract.



### 4.2.3 STIC Color

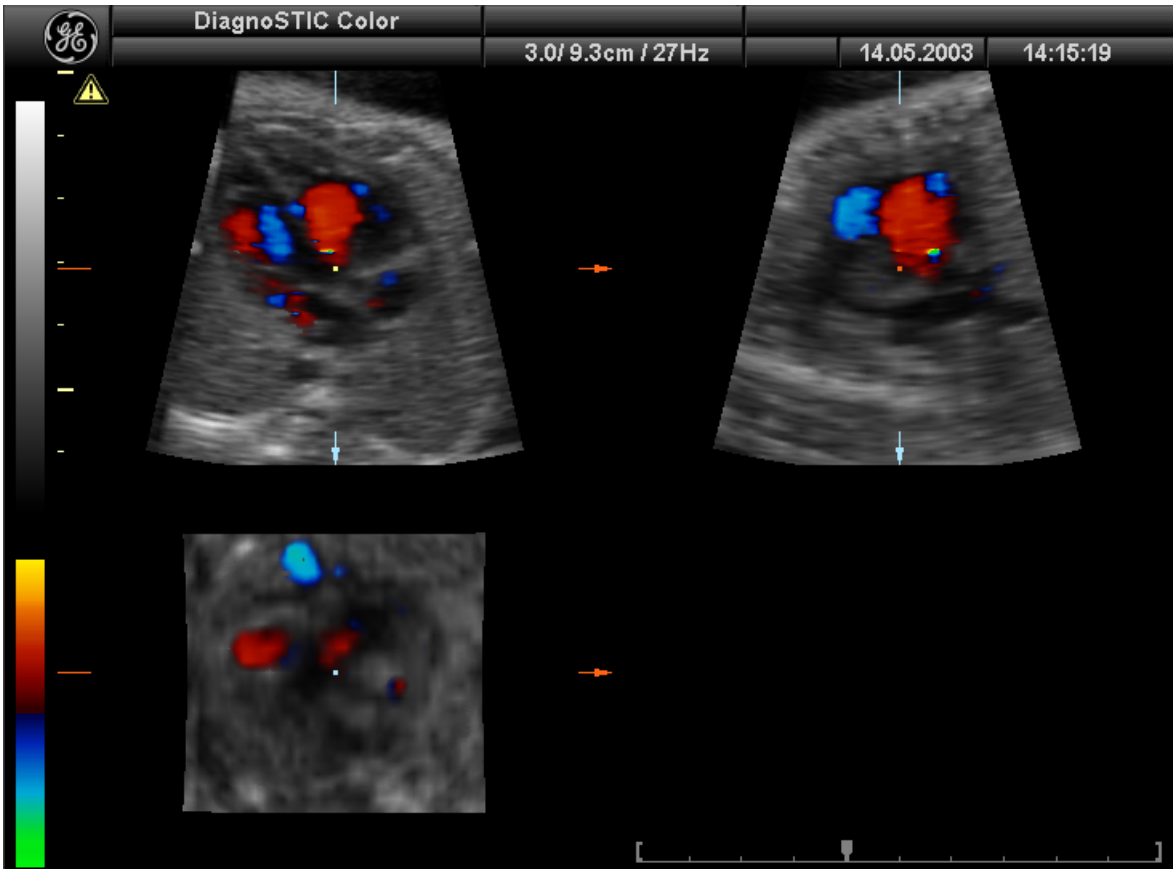
`Filename: STICColor.vol`

Fetal Heart, 25 weeks GA:

This is a STIC-Color acquisition of a normal heart. The scan was performed from a five chamber view. This initial position as well as the septum angulated to the image are recommended prerequisites for the scan. The angulation of the septum is necessary to have an appropriate Doppler angle. The top right image shows the heart in an oblique plane through the left ventricular outflow tract.

**NOTE:** Pick the "Rotation Z" slider and rotate image A 50 degrees counterclockwise (-50 deg). Use the "Ref. Slice" slider (ref image A) and move from front to back and vice versa to see the crossing outflow tract.

It is also possible to measure in this volume.

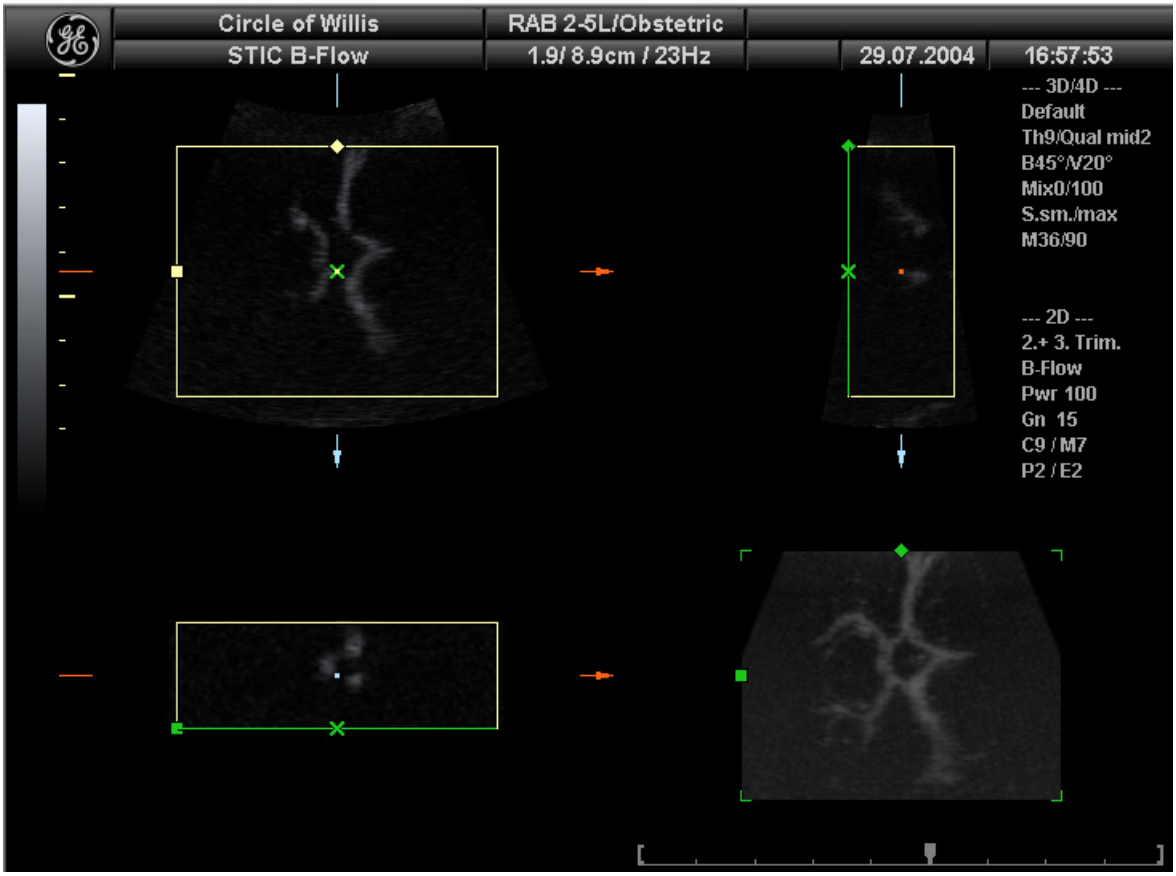


### 4.2.4 STIC B-Flow - Circle of Willis

`Filename: STICBFlow1.vol`

Fetal Brain, Circle of Willis:

This is a STIC-B-Flow acquisition of a normal fetal brain. The pulsation in the Circle of Willis can be inspected in great detail.



### 4.2.5 STIC B-Flow - Fetal Heart and Aorta

`Filename: STICBFlow2.vol`

Fetal Heart and Aorta:

This is a STIC-B-Flow acquisition of a normal fetal heart and the aorta. The pulsation of the heart and the aorat can be inspected in great detail.

### 4.2.6 VCI-C (Fetal Arms)

`Filename: VCI-C.vol`

Second trimester scan:

The fetal arm is placed in a narrow gap below the anterior placenta. The baby's position does not allow to analyze its extremities and profile. VCI-C adjusted in an oblique direction, delivers the information needed.

**NOTE:** Start AutoCine and move the VCI-C plane cursor up and down (right mouse key). The left mouse key changes the angle of the plane.

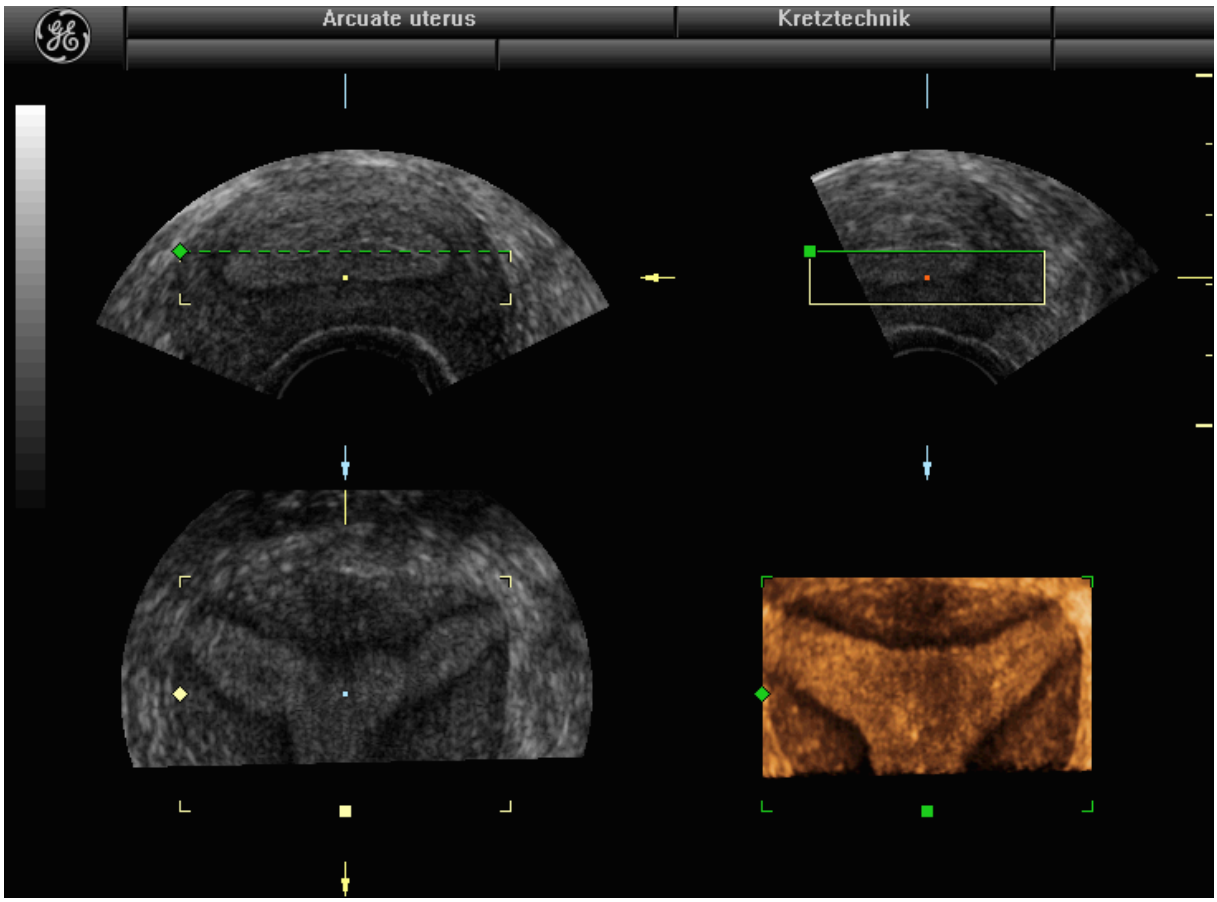
## 4.3 Gynecology

*Demo cases can be found on CD in the directory "Demo Cases \ Gynecology."*

### 4.3.1 Arcuate Uterus

`Filename: Arcuate Uterus.vol`

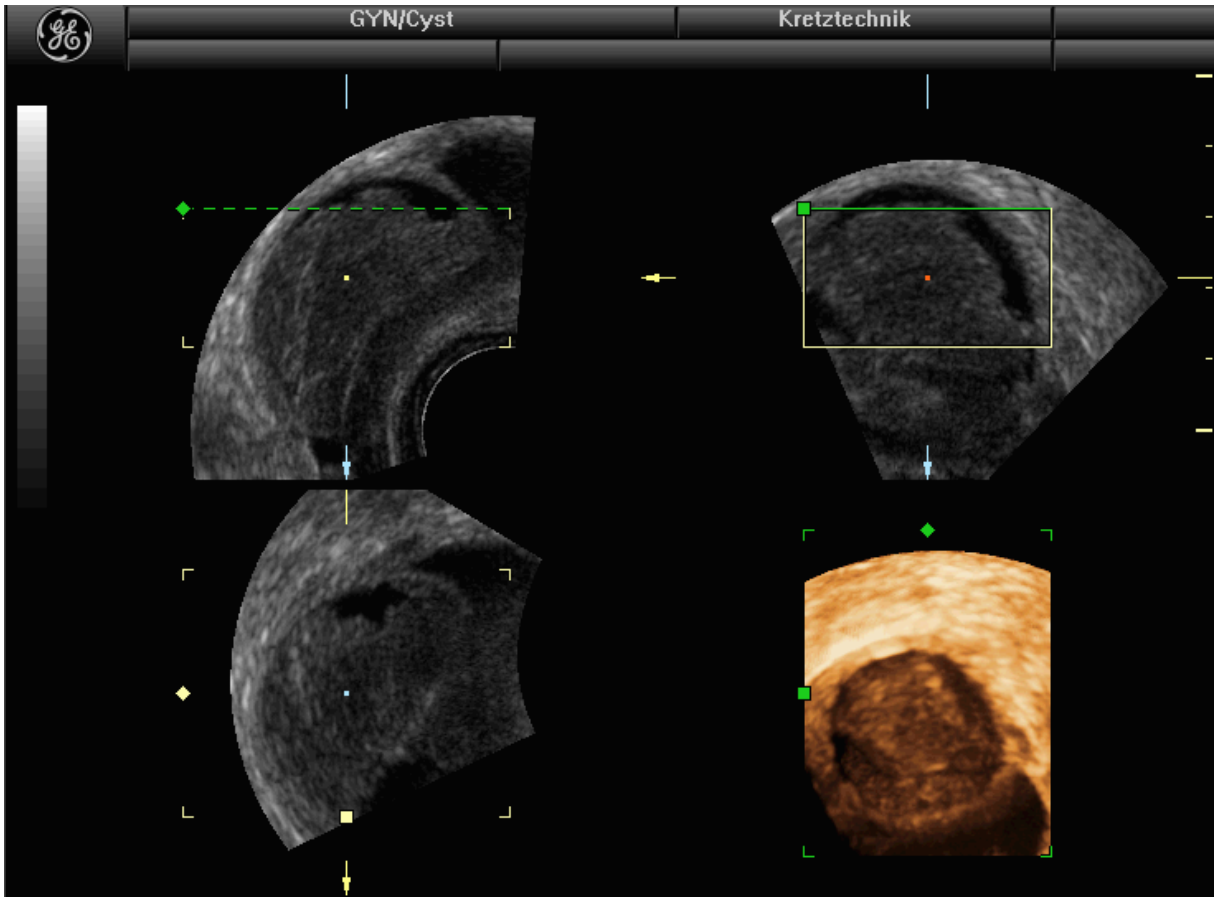
This is a 3D volume scan of an uterus. The shape of the endometrium shows a slight arcuate shape of the fundus.



### 4.3.2 Gyn/Cyst

`Filename: GYN,Cyst.vol`

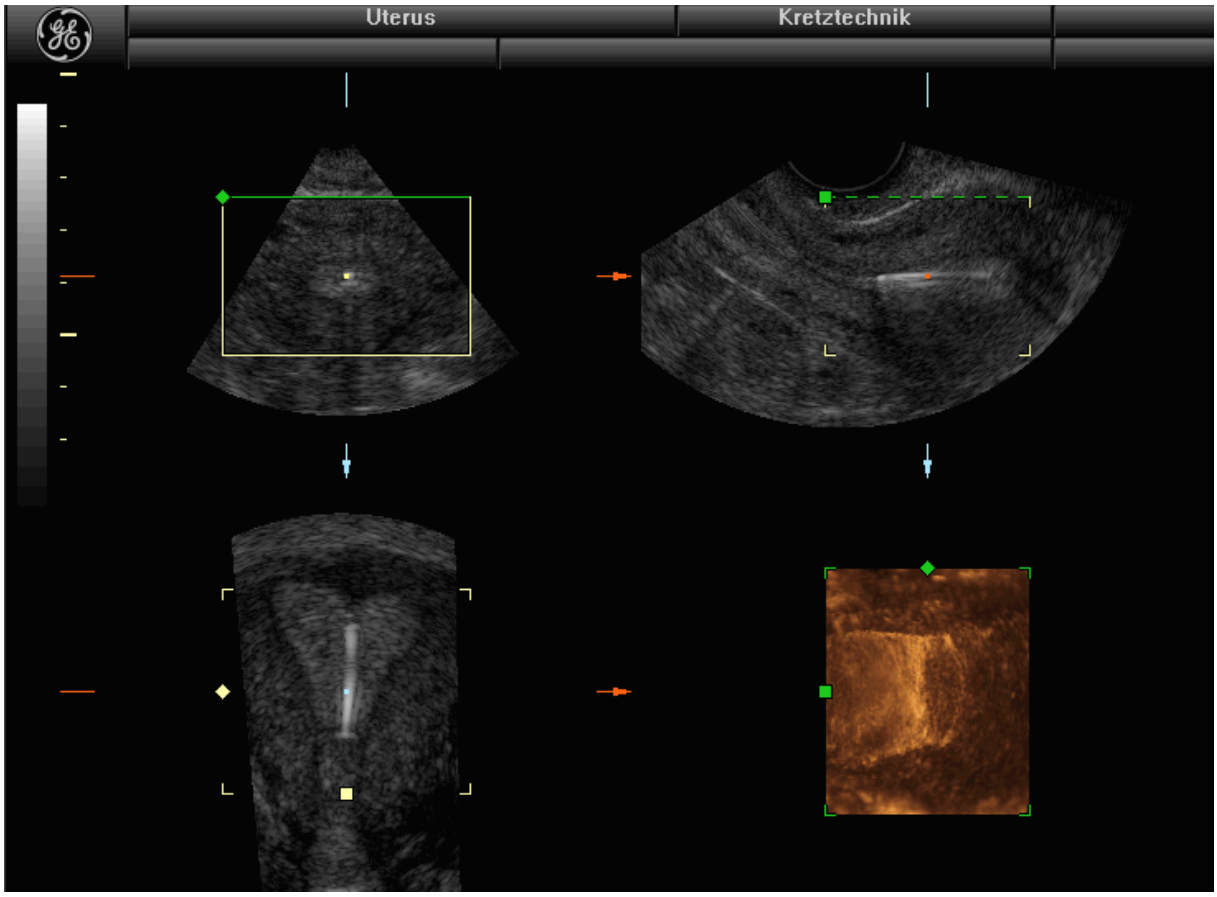
Demonstraged is a complex mass with multiple cystic structures of an ovary. The multiplanar approach allows for complete assessment of the region.



### 4.3.3 Uterus/IUD

`Filename: Uterus,IUD.vol`

This is a uterus with an intrauterine device in situ. 3D ultrasound allows the control for correct positioning of such devices. The rendering is transparent-maximum mode.



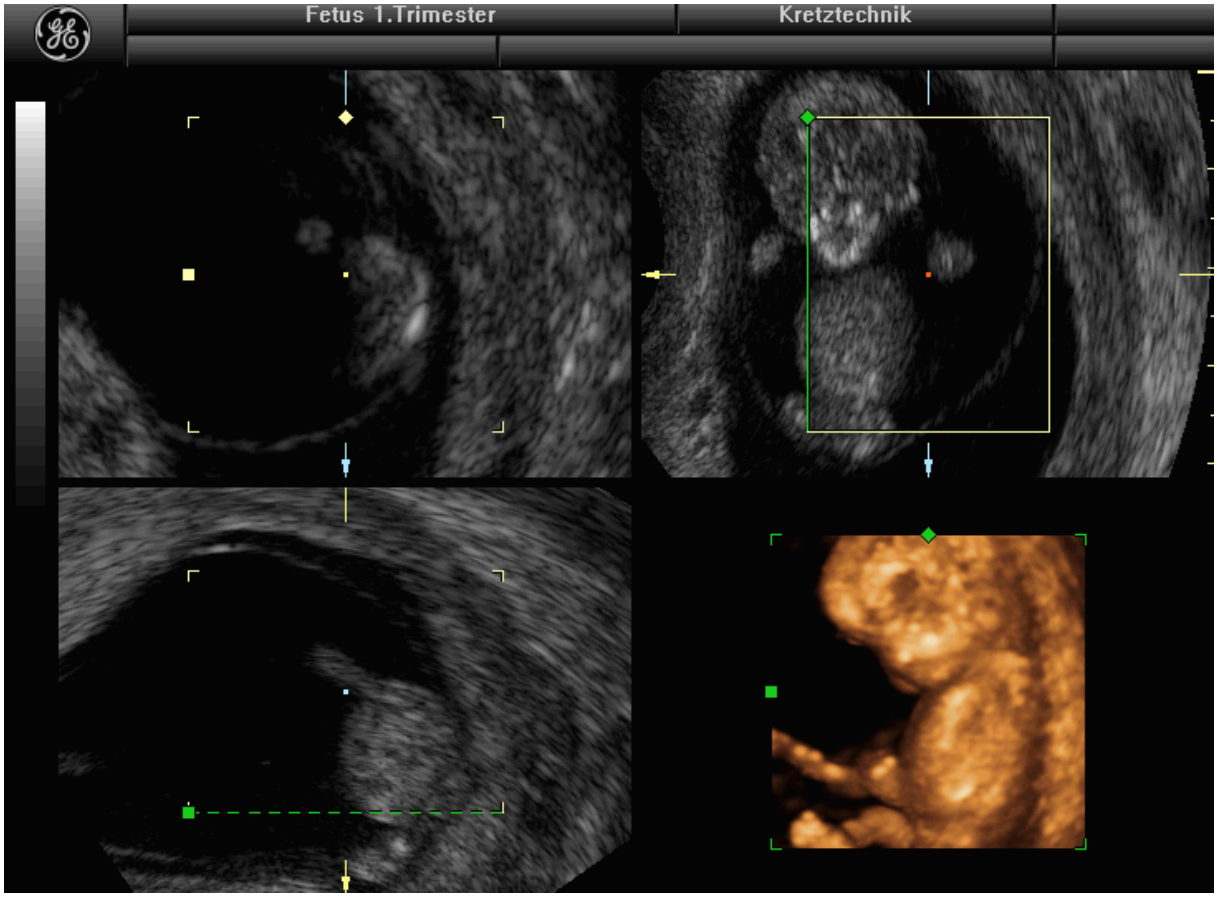
## 4.4 Obstetrics

*Demo cases can be found on CD in the directory "Demo Cases \ Obstetrics."*

### 4.4.1 Fetus First Trimester

`Filename: Fetus 1 Trimester.vol`

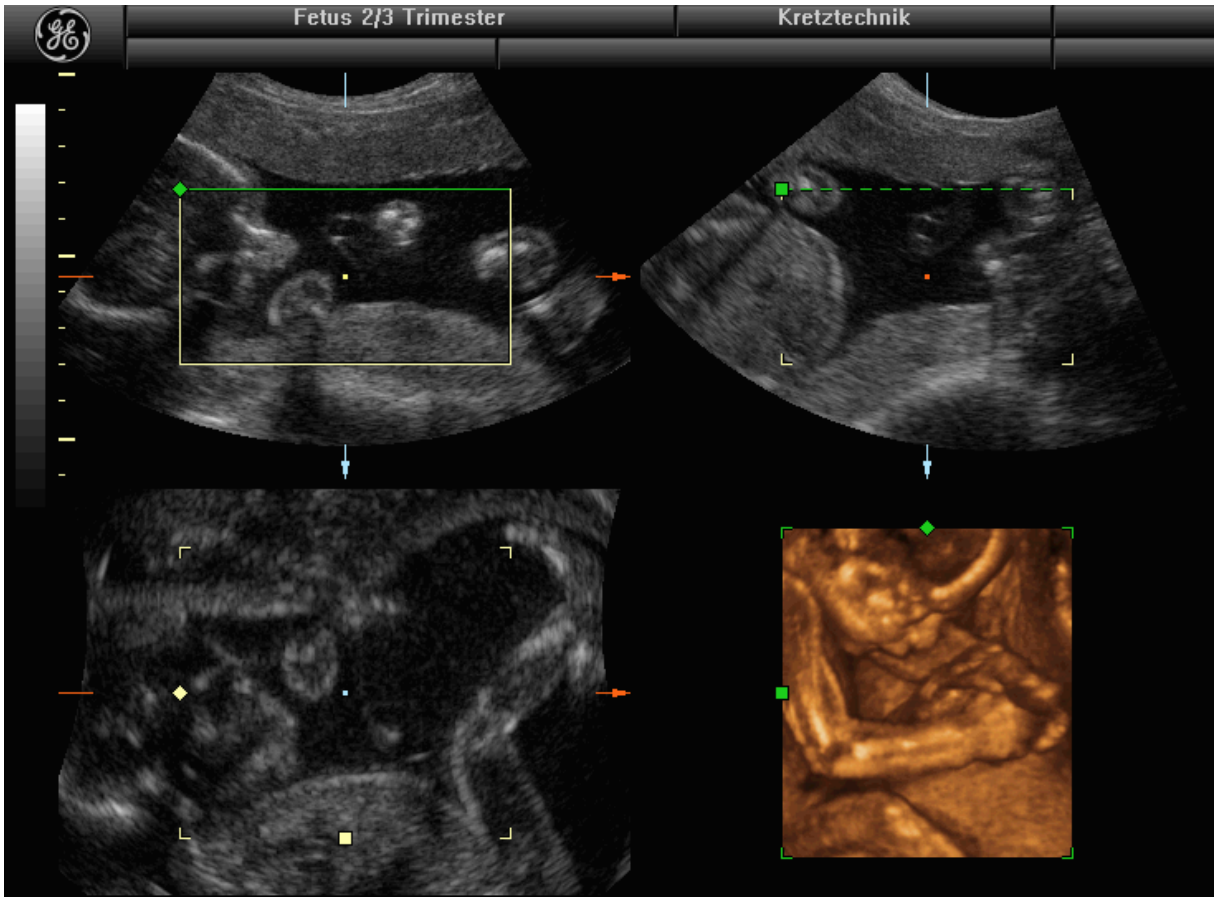
This is a fetus in the uterine cavity. Note the highly detailed imaging of the fetal morphology. The high resolution of the ultrasound scan can be optimized in combination with surface-rendering mode.



### 4.4.2 Fetus Second Trimester

`Filename: Fetus 2 Trimester.vol`

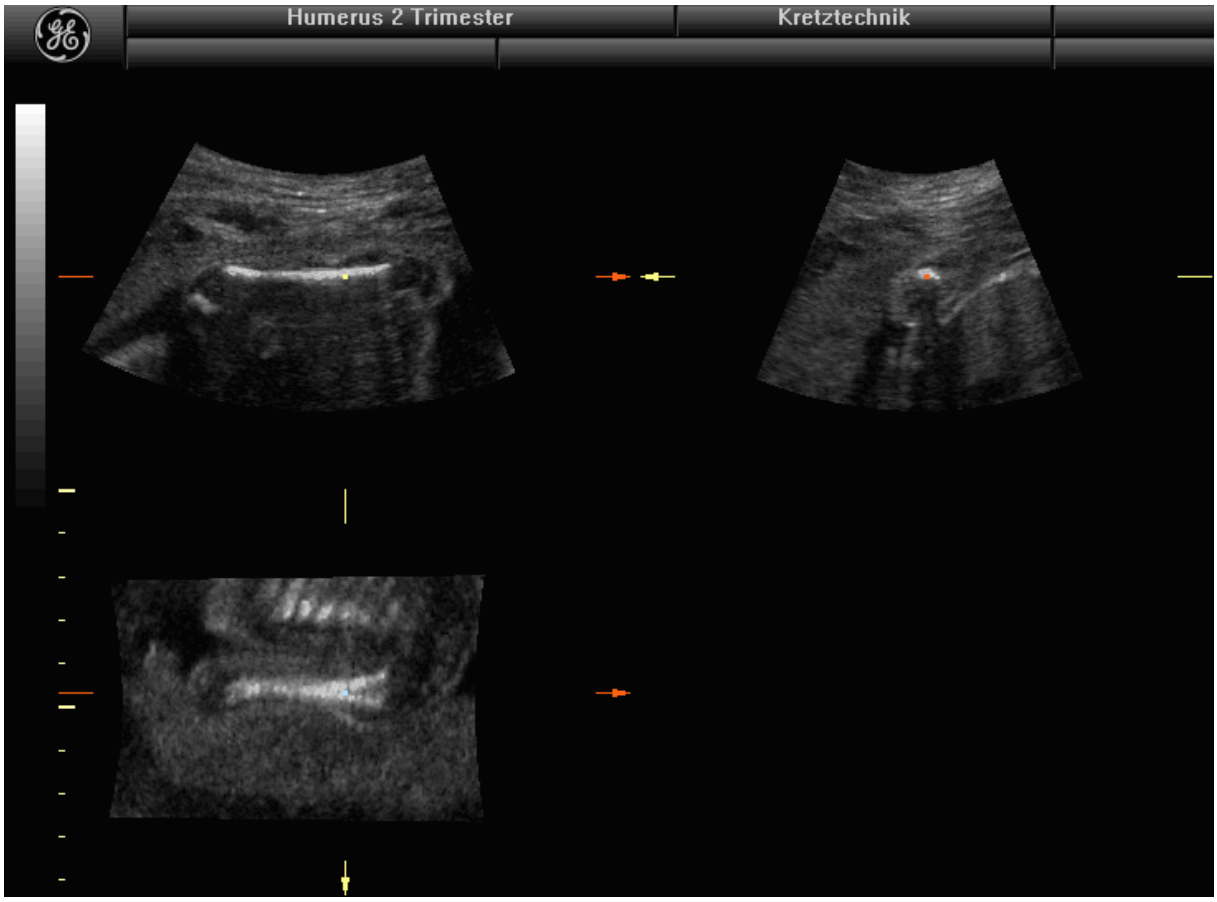
Nearly the entire fetus was recorded in this volume dataset. Minute exploration of the fetal structures is possible by means of the multiplanar scan plane analysis. The rendering is surface mode.



### 4.4.3 Humerus Second Trimester

`Filename: Humerus 2 Trimester.vol`

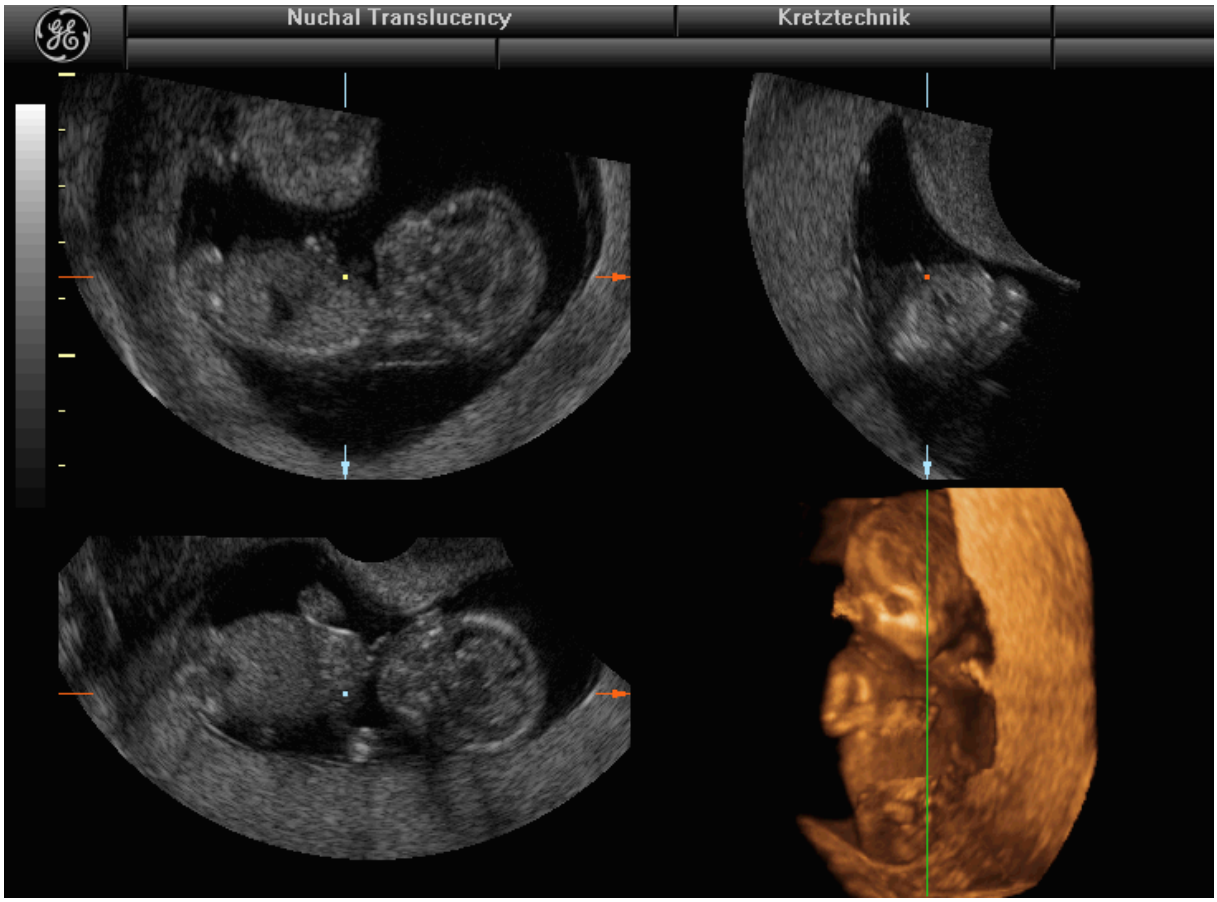
This dataset presents very clear information about the bony structures of the fetus. In transparent rendering mode (X-ray/maximum) several ribs and the scapula can be seen as well as the humerus.



### 4.4.4 Nuchal Translucency

`Filename: Nuchal Translucency.vol`

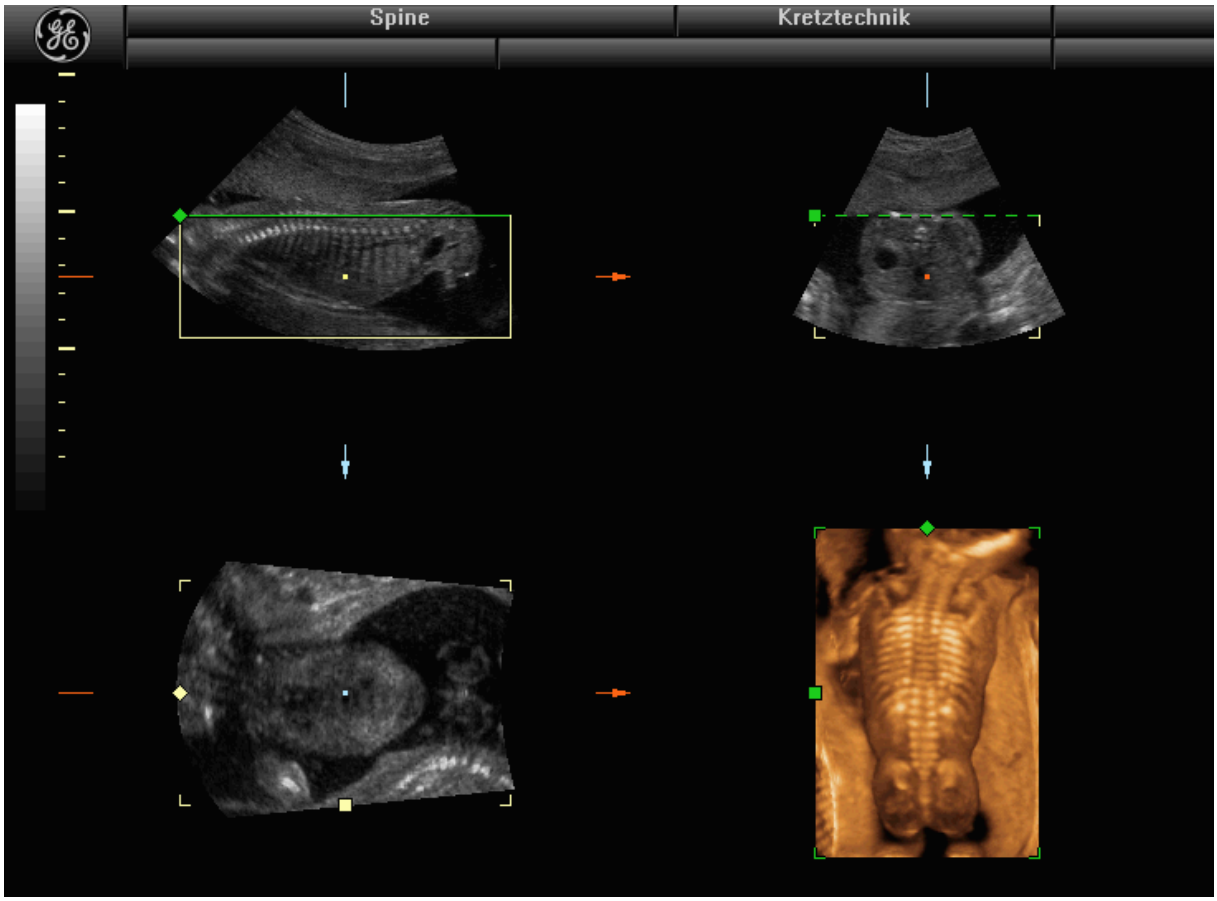
In the high-risk group the NT measurement is crucial. A problem often occurs when the fetus lies in an unfavorable position. 3D ultrasound greatly facilitates this important examination due to the possibility of rotational movements of the multiplanar slices.



### 4.4.5 Spine

`Filename: Spine.vol`

Easy assessment of the spine and bony processes is achieved due to the combination of multi-planar imaging and maximum rendering.



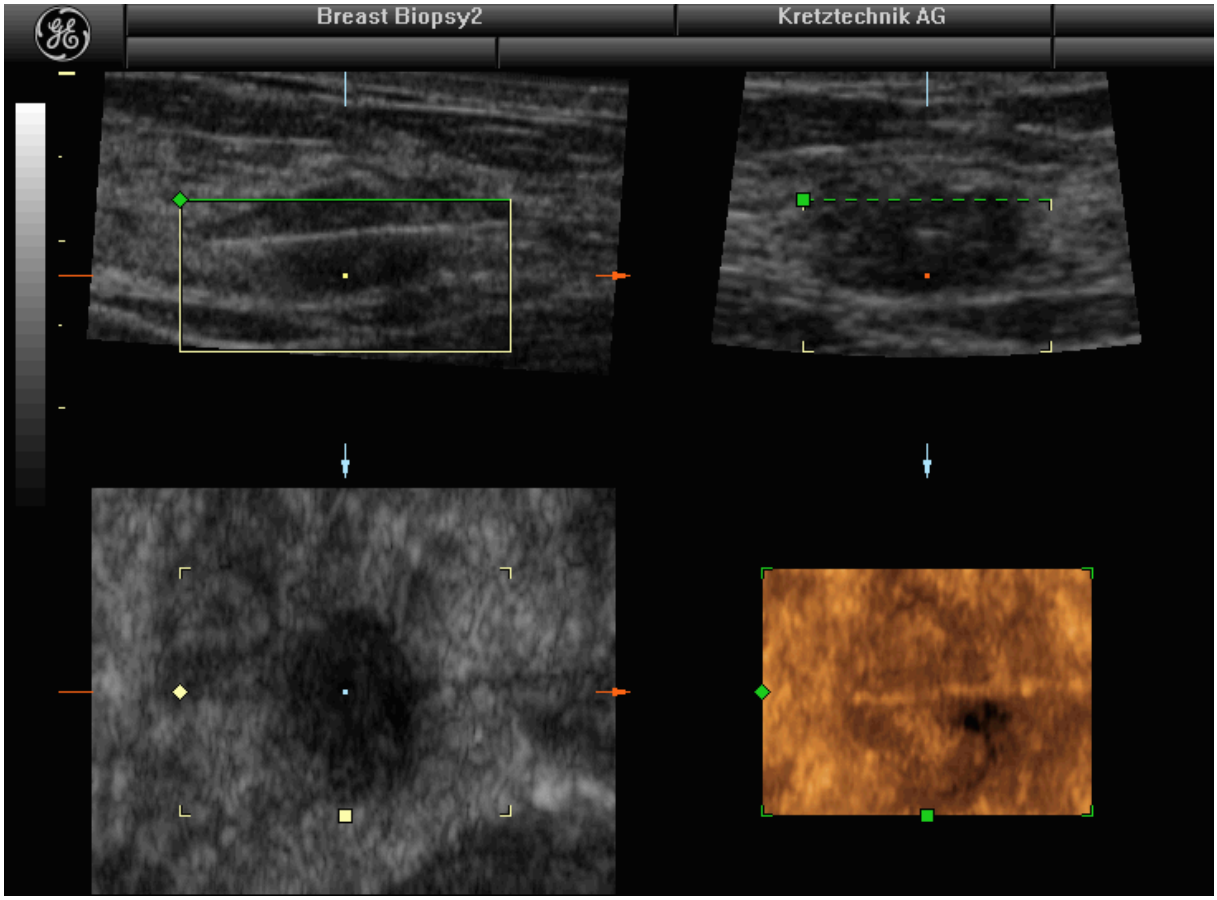
## 4.5 Radiology

*Demo cases can be found on CD in the directory "Demo Cases \ Radiology."*

### 4.5.1 Breast Biopsy

`Filename: Breast,Biopsy.vol`

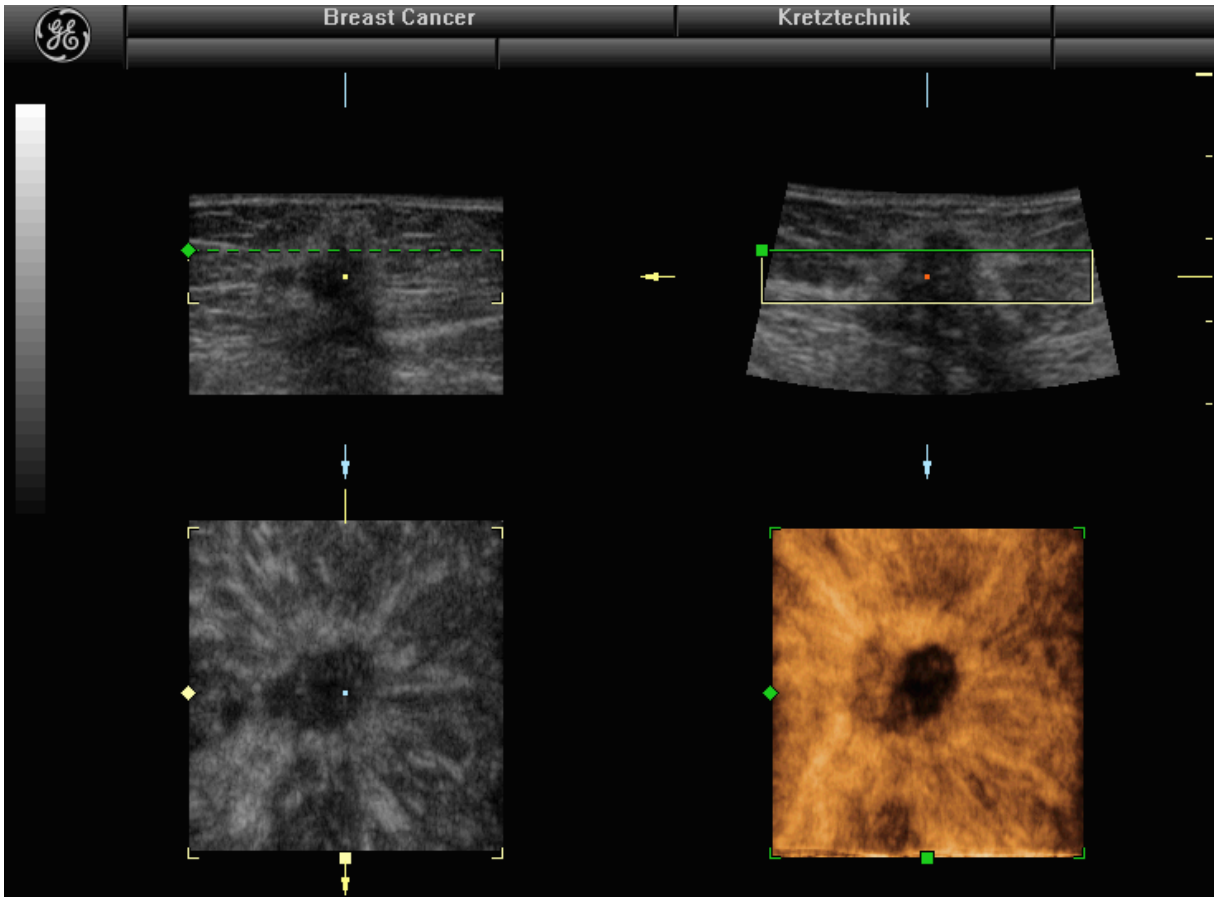
Here is a biopsy of a breast lesion using 3D-Targeting control. The needle is accurately placed in the center of the lesion. This is known as a 100% hit.



### 4.5.2 Breast Cancer

`Filename: Breast,Cancer.vol`

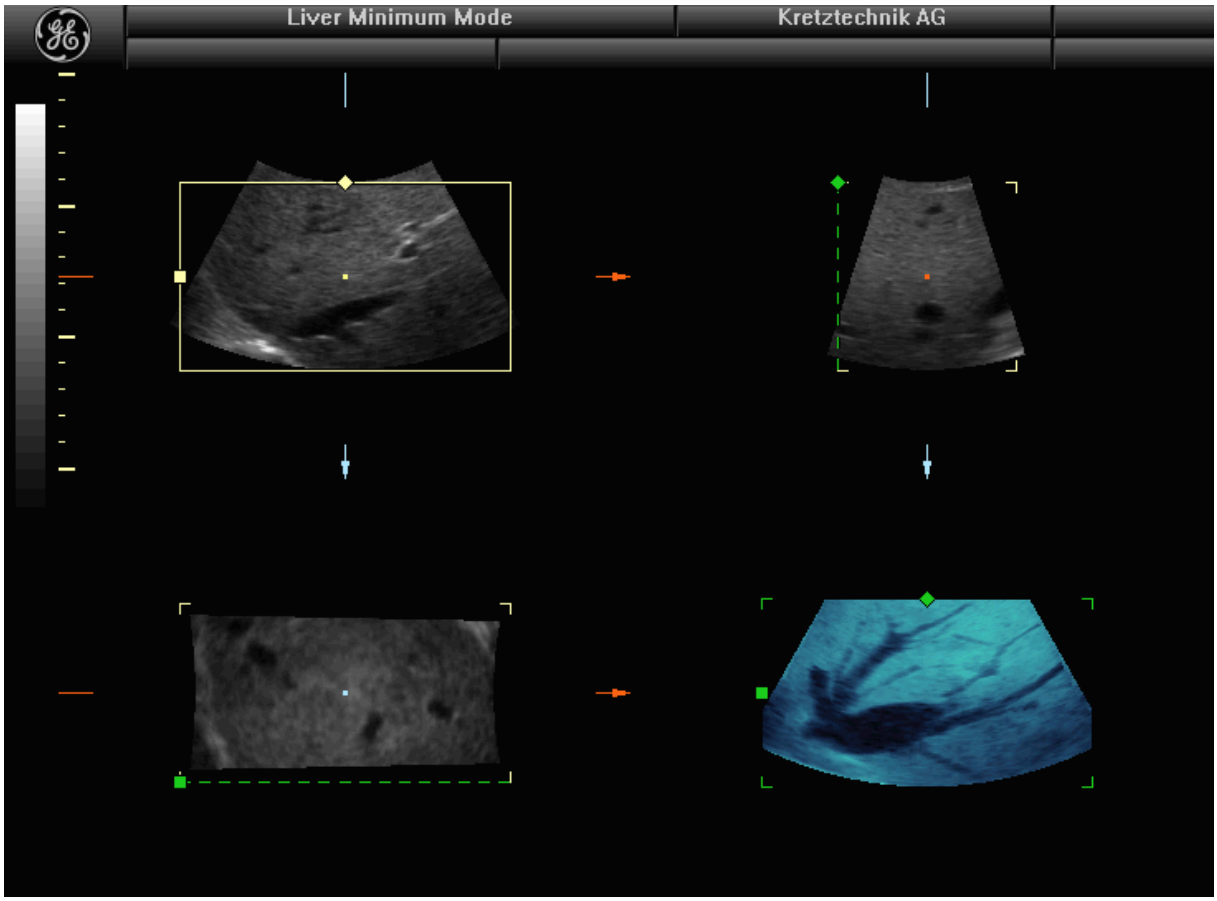
This is a breast carcinoma. Note the typical tissue pattern in the C-plane. The cancer is disorganizing the surrounding tissue which leads to a “chaotic” appearance.



### 4.5.3 Liver Vessels, Minimum Mode

`Filename: Liver Minimum Mode.vol`

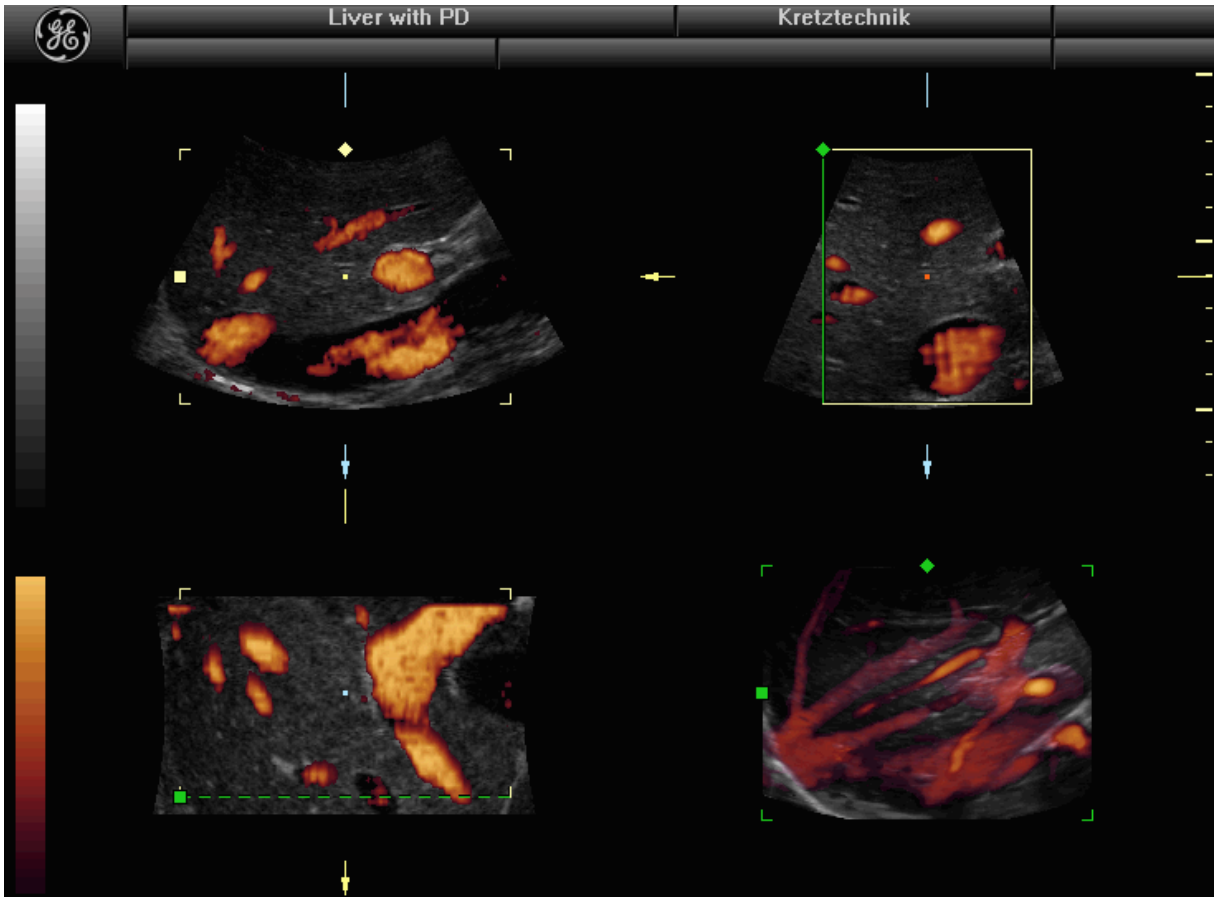
Here is an abdominal volume scan showing the liver. In the rendering (transparent-minimum) the vessels are clearly depicted.



### 4.5.4 Liver Vessels, Power-Doppler Mode

`Filename: Liver,Powerdoppler.vol`

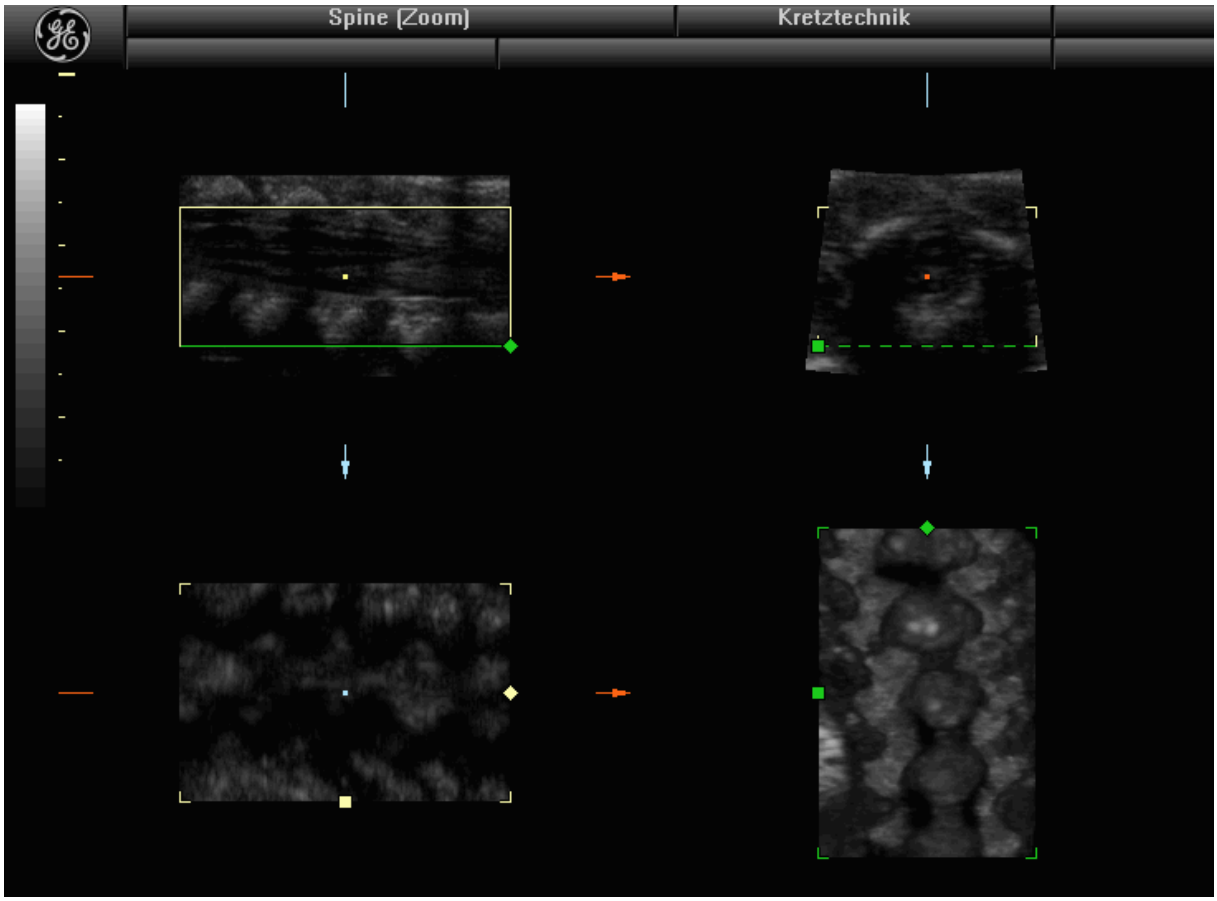
This is the volume scan of a liver including power-Doppler information. The new “Glass Body” rendering mode allows the display of transparent tissue and angio vessel information at the same time.



### 4.5.5 Spine

`Filename: Spine.vol`

Here is the spine of a child. Internal, external and bony processes can be analyzed in detail. In adult scanning the intervertebral disks can also be examined.



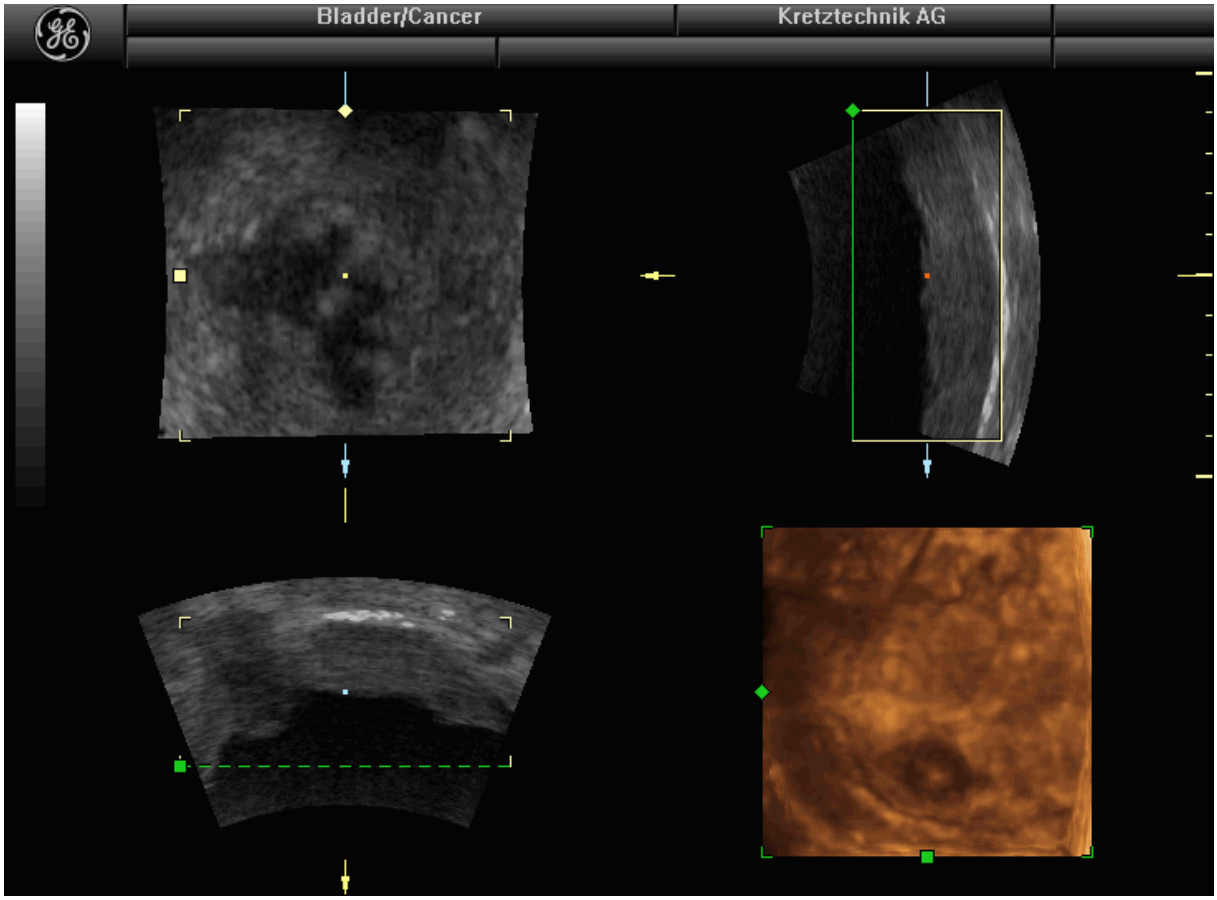
## 4.6 Urology

*Demo cases can be found on CD-ROM in the directory "Demo Cases \ Urology."*

### 4.6.1 Bladder Cancer

`Filename: Bladder,Cancer.vol`

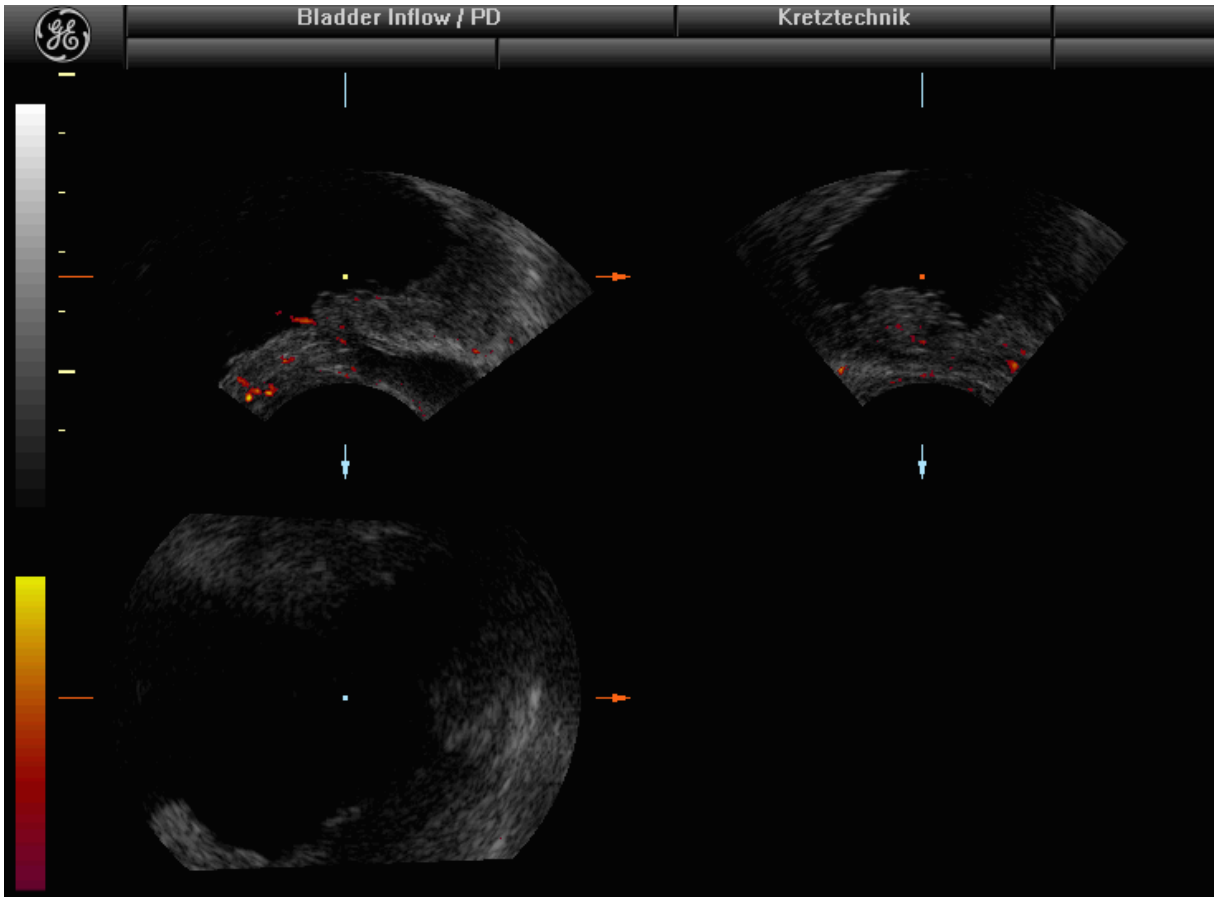
This is a volume scan of the posterior wall of a urinary bladder. The multiplane feature offers the advantage of scrolling through the volume in order to evaluate where the cancer penetrates the bladder wall. The surface rendering shows the cancer's inhomogeneity.



### 4.6.2 Bladder Influx / Power-Doppler

`Filename: Bladder,Inflow,Powerdoppler.vol`

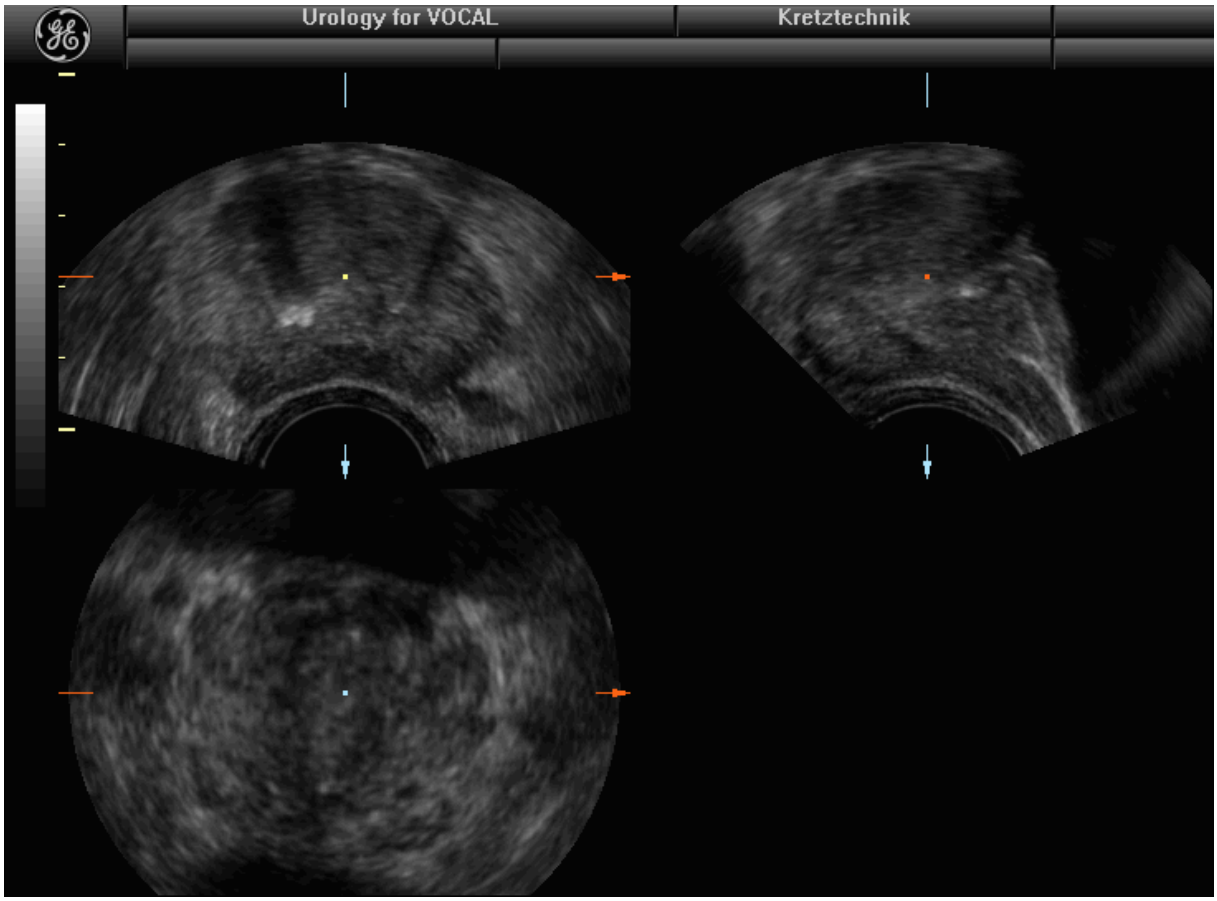
Here is a 3D angio volume of the bladder. There is also a tumor present. During the scan a short influx occurred which was detected by the system's high sensitivity.



### 4.6.3 Prostate

`Filename: Prostate.vol`

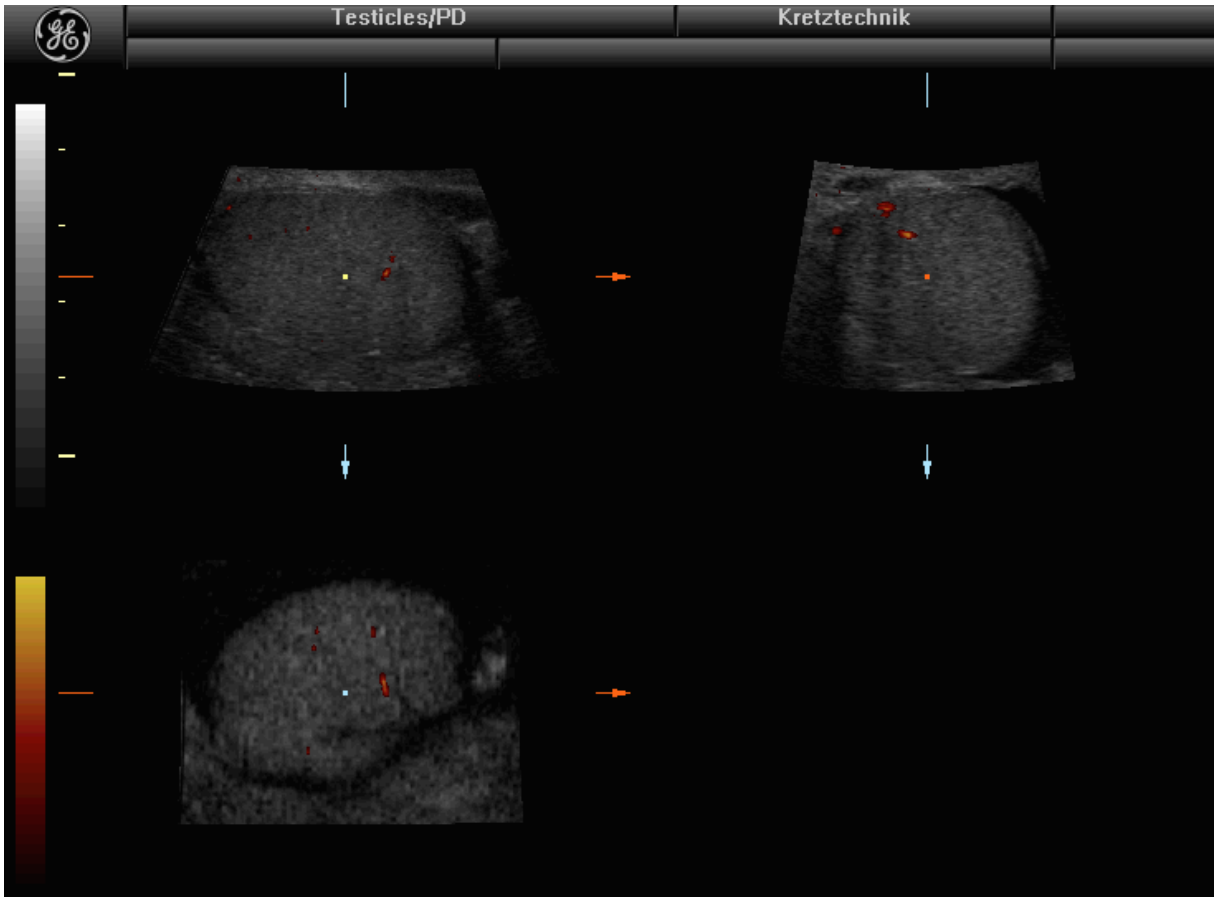
This is a slightly enlarged prostate (BPH) with some calcifications. The C-plane, in particular, shows the zonal anatomy of the gland.



### 4.6.4 Testicles / Power-Doppler

`Filename: Testicles Powerdoppler.vol`

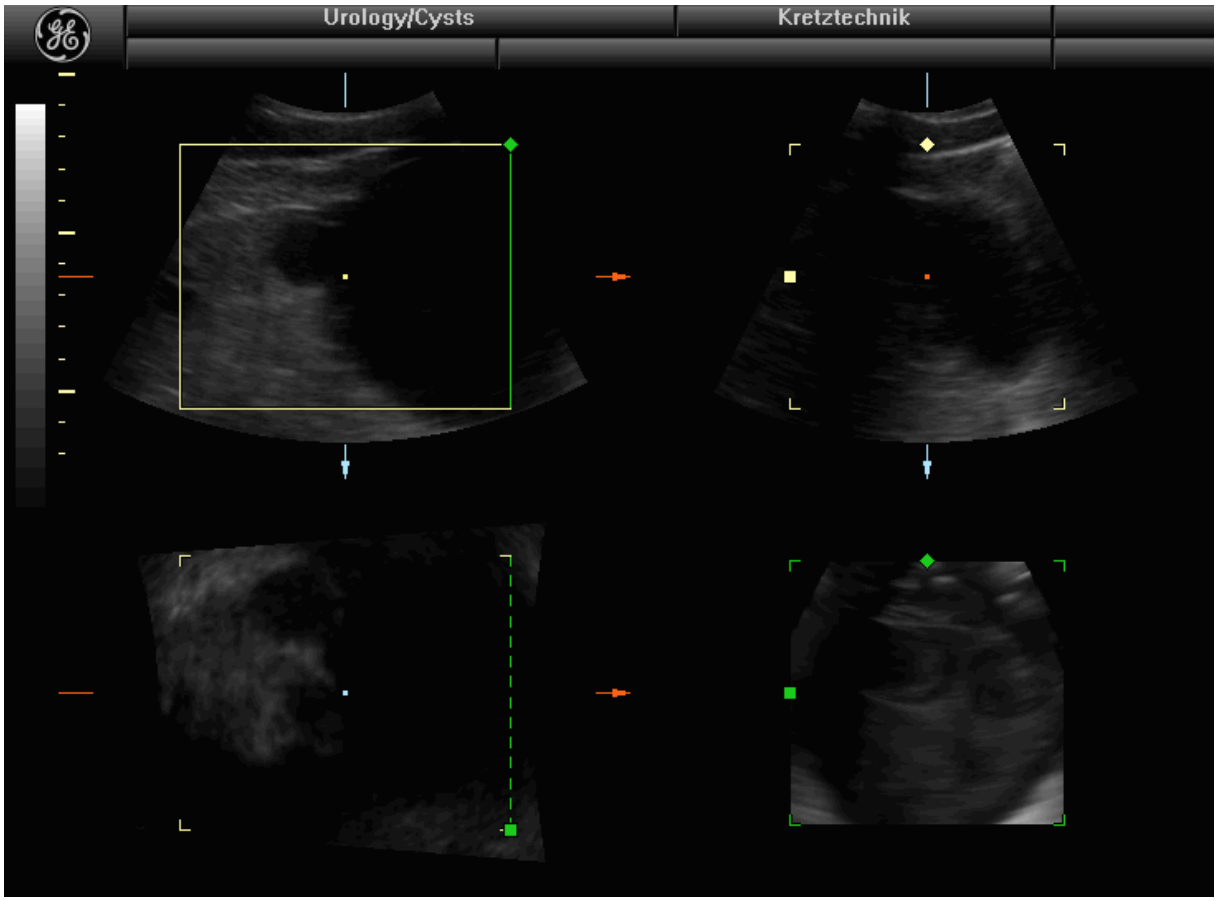
This is the volume scan of a testicle including PD information which was made using the small-parts 4D transducer. The volume was scanned in trapezoid mode in order to increase the field of view.



### 4.6.5 Kidney with Cysts

`Filename: Kidney,Cysts.vol`

Here is a kidney with multiple large and small septated cysts. The rendering offers an impressive insight for the diagnosis.



# Chapter 5

# Menu Functions

## 5.1 File

Using the "File" menu on the menu bar, it is possible to select one of the following functions:

### 5.1.1 Open

Toolbar button

By selecting the "Open" function, an "Open File" window will appear. This enables selection of a directory and opening of volume files.

The volume file has the format VOL_NAME.VOL.

When selecting a volume file, a preview image in *JPEG* (Glossary) format and detailed information at the lower part of the "Open File" window such as date, patient ID and clinic name is shown.

### 5.1.2 Close

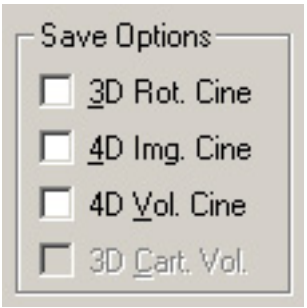
Toolbar button:

This button closes the current volume dataset.

### 5.1.3 Save

Toolbar button:

After loading a file, it is possible to save it as a volume file, which can be loaded with the "Open" function. The default filename extension is `.vol`.




**Save Options:**
In the volume file a *3D Rotation Cine* (Glossary), a *4D Image Cine* (Glossary) or a *4D Volume Cine* (Glossary) can be included, if these are available. Save the volume in **"3D Cartesian Volume"** format, by selecting the appropriate option.

### 5.1.4 SonoView

Toolbar button:

*SonoView*$^{TM}$ (Section 22.2.1) is initialized, or brought to the foreground if it is already active.

### 5.1.5 Save to SonoView

Toolbar button:

The volume file is stored in the *SonoView*$^{TM}$ (Section 22.1.1) database system.

### 5.1.6 DICOM Send

Toolbar button:

By selecting the *"DICOM Send"* (Section 23.3) function, the current image is sent to a *DICOM Server* (Section 23.7), or the current volume to another PC which is equiped with 4D View, where it can be loaded with the help of *SonoView*$^{TM}$ (Section 22.1.5).

For more information about sending a DICOM image or volume, review *"Sending a DICOM Image"* (Section 23.3).

### 5.1.7 DICOM Print

Toolbar button:

By selecting the *"DICOM Print"* (Section 23.4) function, the current image can be printed on a DICOM printer.

### 5.1.8 Export 3D Rotation Cine Sequences

see *"Export 4D Image Cine Sequence"* (Section 5.1.9)

### 5.1.9 Export 4D Image Cine Sequences

A Cine sequence that has been calculated previously, can be saved for viewing later on. The file is saved as an AVI file, so that it can be viewed using a standard Microsoft® Windows 2000® viewer. In order to save the file, simply specify the directory and the filename.

By default the AVI file contains images 1, ..., N of the Cine sequence. If the "Save SE / ES" check box is checked, the AVI file contains images 1, ..., N, (N-1), ..., 2. This means the sequence will be shown from **s**tart to **e**nd and from **e**nd to **s**tart.

For more information on Cine sequences see *"Calculate Cine Sequence"* (Section 18.1).

### 5.1.10 Export Graphic

This menu item enables the user to capture the graphic window and save its contents as a bitmap file to the disk.

### 5.1.11 Print

Toolbar button:

This item enables the user to print the entire graphic output window of 4D View.

### 5.1.12 Print Preview

Select this to show a preview of how the image will be printed.

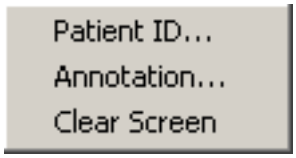
### 5.1.13 Print Setup

This menu item allows configuring of printer settings, such as paper orientation (portrait or landscape) or paper format, and enables the selection of different printers.

### 5.1.14 Exit

When this menu itme is chosen, 4D View will exit to Microsoft® Windows 2000®.

## 5.2 Edit




It is possible to select the following items from the “Edit” menu on the menu bar:

### 5.2.1 Patient ID

Toolbar button:

Display and edit *patient and exam data* (Section 22.1.3).

### 5.2.2 Annotation

Toolbar button:

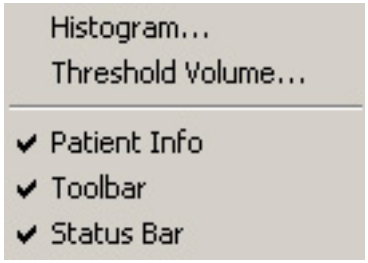
Open the *annotation menu* (Section 21) in order to place text and arrows.

### 5.2.3 Clear Screen

Toolbar button:

Remove all annotations (text and arrows).

## 5.3 View




In the "View" menu on the menu bar the following items are selectable:

### 5.3.1 Histogram

Click the menu item "Histogram," to display a *histogram* (Section 12.1) of the ultrasound intensities.

### 5.3.2 Threshold Volume

This menu item is only available if a VOCAL$^{TM}$II contour is available. It displays the result window of the *Threshold Volume* (Section 11.4) measurement utility.

### 5.3.3 Patient Info

At the top of the graphic output window of 4D View there are two lines of patient information including "Patient Name" and "Patient ID:"

**NOTE:** GA is only shown if the application selected in the *"Patient Information" dialog* (Section 22.1.3) is "OB". If the application is "Gyn" the LMP is shown in this place.

In order to protect the privacy of a patient, the graphic output window can be shown without that information. Only the output of this information is suppressed. The information is preserved in the volume file and in the *SonoView*$^{TM}$ (Section 22.2.1) database.

In the "View" menu select "Patient Info" to show or to hide these two lines of patient information.

### 5.3.4 Toolbar

Some functions of the program can be started from the toolbar. This toolbar can be visible or hidden.

Open a file as in using *"File, Open"* (Section 5.1) from the menu bar.

Close a file as in using *"File, Close"* (Section 5.1) from the menu bar.

Save a file as in using *"File, Save"* (Section 5.1) from the menu bar.

Print a file as in using *"File, Print"* (Section 5.1) from the menu bar.

View and edit patient/exam data as in using *"Edit"* (Section 5.2) from the menu bar.

Select SonoView™ as in using *"File, SonoView"* (Section 5.1) from the menu bar.

Save to SonoView™ as in using *"File, Save to SonoView"* (Section 5.1) from the menu bar.

Send as DICOM image or volume as in using *"File, DICOM Send"* (Section 5.1) from the menu bar.

Print to a DICOM printer as in using *"File, DICOM Print"* (Section 5.1) from the menu bar.

Open annotation menu as in using *"Edit, Annotation"* (Section 5.2) from the menu bar.

Remove all annotations as in using *"Edit, Clear Screen"* (Section 5.2) from the menu bar.

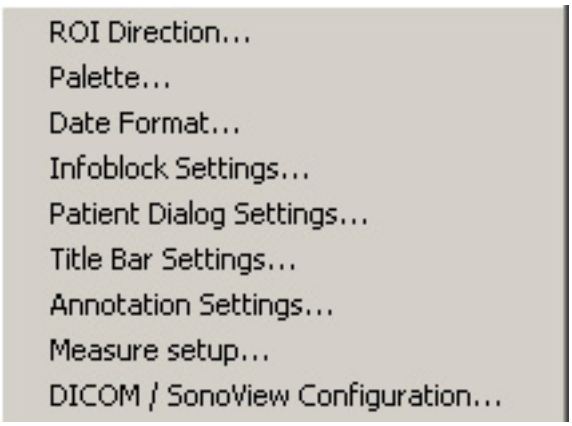
Start 4D View Help program as in using *"Help, Help Topics"* (Section 5.5) from the menu bar.

### 5.3.5 Status Bar

A status bar can be displayed that provides information about the loading progress of volume files, or indicates whether the program is busy otherwise.

## 5.4 Settings

The "Settings" menu on the menu bar allows the manipulation of various parameters.




### 5.4.1 ROI Direction

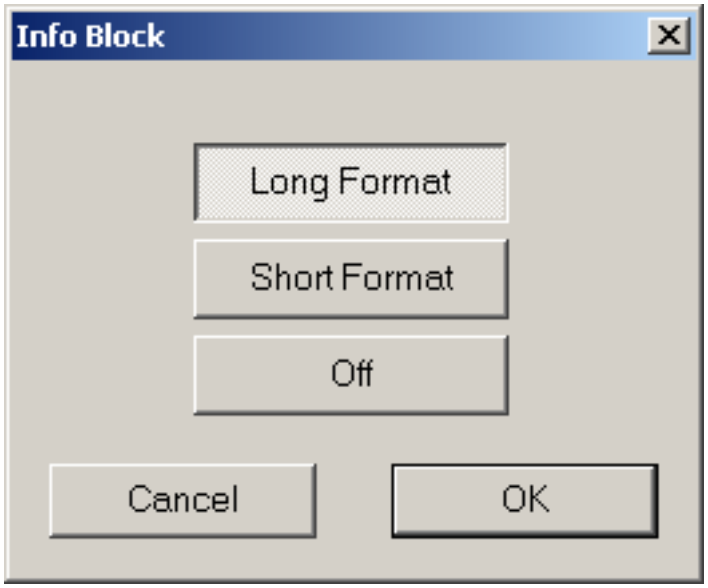
Select different *view directions* (Section 7.2).

### 5.4.2 Palette

Enter a window for interactively selecting *color palettes* (Section 9.2).

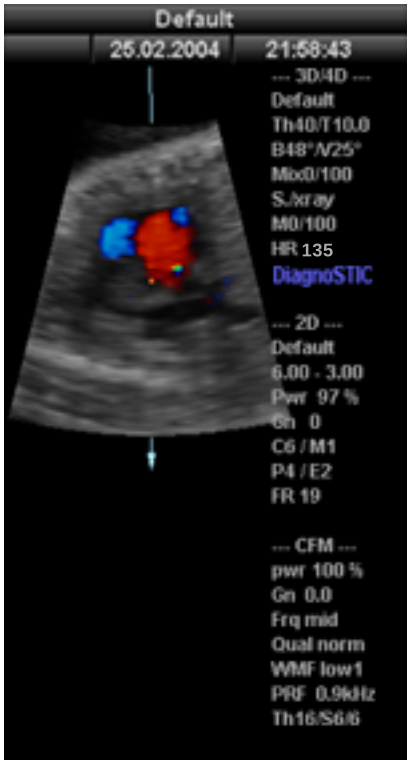
### 5.4.3 Infoblock Settings

Choose to display detailed acquisition information ("Long Format"), basic acquisition information ("Short Format") or to switch off ("Off") acquisition information completely.

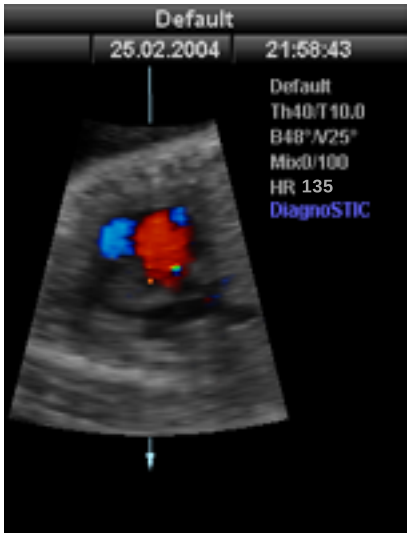


Examples (STIC Color acquisition):

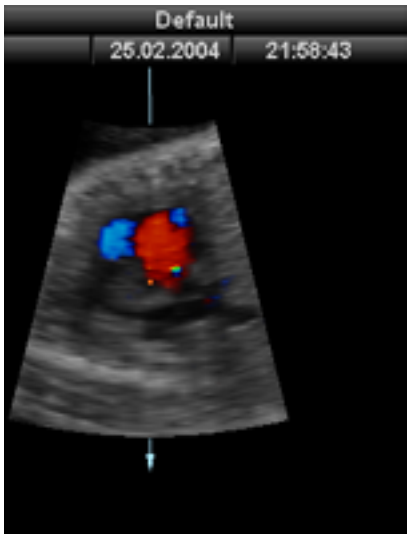
Long Format:




Short Format:



Off:

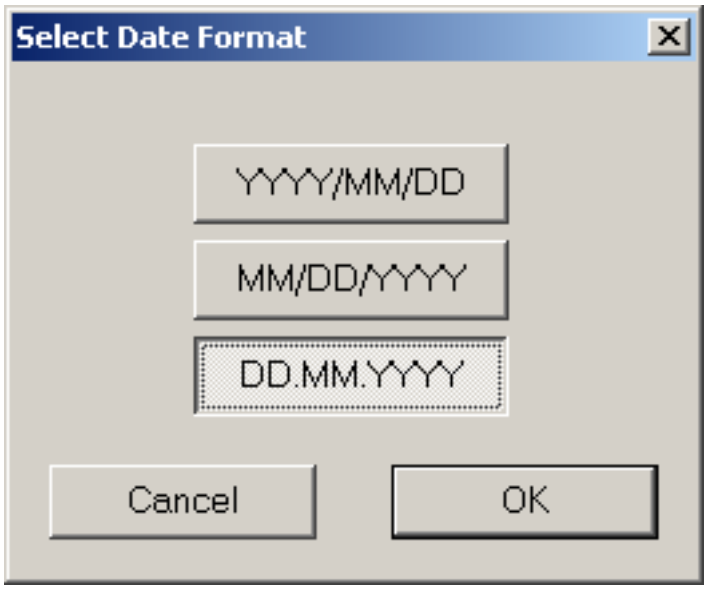



**Note:** Not all information is displayed in all modes. Older volumes, i.e. volumes acquired with a software version smaller than 3.1.0, do not contain all information. Therefore, the information displayed is not very detailed for these older cases.

For more details on the meaning of the displayed information, please refer to the V730 series machine's operation manual Chapter 3.

### 5.4.4 Date Format

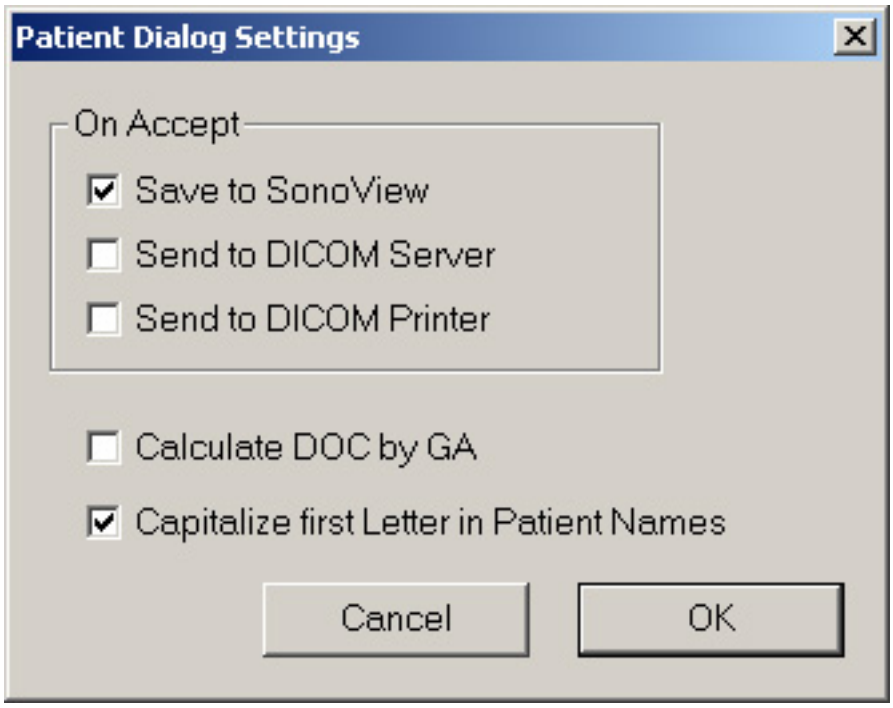
Select one of three possible date formats by pressing the appropriate button. The selected choice is used whenever a date is displayed in 4D View.




Examples:

- YYYY/MM/DD: e.g., 2002/12/06
- MM/DD/YYYY: e.g., 12/06/2002
- DD.MM.YYYY: e.g., 06.12.2002

### 5.4.5 Patient Dialog Settings



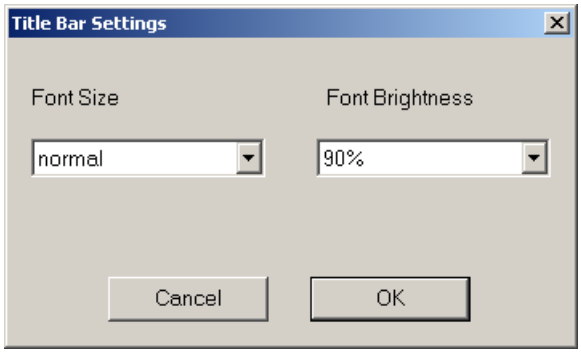

By checking the relevant check boxes, actions apart from starting a study will be performed when the "Accept" button is pressed in the *Patient Information Dialog* (Section 22.1.3). Choose to save the patient dialog to *SonoView* (Section 22.1.1), send it to *the selected DICOM server* (Section 23.1) and/or add it to the *printing queue* (Section 23.4) of *the selected DICOM printer* (Section 23.1).

Select to calculate the DOC (Date of Conception) from the given GA (Gestational Age). By placing a checkmark next to "Calculate DOC by GA".

Turn on or off Auto-Capitalization of first letter (in field, after blank, after dash) of the patient names (first, middle, last) in the *Patient Dialog* (Section 22.1.3).

### 5.4.6 Title Bar Settings

Adjust size and brightness of the font used for displaying the patient information in the title bar.




### 5.4.7 Annotation Settings

Open the *annotation settings dialog* (Section 21.5) which allows to adjust certain parameters for annotations (e.g. font size, text presets, ...).

### 5.4.8 Measure Setup

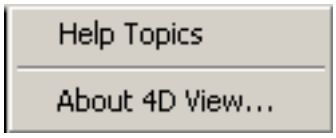
Enter

- *Measurement & Calc* (Section 16.1) Measurement Setup,
- *Application Parameter* (Section 16.2) Measurement Setup, or
- *Global Parameter* (Section 16.3) Measurement Setup.

### 5.4.9 DICOM Configuration

Define *DICOM settings* (Section 23.1).

## 5.5 Help




The “Help” menu allows access to the help topics of 4D View.

### 5.5.1 Help Topics

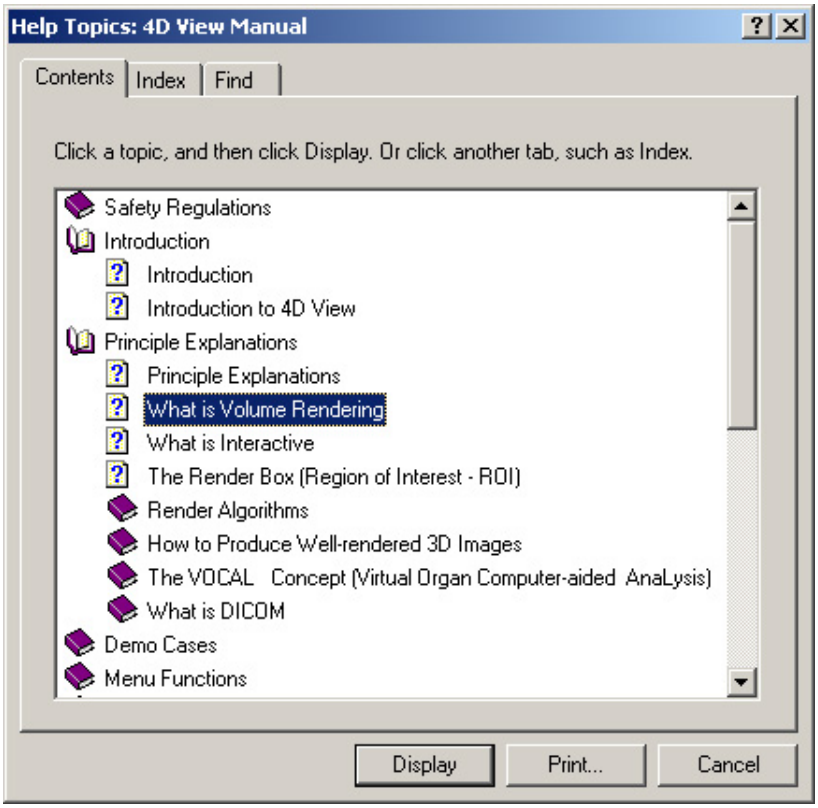
Open a browser and searchable electronic version of this manual. There are three possibilities of navigating through the help file:

1. Browse the Contents

By selecting a closed book and pressing “Open,” the subtree of this book is expanded.

By selecting an open book and pressing “Close,” the subtree of this book is collapsed.

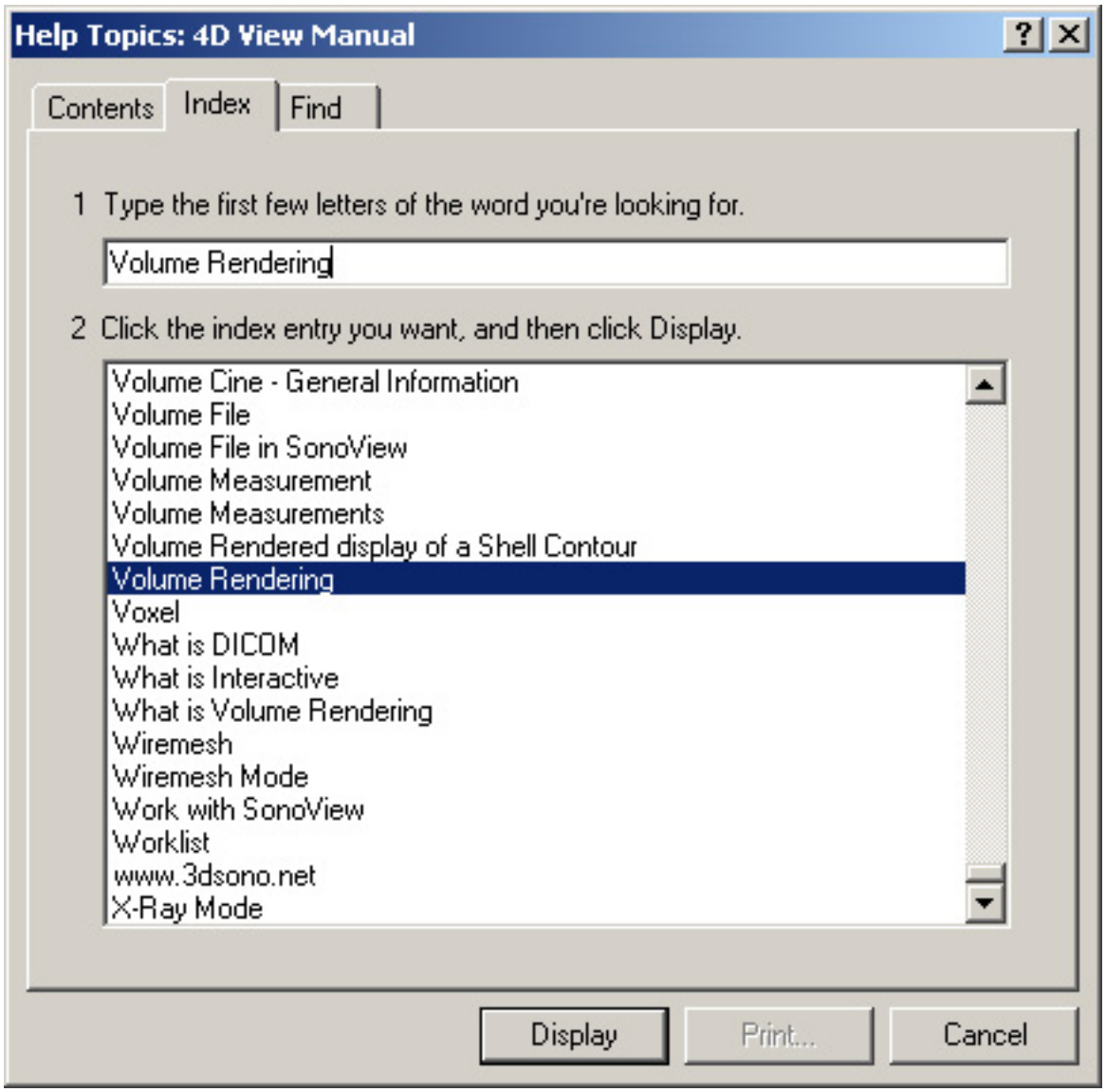
By selecting a page and pressing “Display,” a new window containing the information is opened.



2. Use the Index

Click the “Index” tab in order to look for a certain topic.

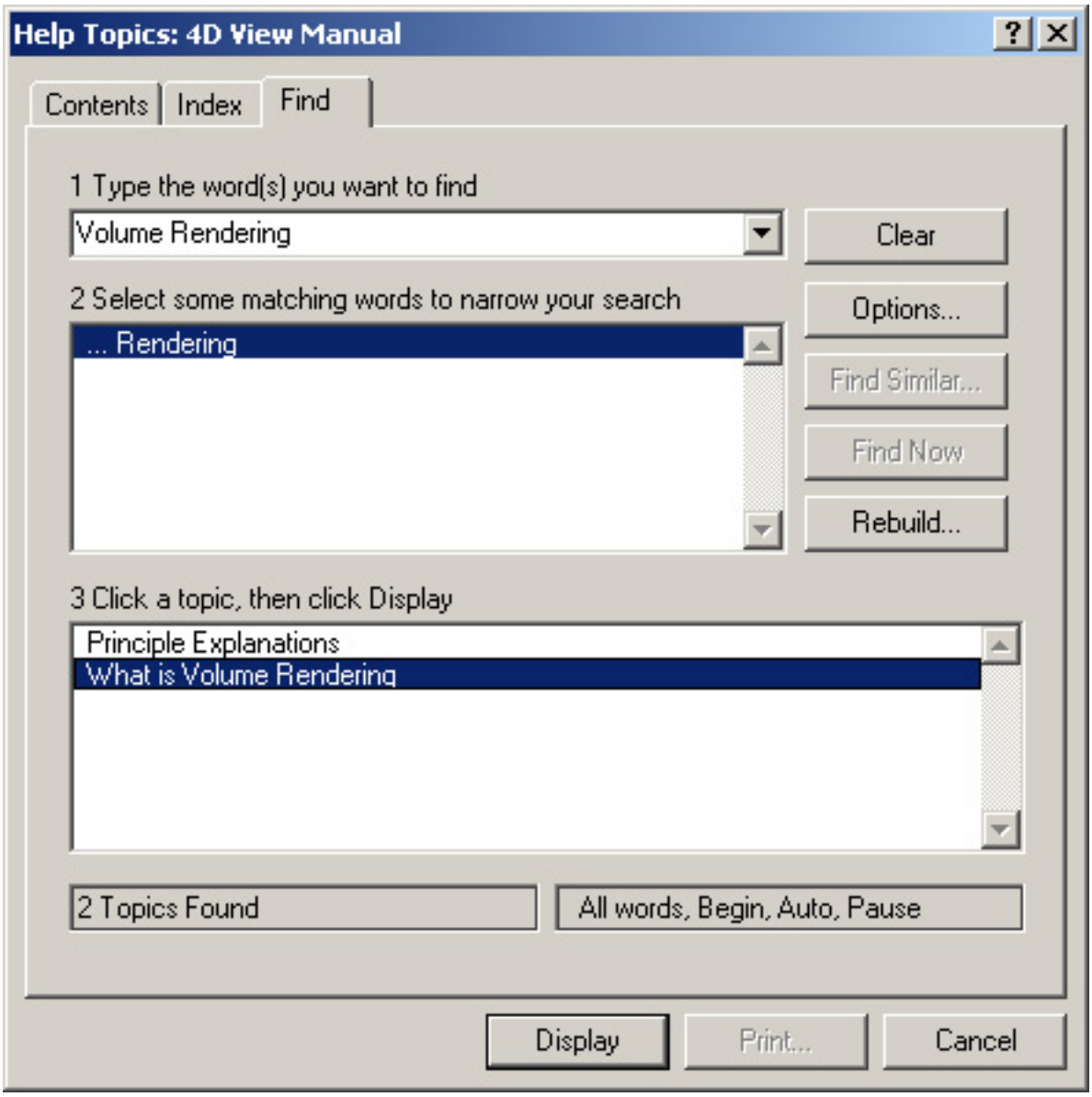
Type the topic for in the text field, select the appropriate index and click “Display” to open the window containing the information.



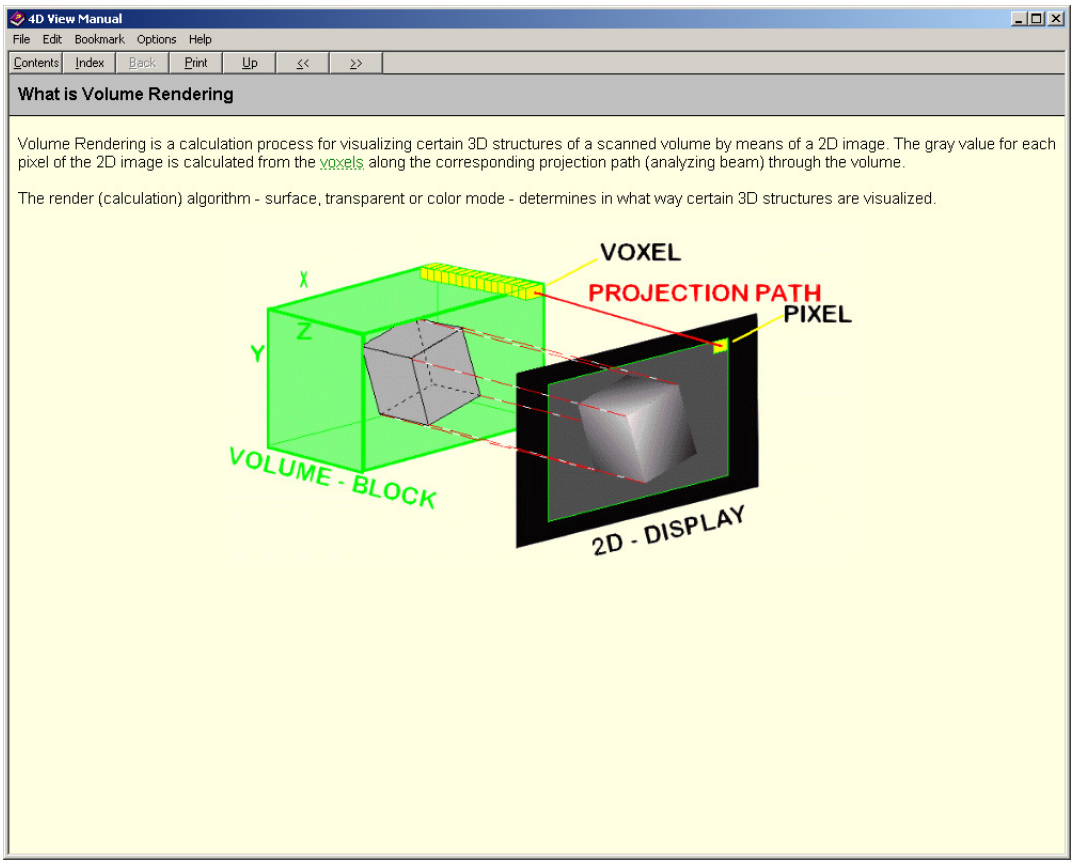
3. Search the Helpfile

Click the “Search” tab in order to search the information for certain keywords.

Type the desired word in the text field, select a matching word from a list displayed below, select a topic from bottom list and then click “Display.” The window containing the information is displayed.



The actual help pages look similar to the example below.

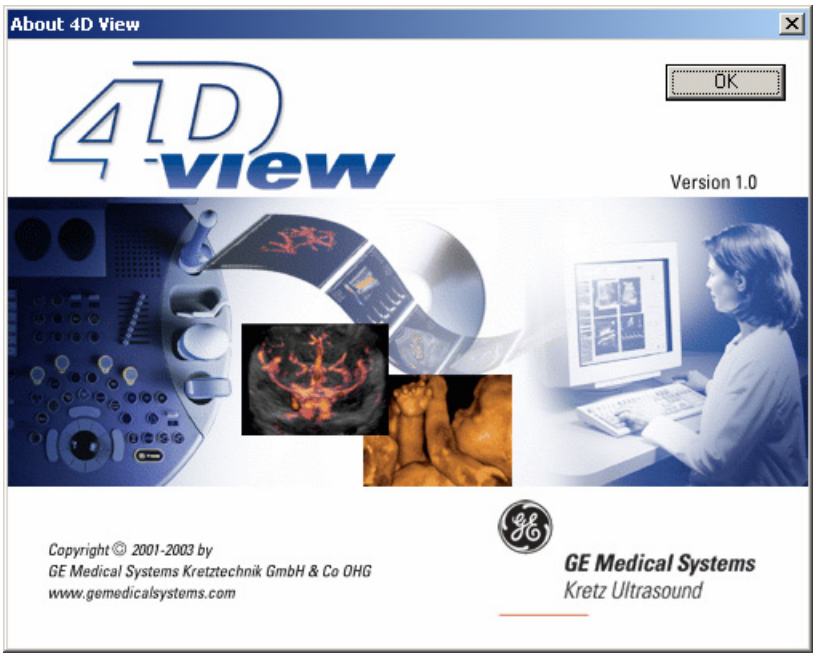



Once in the new window, it is possible to return to the “Contents/Index/Find” window again by pressing the “Contents” or “Index” button. Return to the last page visited by clicking the “Back” button. Using the “Up” button, the next higher level in the hierarchic structure of the help file (the next higher book) is reached. The left and right arrows can be used to move sequentially through the help file.

Click on any green and underlined (complete line or broken line) part of the text in order to display a related topic (complete line) or a glossary entry concerning the phrase (broken line). Buttons appearing in the text open additional information such as PDF files or movies when pressed.

### 5.5.2 About 4D View ...

Choose this item in order to display the 4D View Start Up screen.

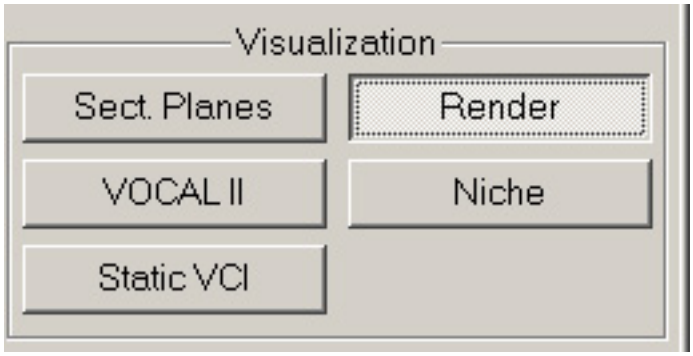



Normally, this is used for finding out which version of 4D View is installed on the system. Press the “OK” button to close the screen again.

# Chapter 6

# Display Modes

## 6.1 Visualization Types




At the top of the main menu of 4D View, choose between the main modes of visualization:

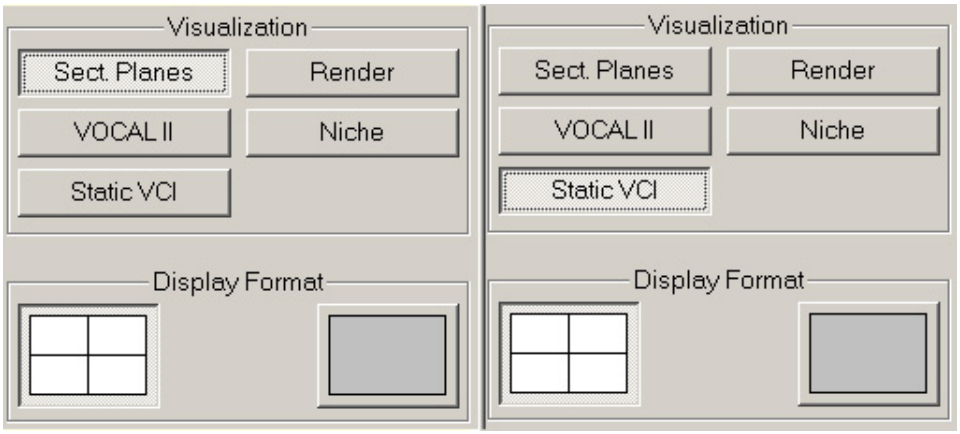
- Sect. Planes (Sectional Planes)
  - ABC Multiplanar Mode
  - ABC Multiplanar Mode with Volume Orientation
- Static VCI
  - ABC Multiplanar Mode
  - ABC Multiplanar Mode with Volume Orientation
- Render
  - 3D ROI Mode
  - 3D Full-Screen Display
  - 3D Plane Adjustment Mode
  - Split-Screen in 4D Volume Cine Mode

- VOCAL™II
  - Edit VOCAL™
  - 3D ROI Mode
  - 3D Full-Screen Display
  - 3D Plane Adjustment Mode
  - VOCAL™ II Niche in Quad- or Full-Screen Format
- Niche
  - Niche in Quad- or Full-Screen Format

For details review *"Display Modes"* (Section 6.2) and *"VOCAL™ - Edit Contour"* (Section 11.3).

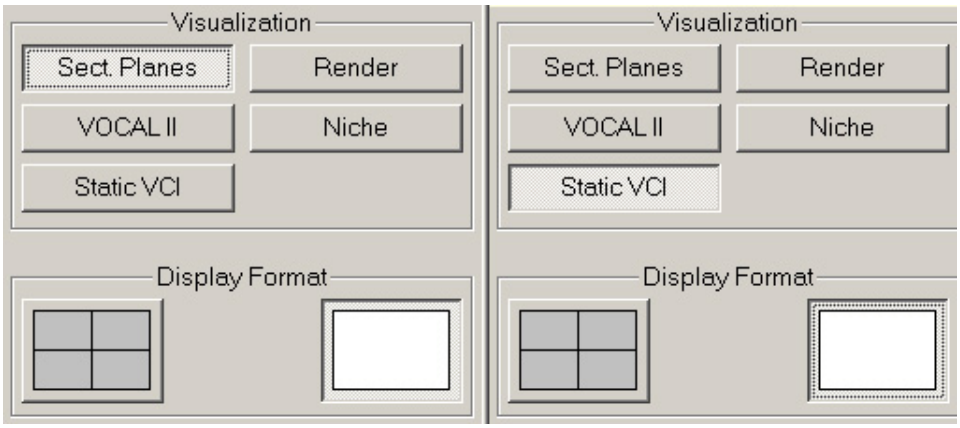
## 6.2 Display Format

### 6.2.1 ABC Multiplanar Mode



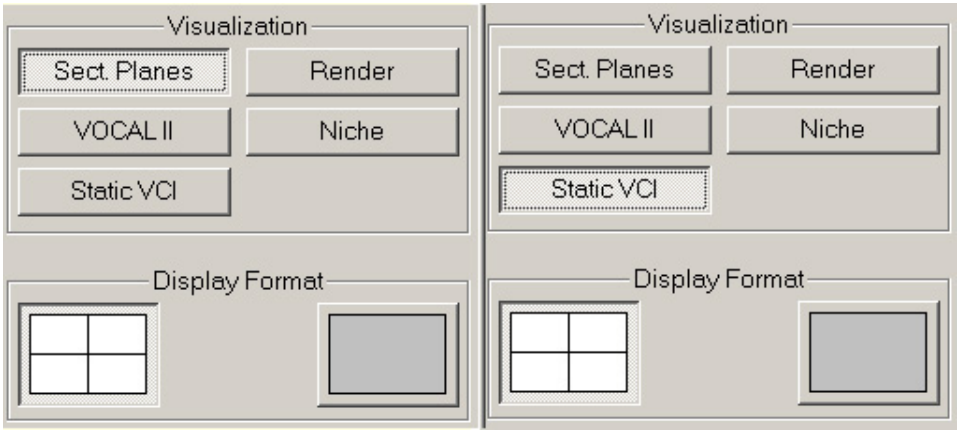

Select the "Sectional Planes" button or the "Static VCI" button in the main menu. The "ABC Mode" can be activated by selecting the left button shown above. This mode does not permit changing of the *ROI* (Glossary), and displays no 3D rendered image. It allows viewing and parallel movement through the image slices. (Review: *"Reference Slices"* (Section 7.3)).

In "Static VCI" mode the VCI algorithm is applied to the image slices. VCI displays a "Pseudo-2D" image which is created by using a very small render box in order to create a contrast-enhanced image plane. For more information please review the Voluson® 730 Expert "Operation Manual."



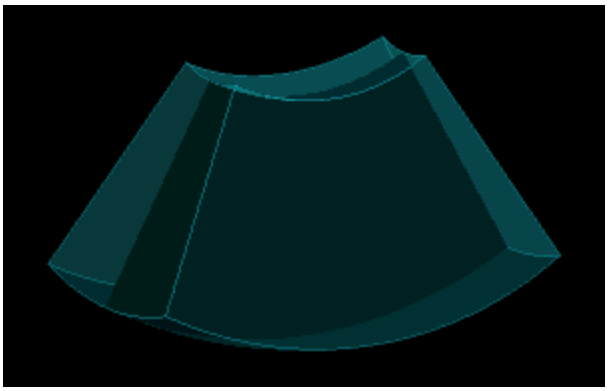

The "Full-Screen View" of a single image slice can be activated by selecting the "Full-Screen" button. It allows viewing and parallel movement through the slices of a single image. (Review: *"Reference Slices"* (Section 7.3))

### 6.2.2 ABC Multiplanar Mode with Volume Orientation

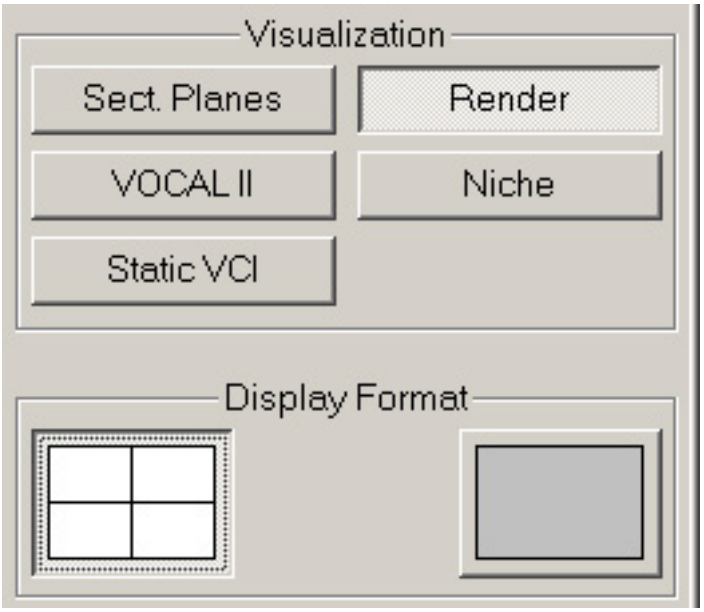



Select the "Sectional Planes" button or the "Static VCI" button in the main menu. In this mode sectional planes are displayed, one of which is chosen as the reference plane. See also: *"ABC Mulitplanar Mode"* (Section 6.2.1).

In addition, the orientation help figure can be displayed in the lower right quadrant of the image by clicking on "Orient. Help."



### 6.2.3 3D ROI Mode

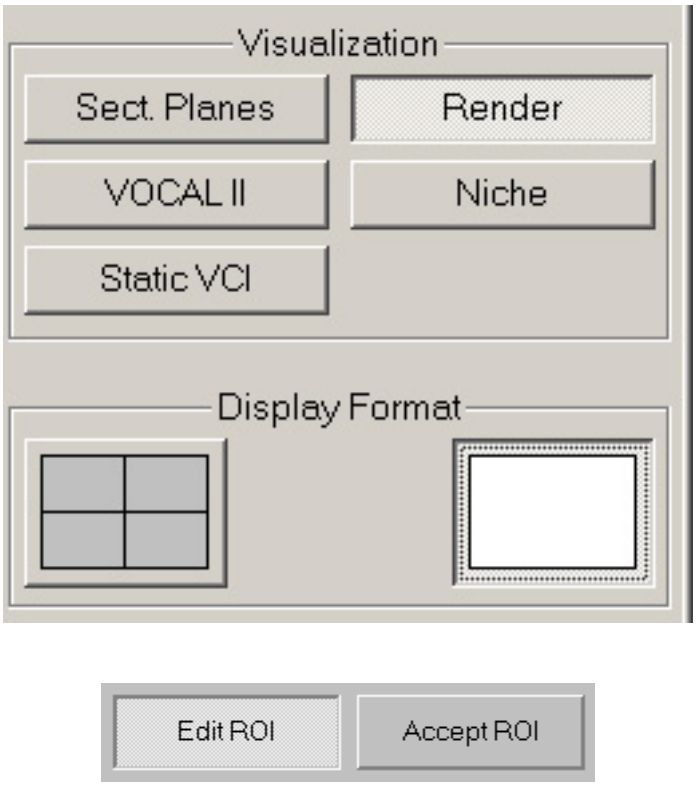


Select the "Render" button in the main menu. This mode is used to adjust the volume render box. The volume render box determines the ROI for the 3D calculation. It is displayed in the orthogonal planes A, B and C.

**Review:** *"How to Position the Render Box"* (Section 7.2)

**Note:** If the "VOCAL™ Surface Mode" is activated in the *"3D Rendering Mode"* (Section 8.1) menu, the intersection curves between the *shell geometry* (Section 3.6) and the different image planes A, B and C are displayed instead of the volume render box. Instead of the rendered 3D image the shell geometry is visualized.

### 6.2.4 3D Full-Screen Display

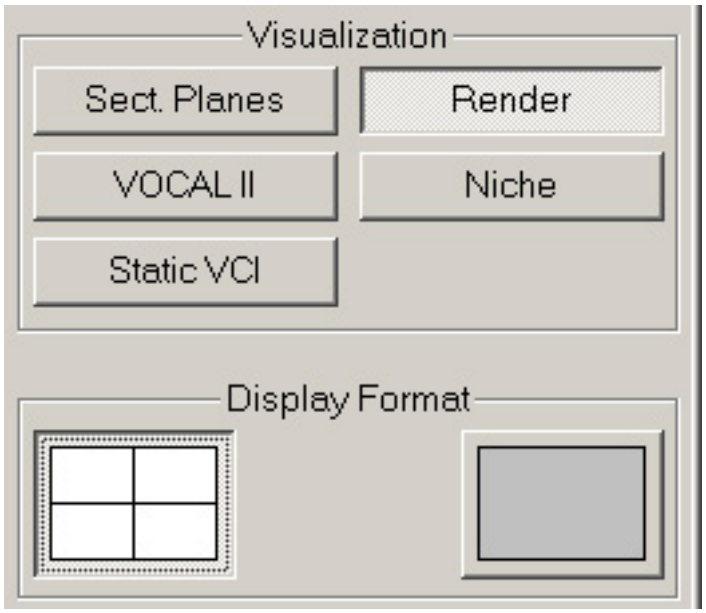



The rendered 3D image is magnified and displayed in a full-size image format without the sectional planes of A, B, and C.

**Review:** *"How to Rotate the Image"* (Section 7.1)

**Note:** If the "VOCAL™ Surface Mode" is activated in the *"3D Rendering Mode"* (Section 8.1) menu, the *shell geometry* (Section 3.6) is visualized instead of the rendered 3D image. If the "VOCAL™ II Mode" is activated and a "Gray," "Color" or "Glass Body" rendering is selected in the *"3D Rendering Mode"* (Section 8.1) menu, the volume rendered image is displayed with a *shell contour* (Section 3.6).

### 6.2.5 3D-Plane Adjustment Mode



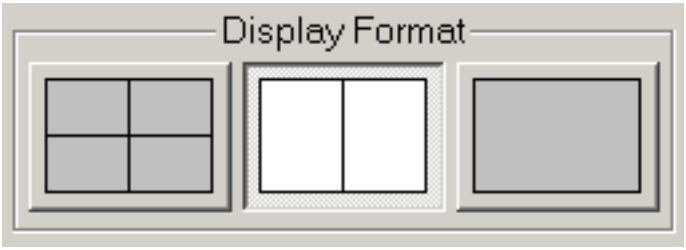
This mode uses the rendered 3D image in order to adjust the 2D sectional planes A, B and C. An inserted green line on the 3D image marks the position of image B or C in relation to the rendered 3D image.

**View:**
*"Reference Image A"* (Section 6.3)
*"Reference Image B"* (Section 6.4)
*"Reference Image C"* (Section 6.5)

With these buttons, toggle between "3D ROI Mode" and "3D Plane Adjustment Mode."

**Note:** If the "VOCAL™ II Mode" is activated and a "Gray," "Color" or "Glass Body" rendering is selected in the *"3D Rendering Mode"* (Section 8.1) menu, the volume rendered image is displayed with a *shell contour* (Section 3.6).

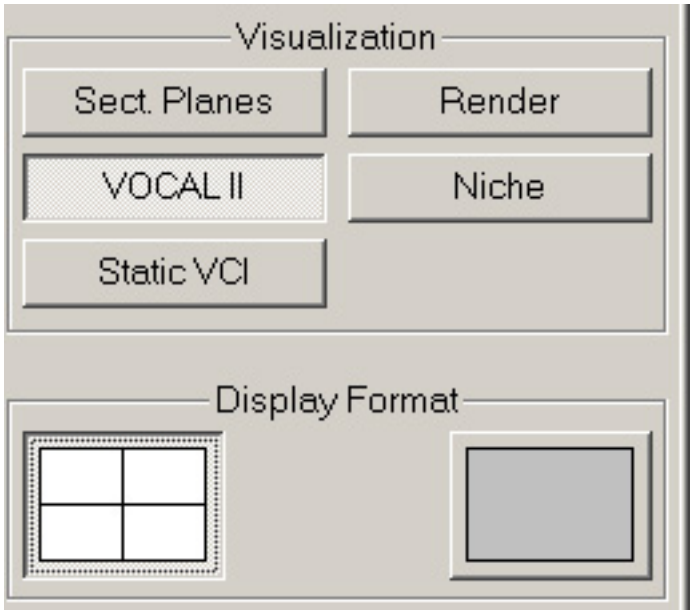
### 6.2.6 Split-Screen in 4D Volume Cine Mode




In some *"4D Volume Cine" modes* (Section 20.1) "Split-Screen" can be selected as the display format. If this format is activated, a normal 2D image is seen on the left side of the screen and the rendered image on the right half of the screen.

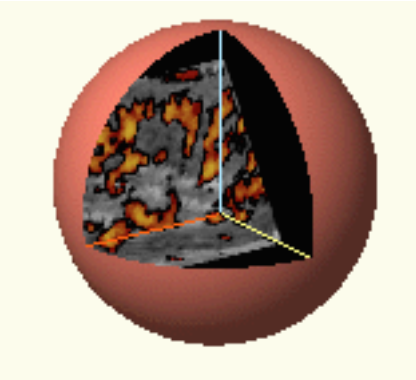
This is especially helpful for *positioning the render box* (Section 7.2) and *producing a well-rendered image* (Section 3.5), as the reference image and the rendered image are larger.

### 6.2.7 VOCAL II Niche in Quad- or Full-Screen Format




Select the "VOCAL II" button in the main menu.

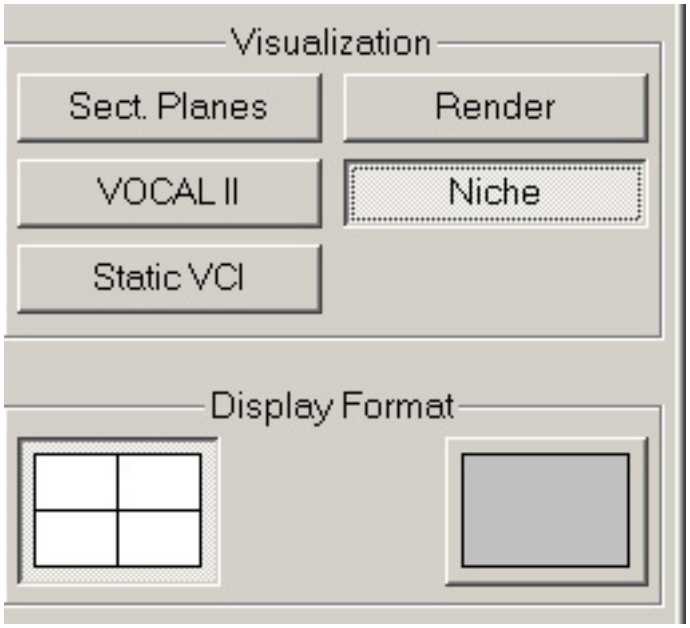
The "VOCAL$^{TM}$ Niche Mode" can be activated by selecting the "VOCAL Niche" button shown here. ("Full-Screen Mode" is obtained by selecting the "Full-Screen" button.)



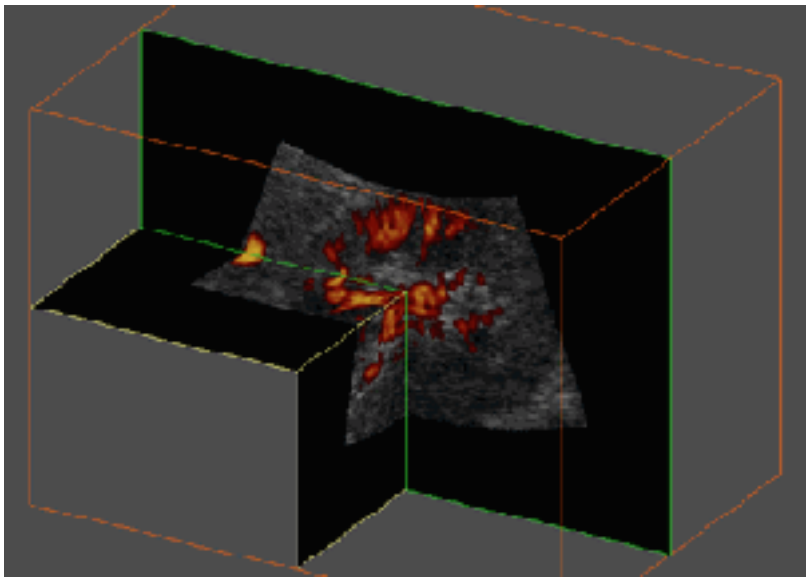
The niche mode allows the viewing of 3 orthogonal planes in a stereoscopic view bounded by the *VOCAL*$^{TM}$ *contour* (Section 11.2) .

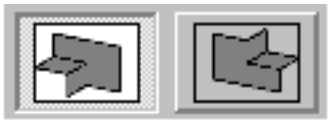
A VOCAL$^{TM}$ view direction (=niche mode) can be selected with the "Niche Mode" control shown below:

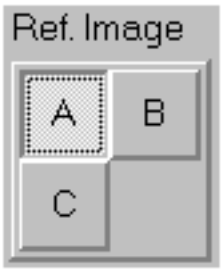
### 6.2.8 Niche in Quad- or Full-Screen Format




Select the "Niche" button in the main menu. This mode does not permit changing of the *ROI* (Glossary), and displays no 3D rendered image. ("Full-Screen Mode" is obtained by selecting the "Full-Screen" button.)





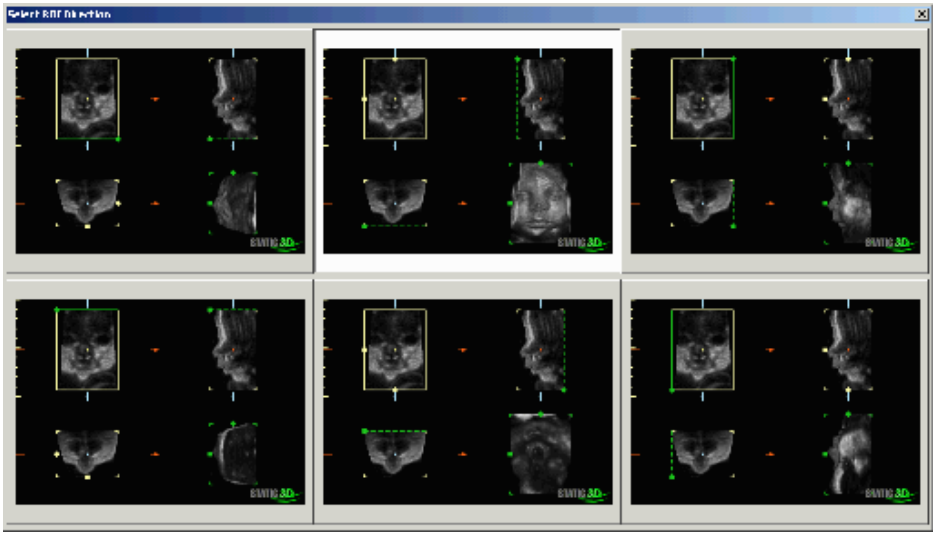



The “Niche Mode” allows the viewing of 3 orthogonal planes in a stereoscopic view. In order to select different niches (=niche mode) use the “Niche Symbol” buttons shown here and the “Ref. Image” buttons.

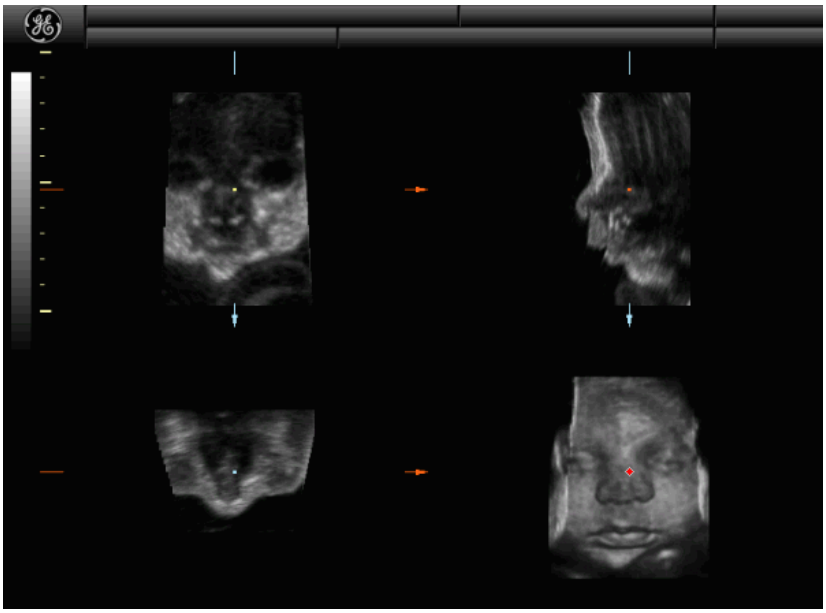
## 6.3 Reference Image A

### Selected reference image is sectional plane A

For instructional purposes assume that the following orientation of the region of interest is selected:



For more information about the selection of the view direction review: *"Menu Functions - Settings"* (Section 5.4) and *"Rotation and Reference Slices - How to Position the Render Box"* (Section 7.2).



With this orientation of the region of interest, plane A is in parallel direction to the displayed 3D image. Therefore, there is no intersection between plane A and the 3D image. The dots in image A and in the 3D image are equal in horizontal and vertical position, but different in depth position. These two dots are situated on the intersection line of plane B and plane C.

Moving the dot in the 3D image with the right mouse button, select the corresponding horizontal and vertical planes (image planes B and C).

**Adjust the depth position of plane A:**

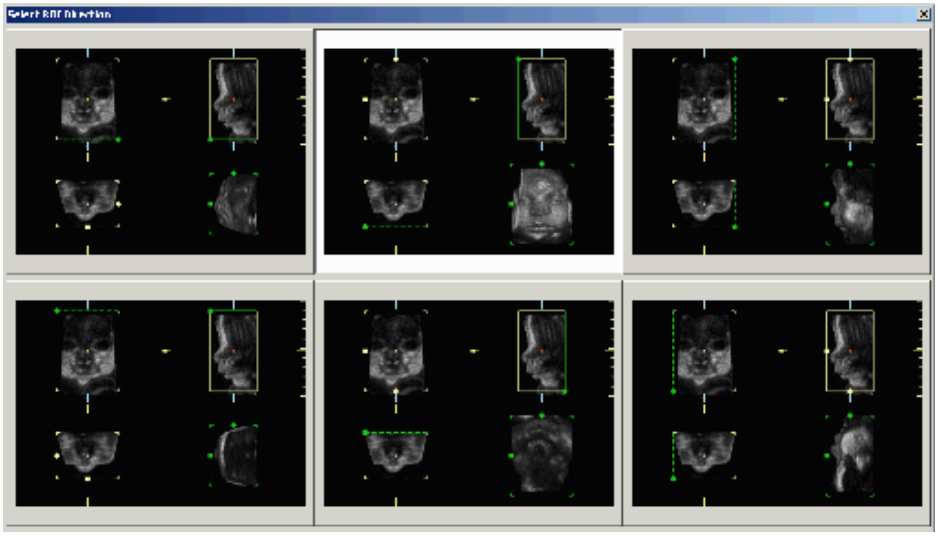
The depth position of plane A can be changed by using the “Ref Slice” slider.

For more information about reference slices review *“Rotation and Reference Slices - Reference Slices”* (Section 7.3).

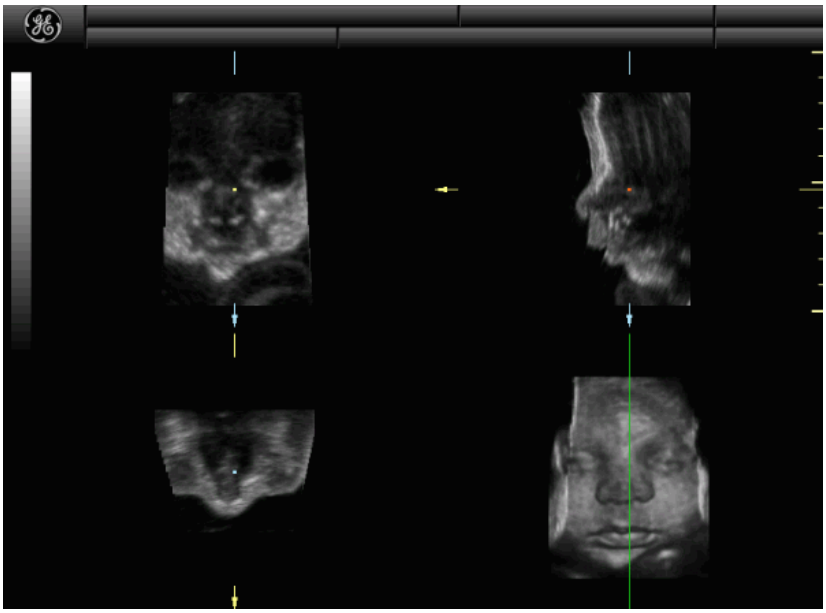
## 6.4 Reference Image B

### Selected reference image is sectional plane B

For instructional purposes assume that the following orientation of the region of interest is selected:



For more information about the selection of the view direction review: *"Menu Functions - Settings"* (Section 5.4) and *"Rotation and Reference Slices - How to Position the Render Box"* (Section 7.2).



With this orientation of the region of interest, plane B is in orthogonal direction in relation to the displayed 3D image. The vertical green line indicates the position of plane B in the 3D image (see picture above).

**Adjust the position of the green line within the 3D image:**

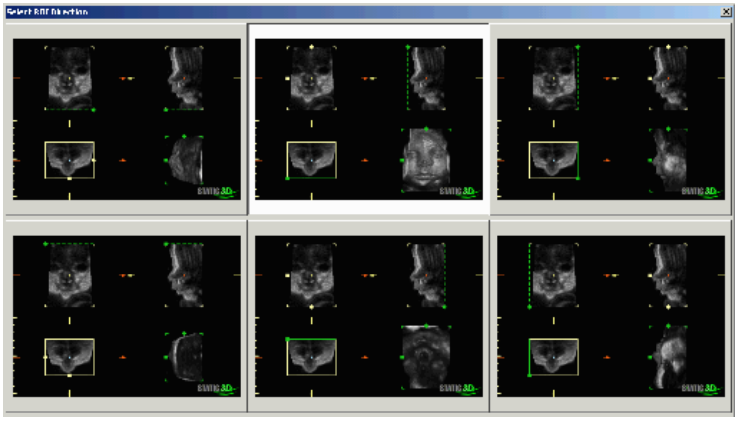
Place the mouse cursor on the green line and press the right mouse button for positioning the line (parallel movement of image B).

For more information about reference slices see: *"Rotation and Reference Slices - Reference Slices"* (Section 7.3).

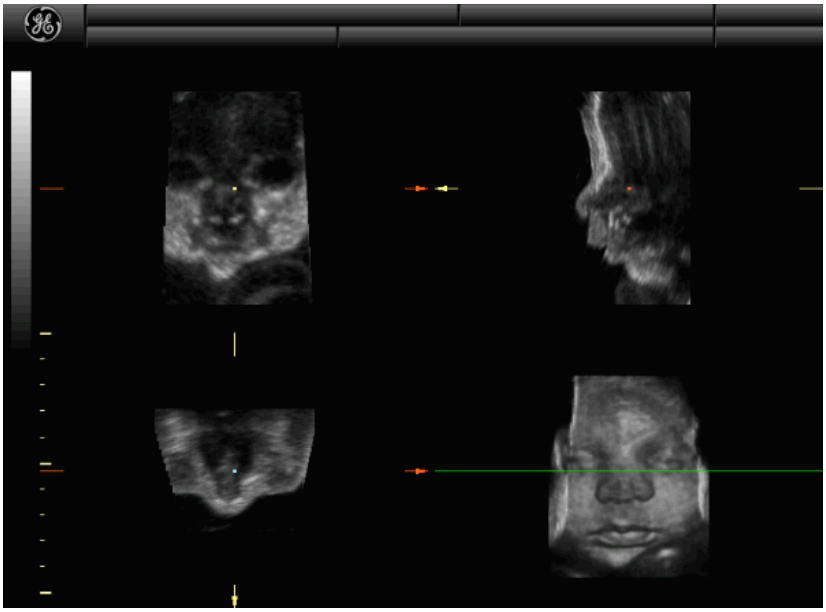
## 6.5 Reference Image C

### Selected reference image is sectional plane C

For instructional purposes assume that the following orientation of the region of interest is selected:



For more information about the selection of the view direction review: *"Menu Functions - Settings"* (Section 5.4) and *"Rotation and Reference Slices - How to Position the Render Box"* (Section 7.2).



With this orientation of the region of interest, plane B is in orthogonal direction in relation to the displayed 3D image. The vertical green line indicates the position of plane B in the 3D image (see picture above).

**Adjust the position of the green line within the 3D image:**

Place the mouse cursor on the green line and press the right mouse button for positioning the line (parallel movement of image C).

For more information about reference slices see: *"Rotation and Reference Slices - Reference Slices"* (Section 7.3).

# Chapter 7

# Rotation and Reference Slices

## 7.1 Rotation

The mouse and slider bars are available to rotate the image slices and the 3D image, which makes it possible to obtain an improved view of the object of interest. The availability of the rotation function differs with the different display modes.

### 7.1.1 ABC or Full-Screen Slice, 3D ROI and 3D Full-Screen Mode

**Mouse Functionality:**

For rotation around the X-axis, place the cursor on the left or right border of the selected image, keep the left mouse button pressed and move up and down as soon as a double-pointed vertical arrow appears.

For rotation around the Y-axis, place the cursor on the top or bottom border of the selected image, keep the left mouse button pressed and move left or right as soon as a double-pointed horizontal arrow appears.

For rotation around the Z-axis, place the cursor close to the center of the selected image, keep the left mouse button pressed and rotate as soon as a circle appears.

In order to move the entire image, place the cursor within the selected image, keep the right mouse button pressed and move the mouse as soon as a hand-shaped icon appears.

**Slider Functionality:**

The following sliders can be used instead of the mouse.

Using the mouse, simply drag the bar to the left or the right for a rotation in the negative or positive direction, respectively. The angle of rotation is displayed above the slider, as can be seen in the example above for the rotation around the Z-axis.

**NOTE:** When rotating the 3D image in 3D ROI mode with an image slice, the rotation axis for the 3D image refers to the activated image slice.

### 7.1.2 3D-Plane Adjustment Mode

In 3D plane adjustment mode, only the 3D image can be rotated. Of course, the three image slices are updated with respect to the changes made in the 3D image.

**Mouse functionality:**

For rotation around the X-axis place the cursor on the left or right border of the 3D image, keep the left mouse button pressed and move up and down as soon as a double-pointed vertical arrow appears.

For rotation around the Y-axis place the cursor on the top or bottom border of the 3D image, keep the left mouse button pressed and move left or right as soon as a double-pointed horizontal arrow appears.

For rotation around the Z-axis place the cursor close to the center of the 3D image, keep the left mouse button pressed and rotate as soon as a circle appears.

The 3D image can be rotated but not moved.

**Slider Functionality:**

Any use of the sliders will affect the 3D rendered image only. The axes are meant in reference to the 3D image.

For information on how to move the reference point, review *"Reference Slices"* (Section 7.3).

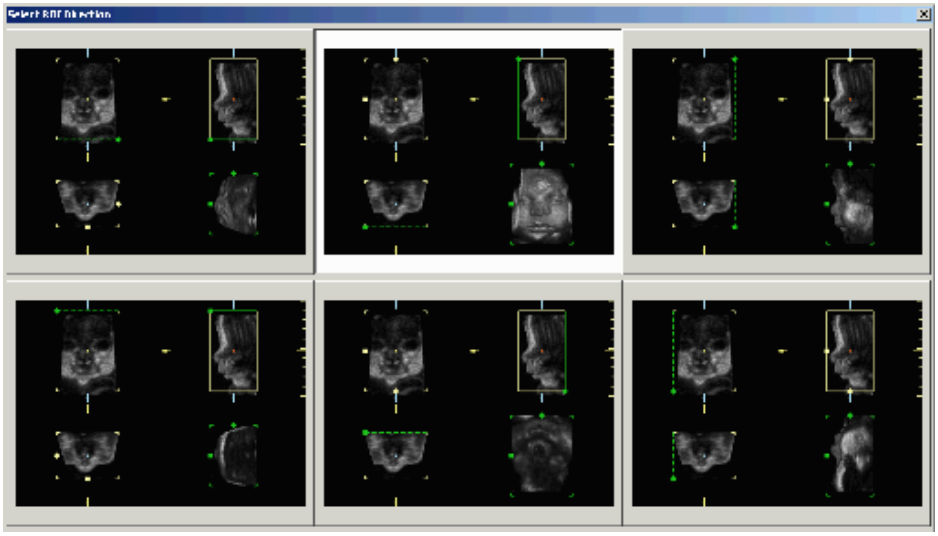
### 7.1.3 Init Function

All images can be reset at any time with the "Init" button. When in "ABC," "Full-Screen Slice Mode" or "3D ROI Mode," all images are reset to their original status which they were in when the file was loaded. When in "3D Plane Adjustment Mode" or "3D-Plane Adjustment Full-Screen Mode," the images are reset to the position in which they were in when the display was changed into the "3D Plane Adjustment Mode."

## 7.2 How to Position the Render Box

The 3D render box determines the *ROI* (Glossary) for the 3D calculation and determines the direction of view through the volume block. The adjustment of the render box is done with the help of the three orthogonal planes A, B and C, which cut through the center of the render box in all three directions.

The direction of view used in the example below is the same as if the highlighted orientation (top row, center) of the region of interest was selected:

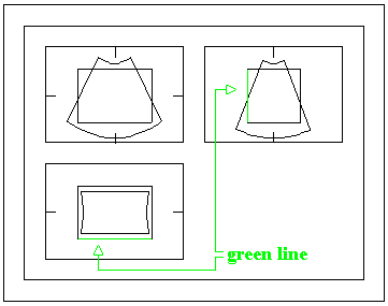


Plane A: The viewing direction is orthogonal to plane A.
Plane B: The viewing direction is from left to right with respect to plane B.
Plane C: The viewing direction is from bottom to top with respect to plane C.

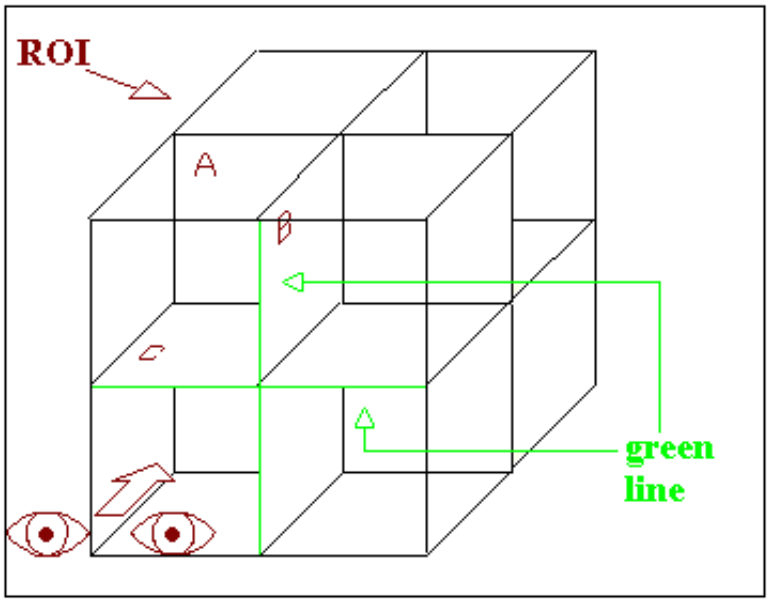
The green line of the render box in the planes B and C symbolizes the direction of view and the border for starting the analysis.

(review also *"Principle Explanations"* (Section 3.1)).

Display on the monitor (schematic):



Position of the sectional images relative to the *ROI* (Glossary):

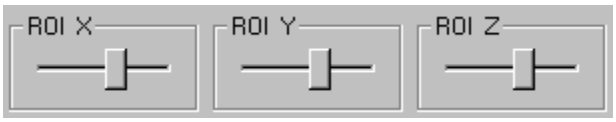



If the "VOCAL$^{TM}$ Contour Mode" is activated in the *"3D Rendering Mode"* (Section 8.1) menu, the intersection curves between the shell geometry and the different image planes A, B and C are displayed, instead of the volume render box. The rendered 3D image is not shown, only the *shell geometry* (Section 3.6) is visualized.

### 7.2.1 Adjust the Size of the Render Box

*Select reference image A, B or C.*

Slider controls and mouse controls are assigned to the reference image for the adjustment of the *ROI* (Glossary).




Additionally, the size (=3D resolution) of the render boxes can be adjusted with the mouse by positioning the cursor on one of the edges of the box, keeping the left or right mouse button pressed and moving the mouse. This can be done in any of the three sectional planes and in the rendered image itself.

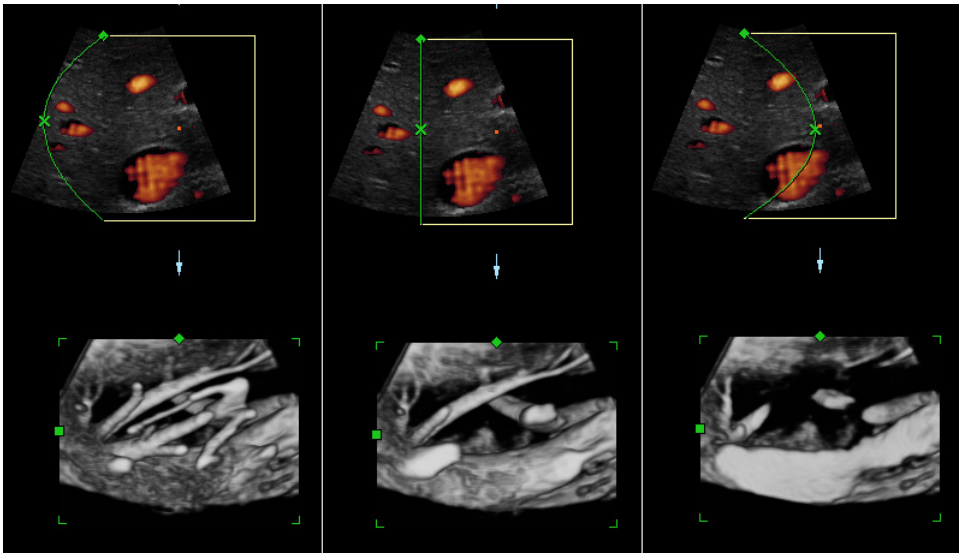
**Note:** The benefit of a smaller box is less calculation time.

If the "VOCAL$^{TM}$ Contour Mode" is activated in the *"3D Rendering Mode"* (Section 8.1) menu, adjustments of the render box are impossible.

### 7.2.2 Adjust the Curvature of the Render Box

Using the curved render start is an intuitive way of adapting the render box to the anatomical structures in the data set. The render start can be modified so it becomes a smooth convex or concave curve. This is used to increase the quality of the rendered image of a 3D or 4D acquisition and reduce post processing time. Typical applications: First Trimester Scans and detailed studies of the spine

View the three images below to understand how the curvature of the render box effects the rendered image:



Position the mouse over the "x" on the green line, hold the left mouse button pressed and move the mouse in order to change the curvature of the render start.

### 7.2.3 Adjust the Contents of the Render Box

The selected images in the planes A, B or C can be positioned relative to the render box by placing the cursor within the image, keeping the right mouse button pressed and moving the image (a hand-shaped mouse cursor appears).

**Important:** This proceedure eliminates structures that interfere with a free viewing path to the object. They can be moved outside of the render box and will, therefore, not disturb the 3D volume rendering.

### 7.2.4 Adjust the Magnification of the Rendered 3D Image

The magnification control changes the size of the box's contents within image A, B, and C relative to the render box.

**Note:** The magnification of the entire 3D image without changing the box's contents is only possible in "3D Plane Adjustment Mode."

### 7.2.5 Rotate the Contents of the Render Box

The rotation controls rotate the box's contents relative to the render box. The mouse can also be used to rotate the images.

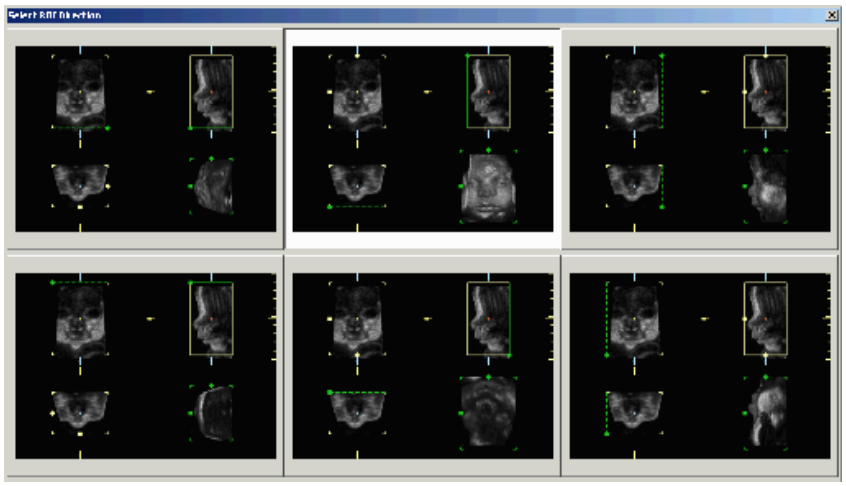
**Important:** The direction of view of the 3D image is selected with the rotation controls.

For rotation, mouse and slider control, see *"Rotation and Sliders"* (Section 7.1).

### 7.2.6 Adjust the View Direction of the Rendered 3D Image

The menu item *"Settings - ROI Direction"* (Section 5.4) allows the definition of six different view directions for the rendered image. The direction of view is symbolized by a green line in the graphic shown on each slice. The frame around the enabled direction of view changes from gray to white, as can be seen in the image below. Another example is given at the beginning of this section.

If "VOCAL$^{TM}$II" is enabled, this menu item is grayed and fixed to the view direction shown below.



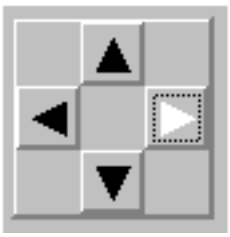
See also the menu item *"Settings - ROI Direction"* (Section 5.4).

### 7.2.7 90 Degree Adjustment of the Rendered 3D Image

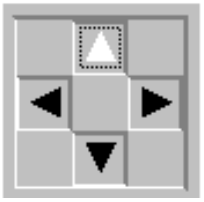
With this control adjustment of the 3D image position–left/right or up/down–without changing between the image planes A, B and C can be made.

If "VOCAL$^{TM}$II" is enabled this control is hidden and set to the up position.

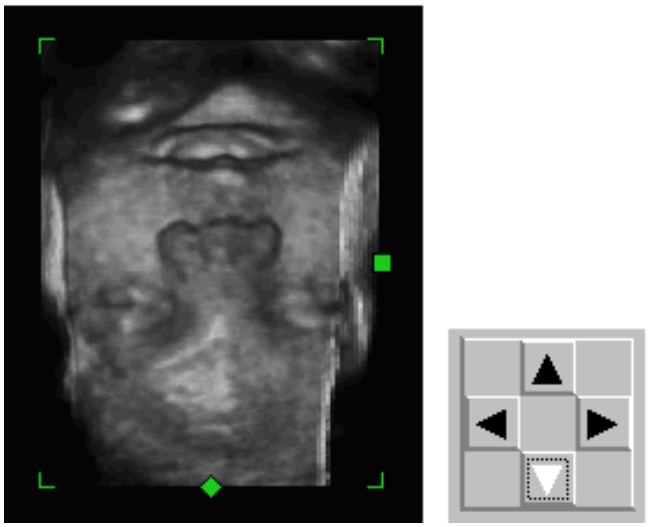
Position Right:



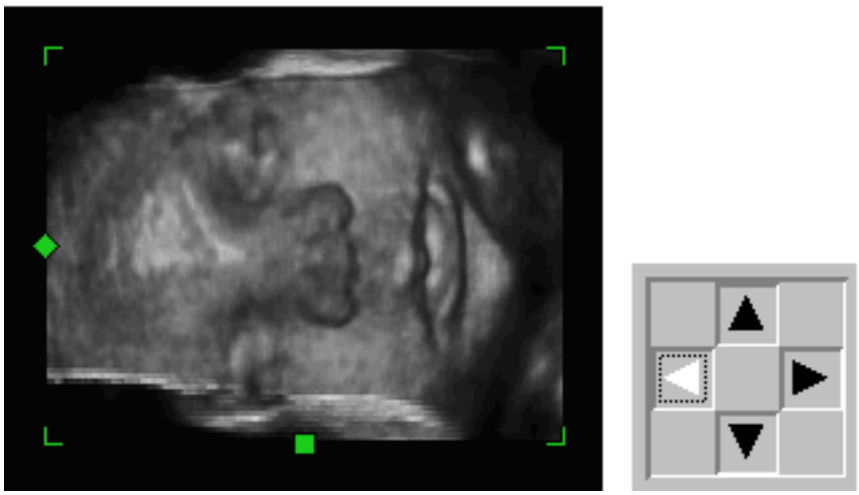
Position Up:



Position Down:



Position Left:



## 7.3 Reference Slices

Using the 4D View software, it is possible to prepare for a parallel translation through a 3D image in each plane, by simply rotating the image to the desired angle, and selecting the appropriate quadrant.

There are two ways in which this parallel translation can be accomplished: Using the "Reference Slice" slider or using the mouse.

The "4D View Reference Slice" slider bar is available in all *display modes* (Section 6.2) except "3D Full-Screen Mode."

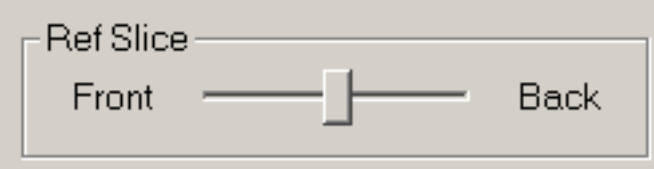
**IMPORTANT NOTE:** The functionality of the reference slider is always with respect to the image shown on the screen.

A parallel movement through a certain image is defined as:

**Image A:** Moving from front to back through the volume.

**Image B:** Moving from left to right through the volume.

**Image C:** Moving from top to bottom through the volume.




The above slider is the "Reference Slice" slider for reference image A. By moving the slider with the mouse, it is possible to move from the front to the back of the entire volume. If another reference image (B or C) is selected, the text within the slider changes accordingly (Left/Right, Top/Bottom). When the slider is moved the distance of the currently displayed reference slice to the last reference slice is displayed in mm.

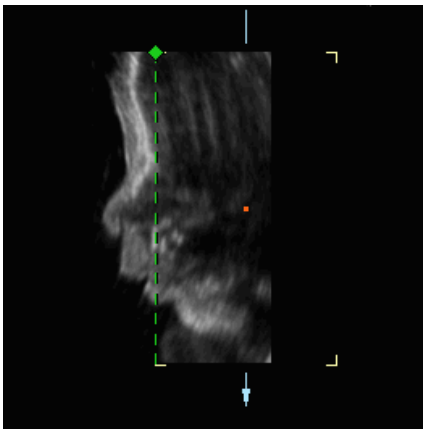
In "ABC Multiplanar Mode" and "ABC Multiplanar Full-Screen Mode," it is possible to move through the image with both slider and mouse functions.

By keeping the left mouse button pressed near the reference point which is located in each of the three image quadrants, the particular reference point chosen can be moved on the slice by moving the mouse.

The reference points in the other quadrants will show in which direction movement occurs (not in "Full-Screen Mode"). The movement in one plane will affect the other planes accordingly.

In order to use the slider, simply activate the desired quadrant with the mouse, and then move the slider using the mouse.

In "3D ROI Mode" only the slider bar can be used. The images move and the reference points stay fixed. Because of this, and the fact that the *ROI* (Glossary) can still be altered, the 3D image is affected by movements in the image slices. One border line of the *ROI* (Glossary) is green (as can be seen below), which indicates the direction of view for that quadrant. As the image intersects this line, the view of the 3D image changes.



**As the image moves from right to left, the ROI box cuts through the image.**

In "3D Full-Screen Mode" only the slider bar can be used. Moving the slider bar affects the 3D image in the same way as selecting reference image A and moving the slider bar in "3D ROI Mode" would.

In "VOCAL™ II Mode" curves representing the *shell geometry* (Section 3.6) are displayed instead of the volume render box. Instead of the rendered 3D image the *shell geometry* (Section 3.6) is visualized.

In "3D Plane Adjustment Mode" both the slider and the mouse functionality are available. Depending on the *ROI direction* (Section 7.2), a green reference line will be active on the 3D image as soon as a quadrant is selected, as is shown below.

**The above image contains a reference line for movement from left to right.**

If the "VOCAL™ Contour Mode" is activated in the *"3D Rendering Mode"* (Section 8.1) menu, the 3D image displays a *shell contour* (Section 3.6).

Using either the mouse or the slider, the green reference line can be moved in order to cut through the 3D image. The selected quadrant displays the parallel movement. The movement

can be achieved by positioning the mouse cursor near the green reference line, keeping right or left mouse button pressed and moving the mouse in a motion that is perpendicular to the reference line.

The reference points in the other image slice quadrants move accordingly.

By positioning the cursor near the reference point in one of the image slice quadrants and keeping the right mouse button pressed, the reference points can be moved instead of the green reference line. The green vertical reference line in the 3D image then represents the plane in which the reference point is moving (in the above case, the vertical plane).

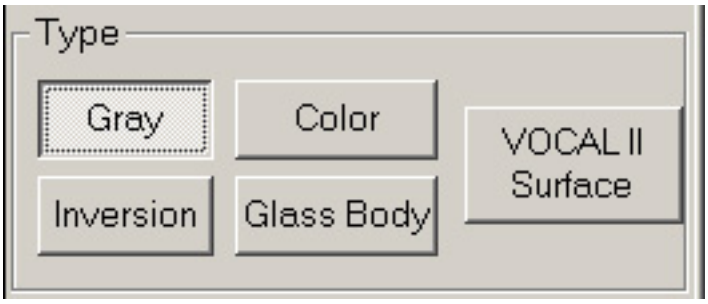
# Chapter 8

# Render Modes

## 8.1 Select Render Mode and Algorithm

In order to select different render modes and algorithms click in the main dialog area of 4D View the “Render Mode” button.

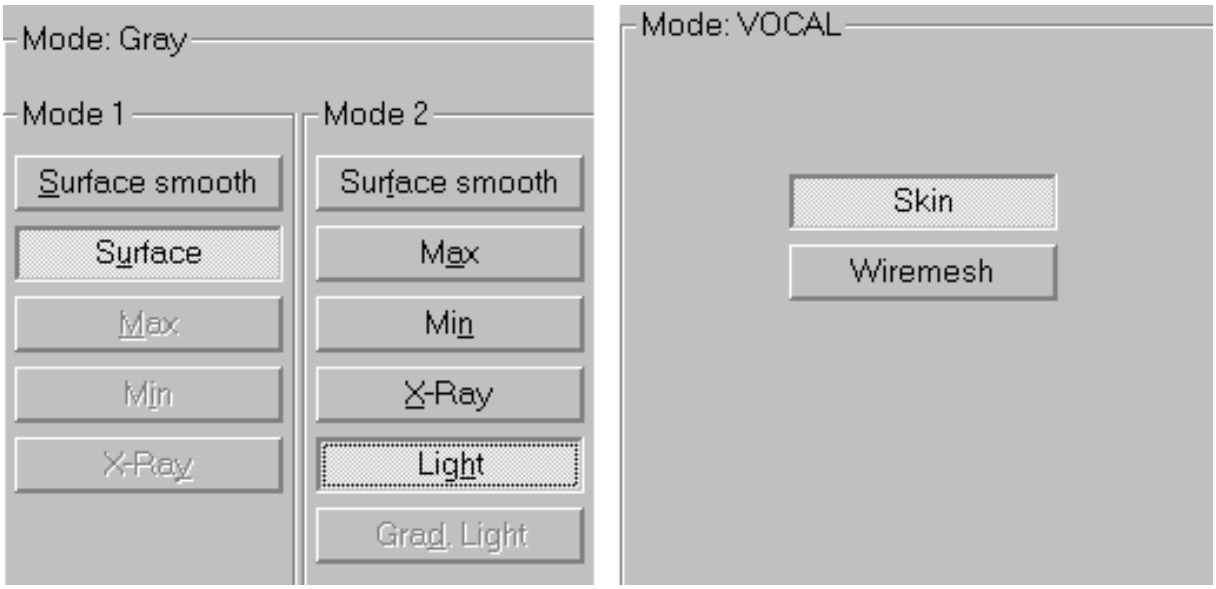
### 8.1.1 Select Render Mode




- *Gray Render Mode* (Section 8.2)
- *Inversion Render Mode* (Section 8.3)
- *Color Render Mode* (Section 8.4)
- *Glass Body Render Mode* (Section 8.5)
- *VOCAL$^{TM}$ Surface Mode* (Section 8.6)

### 8.1.2 Select Render Algorithm

This dialog differs depending on the active mode, either *"3D Mode"* (Section 6.1) or *"VOCAL™ II Mode"* (Section 6.1).




For a description of the different render algorithms see *"Render Algorithms"* (Section 3.4).

## 8.2 Gray Render Mode

In "Gray Render Mode" only gray value information of the dataset is used, even if a color volume image is displayed. In case of a dataset without color information being present, this mode is automatically activated.

**Select desired render algorithm:**

**Surface Mode:** The surface is displayed in "texture" mode.
Texture: The gray values of the surface are identical with the gray values of the original scan.

**Smooth Surface Mode:** The surface is displayed "smoothed" in "texture" mode.

**Light Mode:** The surface is displayed in "light" mode.
Light: Structures closer to the viewer are displayed brighter, structures more distant to the viewer are darker.

**Gradient Light Mode:** The surface is displayed in "gradient light" mode.
Gradient Light: Structures with surfaces more oriented towards the viewer are displayed

brighter. Structures less oriented towards the viewer are displayed darker.
*Application:* Hypoechoic structures can be displayed (e.g., fetus in amniotic fluid).

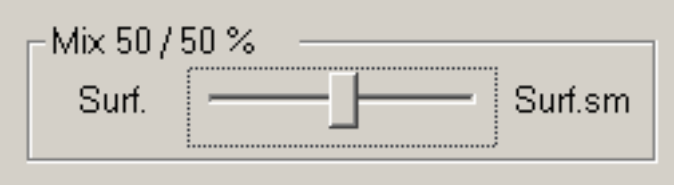
**Maximum Mode:** Only the maximum gray levels of the *ROI* (Glossary) are displayed.
*Application:* Presentation of bony structures.

**Minimum Mode:** Only the minimum gray levels of the *ROI* (Glossary) are displayed.
*Application:* Presentation of vessels, hollow or cystic structures.

**X-Ray Mode:** All gray levels (mean level) within the *ROI* (Glossary) are displayed.
*Application:* Presentation of a tissue block containing a tumor or similar structures.

Two modes mus always be selected (free of choice).

**Mix function**

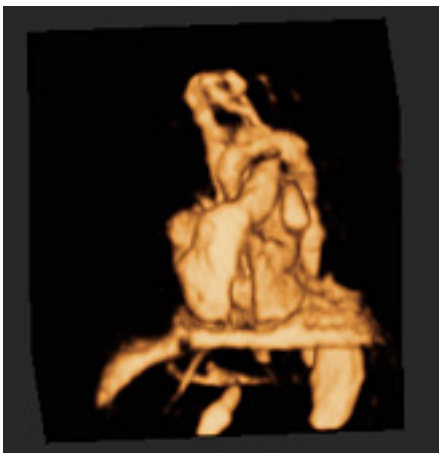



Mixing of the two selected modes can be performed by moving the "Mix" slider, which modes are selected is denoted at each end of the slider.

## 8.3 Inversion Render Mode

"Inversion" is a Render Mode especially designed for visualization of anechoic structures like fetal heart, vessels, cysts and other hollow structures. It makes those parts of a data set visible that do no contain echoes (e.g. fluids).

**Example of a Fetal Heart with Inversion Render Mode**



**Select desired render algorithm:**

**Surface Mode:** The surface is displayed in “texture” mode.
Texture: The gray values of the surface are identical with the gray values of the original scan.

**Smooth Surface Mode:** The surface is displayed “smoothed” in “texture” mode.

**Light Mode:** The surface is displayed in “light” mode.
Light: Structures closer to the viewer are displayed brighter, structures more distant to the viewer are darker.

**Gradient Light Mode:** The surface is displayed in “gradient light” mode.
Gradient Light: Structures with surfaces more oriented towards the viewer are displayed brighter. Structures less oriented towards the viewer are displayed darker.
*Application:* Hypoechoic structures can be displayed (e.g., fetus in amniotic fluid).

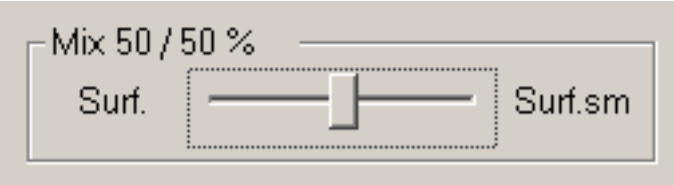
**Maximum Mode:** Only the maximum gray levels of the *ROI* (Glossary) are displayed.
*Application:* Presentation of bony structures.

**Minimum Mode:** Only the minimum gray levels of the *ROI* (Glossary) are displayed.
*Application:* Presentation of vessels, hollow or cystic structures.

**X-Ray Mode:** All gray levels (mean level) within the *ROI* (Glossary) are displayed.
*Application:* Presentation of a tissue block containing a tumor or similar structures.

Two modes mus always be selected (free of choice).

**Mix function**




Mixing of the two selected modes can be performed by moving the “Mix” slider, which modes are selected is denoted at each end of the slider.

## 8.4 Color Render Mode

In “Color Render Mode” only the color information of the color Doppler signal (velocity mode or power mode) is used for the 3D display. For a dataset containing color information, this mode is automatically activated.

**Select desired render algorithm:**

**Surface Mode:** Surface display of color information of blood flow.

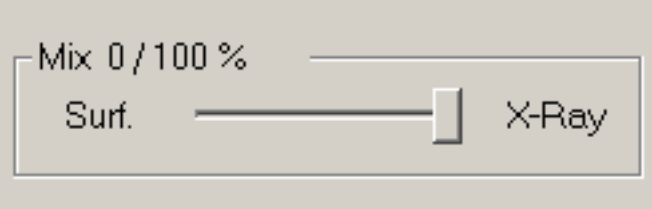
**Light Mode:** The surface is displayed in "light" mode. Structures closer to the viewer are displayed brighter, structures more distant to the viewer are darker.

**Maximum Mode:** The maximum color levels of the *ROI* (Glossary) are displayed.
**Application:** Presentation of all vessels within the *ROI* (Glossary). A 3D impression can be generated by rotating the 3D image.

**X-Ray Mode:** All color levels within the *ROI* (Glossary) are used for calculating the mean color level (impression of an X-Ray image).

A second mode must be selected in addition to the surface mode.

**Mix function**




Mixing of the two selected modes can be performed by moving the "Mix" slider. Which modes are selected is denoted next to the two ends of the slider.

## 8.5 Glass Body Render Mode

In "Glass Body Render Mode" the color and the gray value information are processed and combined to a 3D image.

**Select desired render algorithm:**

*For "Gray Mode:"*

**Surface Mode:** Surface display of gray value information.

**Transparent Mode:** Transparent display of gray value information.

**Maximum Mode:** Only the maximum gray levels of the *ROI* (Glossary) are displayed.

*For "Color Mode:"*

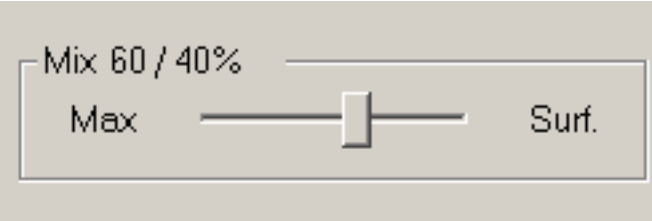
**Surface Mode:** Surface display of color information.

**Transparent Mode:** Transparent display of color information.

For a combined “Glass Body” rendered image, one “Gray Mode” and one “Color Mode” render algorithm must be selected.

**Note:** In case of a combined display of gray values and color, more priority can be assigned to color or to the gray values by using the corresponding surface mode. A combined image showing color and gray values is generated. The “transparency” of the mode which has lower priority (= Mode 2) is adjusted with the “Mix” slider (see below).

**Mix function**



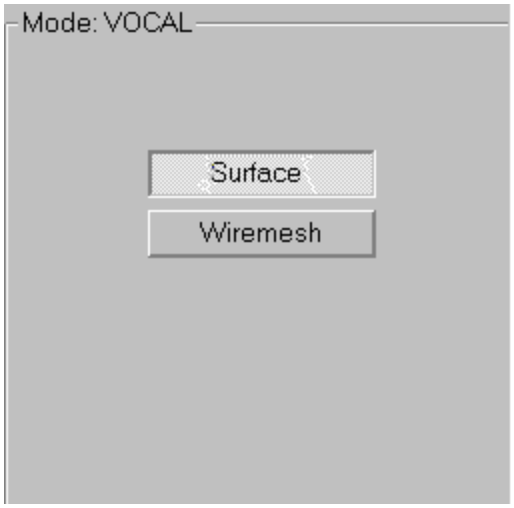

Mixing of the two selected modes can be performed by moving the “Mix” slider, which modes are selected is denoted at each end of the slider.

## 8.6 VOCAL Surface Mode

In "Contour Mode" the *shell geometry* (Section 3.6) can be visualized using a surface or a wiremesh model.

This mode can only be activated if a shell contour has been generated by using $VOCAL^{TM}II$ (Section 11.1).

**Select desired contour render algorithm:**




**Skin Mode:** The surface of the *shell geometry* (Section 3.6) is displayed with illumination. If the inner surface geometry is not degenerated, a combined presentation of the inner and outer surface geometry is displayed. In order to display only one of both surface geometries please follow the "Select desired contour display" instructions below.

**Wiremesh Mode:** The wiremesh of the *shell geometry* (Section 3.6) is displayed with illumination. If the inner surface geometry is not degenerated, a combined presentation of the inner and outer surface geometry is displayed. In order to display only one of both surface geometries please follow the "Select desired contour display" instructions below.

**Select desired contour display:**

A *shell geometry* (Section 3.6) consists of an inner and outer surface geometry. Select which surface geometries will be displayed by checking or unchecking the "Outside/Inside" check boxes.

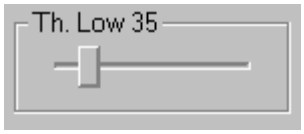
If "Inside" is selected, the inner surface geometry is displayed.
If "Outside" is selected, the outer surface geometry is displayed.
If both boxes are selected, a combined presentation of the inner and the outer surface geometry is displayed.

## 8.7 Threshold Settings

**Function of the threshold values and of the transparency settings (Surface Mode only)**

If "Surface Mode" is selected, it is necessary to adjust low and high threshold for the border recognition of the surface. These threshold levels do not apply for the transparent modes!

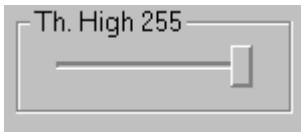
### 8.7.1 Threshold Low (Reject)




Normally, the threshold is always adjusted as to generate a good appearance of the 3D surface image. When changing "Threshold Low," all echoes below the selected gray level are colored in pink during adjustment. By raising "Threshold Low," disturbances in the foreground can be removed.

**Application:** Noise or low-level echoes are removed with this function, in order to get a "clear view" from the start border of the render box to the desired surface.

### 8.7.2 Threshold High




Normally, this threshold does not need to be adjusted and should be set to the maximum value of 255. When changing "Threshold High," all echoes above the selected gray value level are colored in green during adjustment.

**Application:** If the surface render algorithm encounters a gray value higher than the value of "Threshold High," then this gray value marks the border of the surface. Therefore, it is possible to mark the surface border manually using 'Threshold High."

### 8.7.3 Transparency

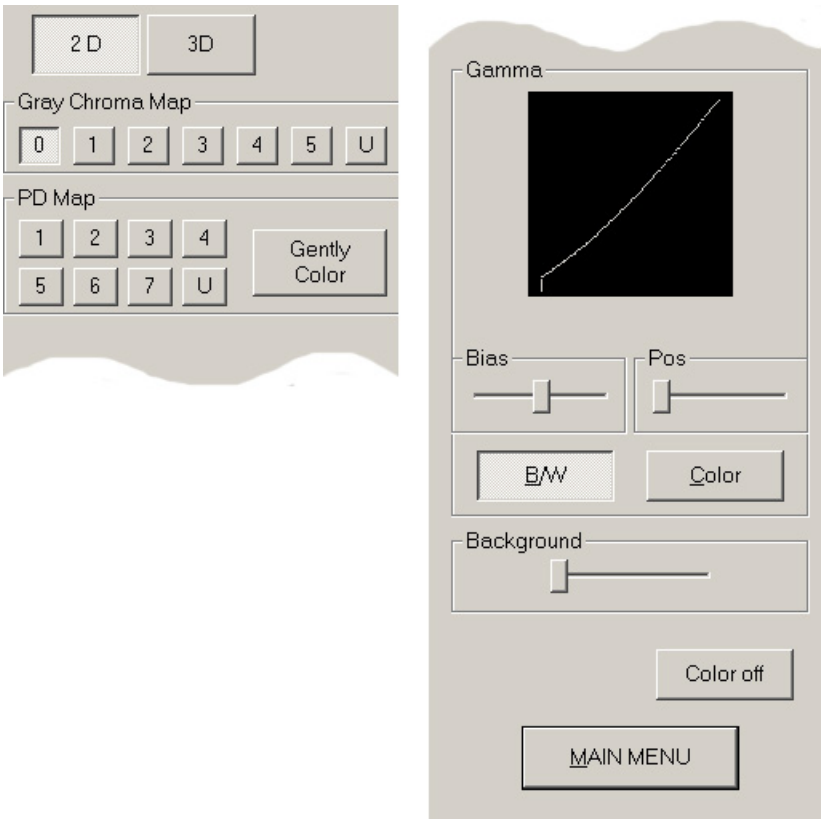
Transparency effects the effect of the threshold values. With a low transparency value, sharp surface boundaries are defined, whereas with a high transparency value the surface defined is more diffuse. With a very high transparency value the surface is comparable to the transparent modes (X-Ray, Max).

# Chapter 9

# Image Settings

## 9.1 Image Settings Overview

Click the “Image Settings” button in the main dialog area in order to enter the dialog area and optimize image settings.



All image settings work either on the ABC image planes (slice palettes) by selecting the button "2D" or on the rendered image by selecting the button "3D."

If a VCI *4D Volume Cine* (Glossary) is opened, an additional "VCI" button is visible. If this button is selected, the settings are applied to the rendered VCI image only.

If a the *visualization type* (Section 6.1) "Static VCI" is selected, an additional "Static VCI" button is visible. If this button is selected, the settings are applied to the Static VCI image slices.

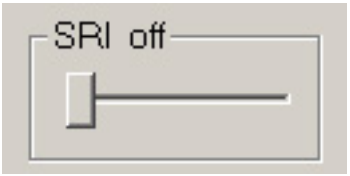
Different palettes for "gray" data can be chosen with the *"Chroma Map"* (Section 9.4) buttons. For "color" data the *"CFM/PD Map"* (Section 9.5) buttons are used.

The *Gamma settings* (Section 9.3) can be adjusted using the "Bias" and "Pos" slider. If "B/W" is selected or the current volume contains no color information, the background color can be changed with the "Background" slider.

If "Color" is selected, the "Background" slider is replaced with two sliders for "Power Threshold" and "Power Balance". These sliders control the amount of color displayed over bright gray echoes and help confine color within the vessel wall. Raising "Balance" displays color on brighter structures. If color is seen on the vessel wall, "Balance" is probably set too high. Additionally, wall motion artifacts can be suppressed with a low "Balance" setting.

The two sliders work together in such a way that the left slider provides the left boundary for the right slider and vice versa.

The "Color off" button is available if the current volume contains color information and if "2D" or "Static VCI" is selected in the image settings dialog. If it is pressed the color information is removed from the A, B and C image slices. If it is pressed again, the color is displayed again.

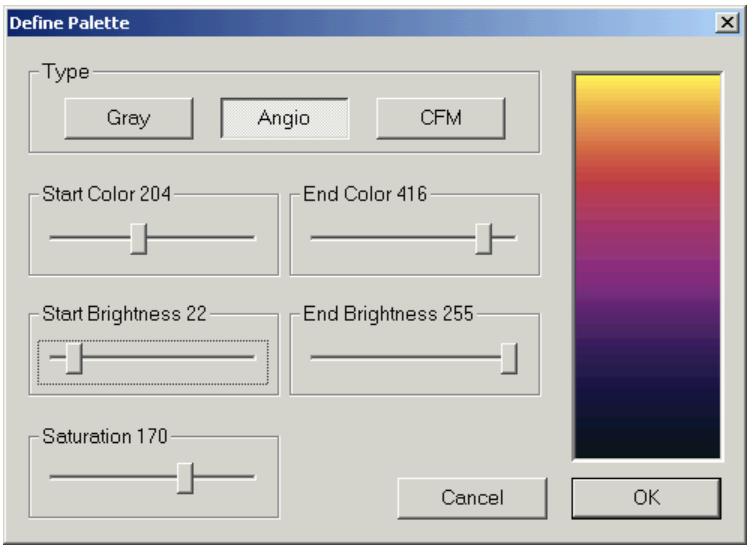



If the current volume does not contain color information and "2D" is selected, the "SRI" slider becomes available.

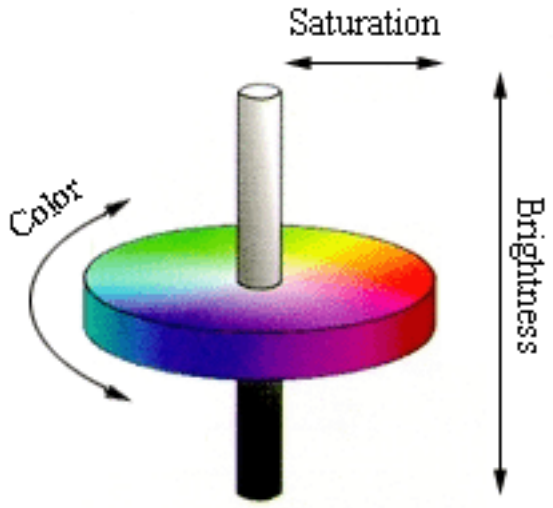
The "SRI" slider can be used to turn on or off the SRI filter for the A, B and C image slices. If turned on, SRI can be set to a value between 1 and 6 with increasing affect of the filter. To turn SRI off, move the slider completly to the left.

## 9.2 Color Palettes

From the *"Settings Menu"* (Section 5.4) select "Palette" in order to enter a dialog area where a user-defined palette can be created for each of the physical visualization types of "Gray," "Angio" and "CFM:"




For the definition of the colors the model of a cylinder is used (see image below):




**Saturation** is the radial distance from the axis of the cylinder in this model. Saturation 0 means that the color value lies on the axis of the cylinder and is a darker or brighter shade of

gray. Saturation 255 means a pure color. In the cylinder model a pure color is situated at the periphery of the cylinder. In order to make a color more reduce the saturation. In order to make a color more intense increase the saturation.

**Brightness** is defined by the height position of the color in the cylinder. The bottom of the cylinder is dark (black), whereas the colors at the top of the cylinder are bright (light colors).

**Color** is represented by the angular position on the cylinder. "Start Color" and "End Color" are given in degrees reaching from 0 to 480. Color 0 equals 360° which is red.

A "Palette" is a range of points in this color space. It is displayed as a column of colors on the right of the dialog area. The "Start Color" is at the bottom of this column, the " End Color" at the top.

In "Gray" and "Angio" the darkest color, i.e., "Start Brightness," is at the bottom, the brightest color, i.e., "End Brightness," is at the top.

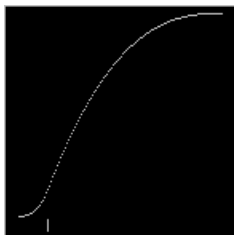
In "CFM" the darkest color is in the middle of the column. The bottom and the top are set to "End Brightness."

These palettes can be accessed using the button "Image Settings" in the main menu and then selecting *"Chroma Map"* (Section 9.4) or *"CFM/PD Map"* (Section 9.5) afterwards.

## 9.3 Gamma Settings

The echo amplitudes are mapped onto gray and color values for image presentation. These values are presented by image palettes on the screen. For adjusting the palette to the image, a mapping called "gamma curve" is used. A linear gamma mapping means the palette is shown unmodified. Changing this curve leads to "harder" or "softer" images.

**Gamma curve correction:**

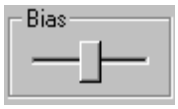


The gamma curve can be adapted. Clicking inside the display field resets the gamma curve to "Init" (linear mapping).

**Horizontal axis:** Image values from 0 to 255.

**Vertical axis:** Brightness from black to white.

This slider sets the starting point to a place from where the gamma curve will be changed.




This slider changes the curvature with respect to the starting point.

**Note:** These settings require careful observation of their influence on the images!

With the two buttons shown above, the gamma adjustment can be performed separately for gray and color values.

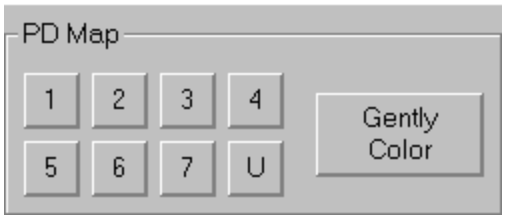
## 9.4 Gray Chroma Map

"Chroma Mapping" is defined as a colored display of gray value images. Each gray value is assigned a color value.

Five chroma curves are available:

- chroma curve 0: chroma off (b/w display)
- chroma curve 1: candle light
- chroma curve 2: sepia
- chroma curve 3: blue
- chroma curve 4: green
- chroma curve 5: clear (use to improve subjective image quality)
- chroma curve U: the user-defined palette created in the *"Settings -Palette"* (Section 5.4) menu is used

## 9.5 CFM/PD Map




Here is a selection of eight different color palettes for "Angio" or "CFM." The button "U" selects the user-defined palette created in the *"Settings- Palette"* (Section 5.4) menu.

**Gently Color:** "Gently" describes the transition between color and gray scale information. With "Gently Color" the embedding of the color into B-Mode is performed smoothly producing less colored splashes. Therefore, color vessels are less spiky with softer borders.

## 9.6 Contour Color

Here is the selection of a different color for the displayed *shell geometry* (Section 3.6).

The color can be chosen from the "Color Select" box.

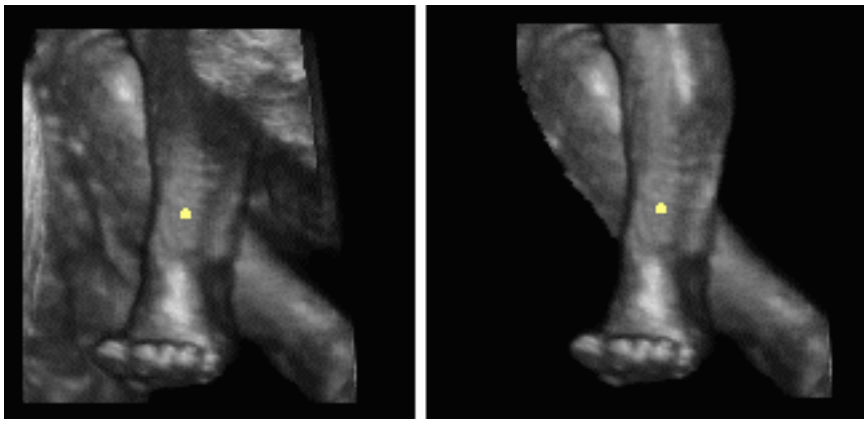
This setting can only be activated if a shell contour was generated by using $VOCAL^{TM}II$ (Section 11.1).

# Chapter 10

# MagiCut

## 10.1 MagiCut - General Information

This application offers the ability to manipulate the images electronically and, thereby, makes it possible to remove overlaying structures or artifacts using the mouse in any of the slice images, or in the 3D rendered image itself.



**The left image displayed above, is rendered without editing, whereas the right image has had editing applied to it in order to achieve a clearer view to the object of interest.**

"MagiCut" is available in "3D Full-Screen Mode" or in "Quad-Screen Display." If the user is in "3D Full-Screen Mode," the cutting is done on the enlarged image. In "Quad-Screen Mode," cutting can be performed on any of the image slices or the 3D image itself. All alterations are applied to the 3D rendered image only.

For more information on the viewing modes see *"Display Modes"* (Section 6.2).

Select this button from the main menu in order to enable editing or cutting.

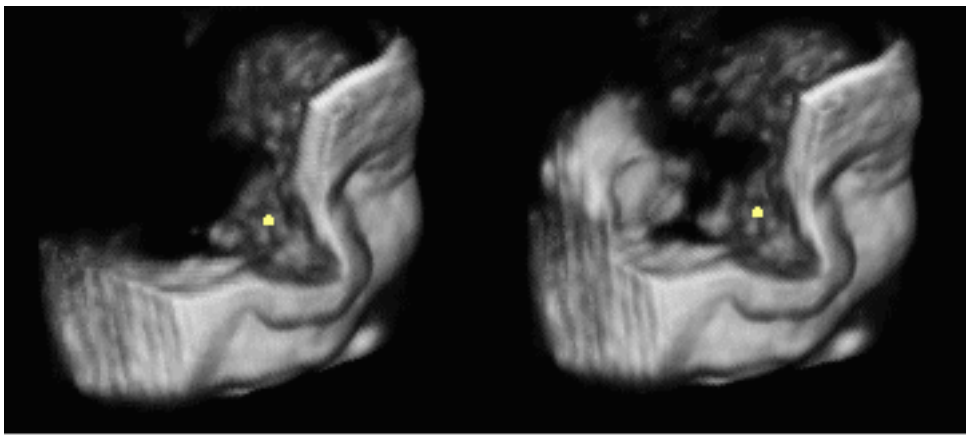
It is then possible to manipulate the images electronically.

"MagiCut" distinguishes between two methods for cutting:

**Full:** The cutting is performed throughout the entire volume.

**Defined:** The cutting is performed with a defined depth.

*Example:*



Full Depth Defined Depth

In order to make corrections, select the *"Undo"* (Section 10.3) or the "Undo All" button.

### 10.1.1 Instructions for MagiCut, Cut Depth "Full"

1. Select cut depth "Full."
2. Rotate the 3D rendered image into an appropriate position, in order to be able to cut away overlaying structures or artifacts.
3. Select the method of cutting. For more information, view *"Cutting Modes"* (Section 10.2).

4. Keep the right mouse button pressed on one of the quadrants while moving the mouse in order to create the outline for the cut. Always have the selected cutting mode in mind, while performing this step.

5. After releasing the right mouse button the region will be cut away (full depth) from the 3D rendered volume.
   **NOTE:** The orthogonal image slices will not be affected by the cutting.

6. Rotate the rendered image into another position and continue with step 3.

### 10.1.2 Instructions for MagiCut, Cut Depth "Defined"

1. Select cut depth "Defined."

2. Rotate the 3D rendered image into an appropriate position, in order to be able cut away unwanted structures or artifacts.

3. Select the method of cutting. For more information, see *"Cutting Modes"* (Section 10.2).

4. Keep the right mouse button pressed on one of the quadrants while moving the mouse in order to create the outline for the cut. Always have the selected cutting mode in mind, while performing this step.

5. After releasing the right mouse button the region is marked. Use the "Cut Depth" slider in order to select the depth of the cut. When "Done" is pressed, the outlined artifact is removed down to the desired cut depth.

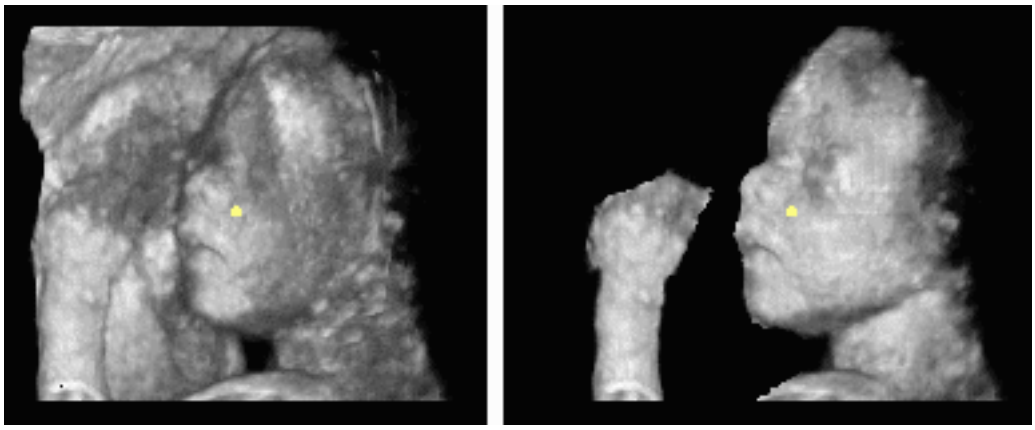
   **NOTE:** The orthogonal image slices will not be affected by the cutting.

6. Rotate the rendered image into another position and continue with step 3.

## 10.2 Cut Mode

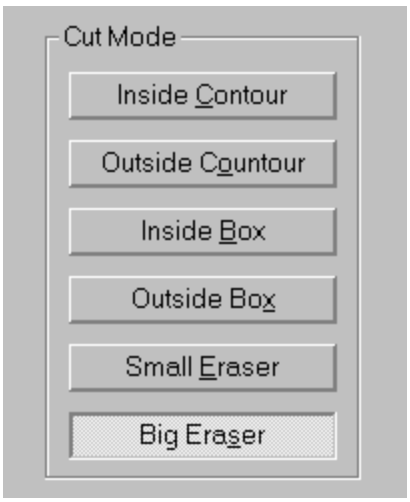
Six cutting methods are available in the "MagiCut" mode. These different methods can be used in different cases in order to achieve an unobstructed view to the object of interest.

The following image shows a 3D rendered image before using "MagiCut," and afterwards. The cutting was performed by rotating the image until the best view for the task was found and using the 'Contour Inside" method.



The available functions can be chosen from a panel. Simply select the desired method, and edit the image. For instructions how to cut, see *"MagiCut - General Information"* (Section 10.1).

Here is the layout of the panel:




**Inside Contour:** The part of the image within the contour (drawn freehand) is discarded. If a contour is left open, the program automatically closes the contour with a straight line from the ending point to the starting point.

**Outside Contour:** All parts of the image which lie outside of the contour (drawn freehand) are discarded. If a contour is left open, the program automatically closes the contour with a straight line from the ending point to the starting point.

**Inside Box:** While holding down the right mouse button, move the mouse in a diagonal fashion from the beginning cut point to the end cut point in order to create a box. The part of the image inside the box is discarded.

**Outside Box:** Using the same way of drawing as with "Inside Box," draw a box. All parts of the image that lie outside the box are discarded.

**Eraser:** Hold down the right mouse button and move across the image. Any area touched by the mouse cursor will be erased. There are two different sizes available for the erasers: small and big.

Any errors can be undone by using the *"Undo"* (Section 10.3) function.

## 10.3 Undo Function

When cutting an image, any mistakes made can be removed by using one of three available buttons:

These buttons allow the removal of mistakes one by one (up to 2 previous cuts), or the removal of all cuts previously performed.

The "Redo" button can reestablish the situation before the "Undo" actions.

## 10.4 MagiCut Save

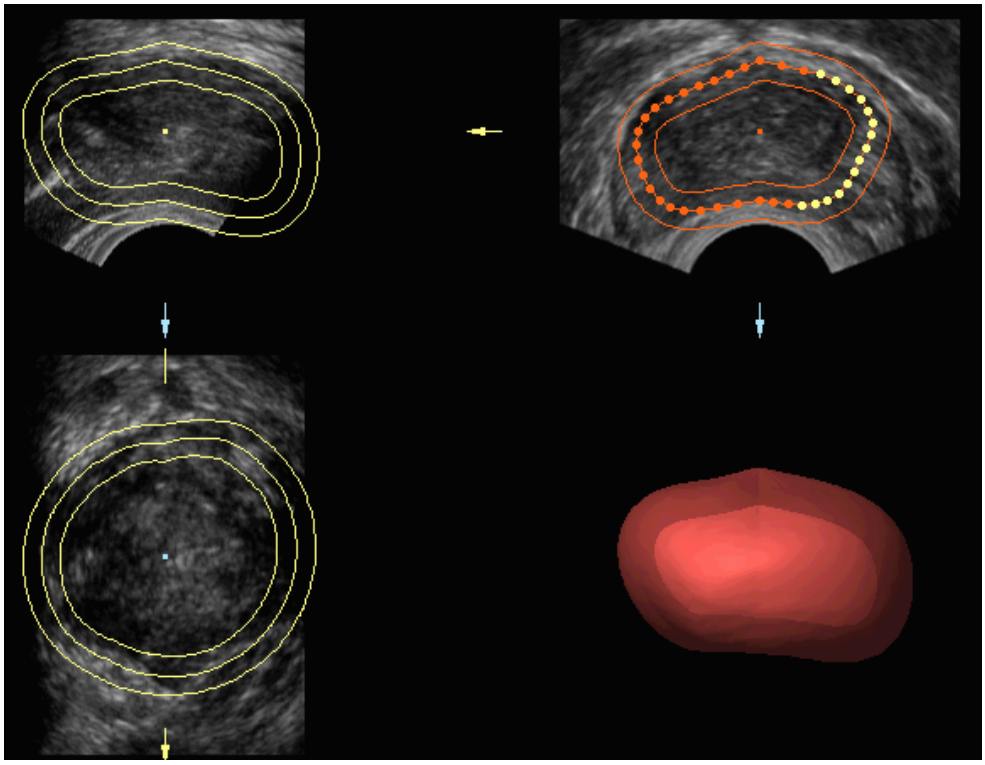
Modifications made with *"MagiCut"* (Section 10.1) can be saved using the GEMS Kretztechnik volume file format, either directly or in the *SonoView*$^{TM}$ (Section 22.1.1) medical data storage system. However, since "MagiCut" is related to the *"3D Plane Adjustment Mode"* (Section 6.1), "MagiCut" modifications are lost as soon as another display mode is selected.

# Chapter 11

# VOCAL II

## 11.1 VOCAL II - General Information

In order to understand the underlying concept of *VOCAL$^{TM}$II* (Glossary), please read the chapter *"Principle Explanations - The VOCAL$^{TM}$ II Concept"* (Section 3.6) first.



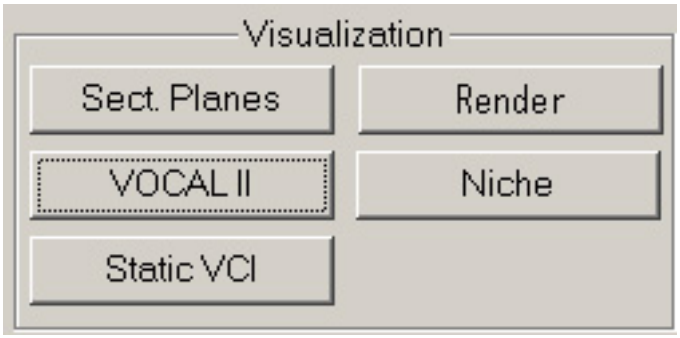
(Screenshot of a shell contour)

The "VOCAL$^{TM}$II" menu is separated into two different menus:

- the *"VOCAL II - Define Contour"* (Section 11.2) menu, where the contours of an object, e.g., lesion or tumor are generated, and
- the *"VOCAL II- Edit Contour"* (Section 11.3) menu, where the contours can be manipulated and a shell can be generated.

## 11.2 VOCAL II - Define Contour

In order to understand the underlying concept of *VOCAL$^{TM}$II* (Glossary), please read the chapter *"Principle Explanations - The VOCAL$^{TM}$ II Concept"* (Section 3.6) first.




Click on the "VOCAL II" button in the main menu in order to enter the "Volume Calculation" menu, given that no (shell) contour has been generated yet.

If a (shell) contour was already generated, enter *"VOCAL II - Edit Contour"* (Section 11.3) by pressing the "Edit ROI" button.

**Attention:**

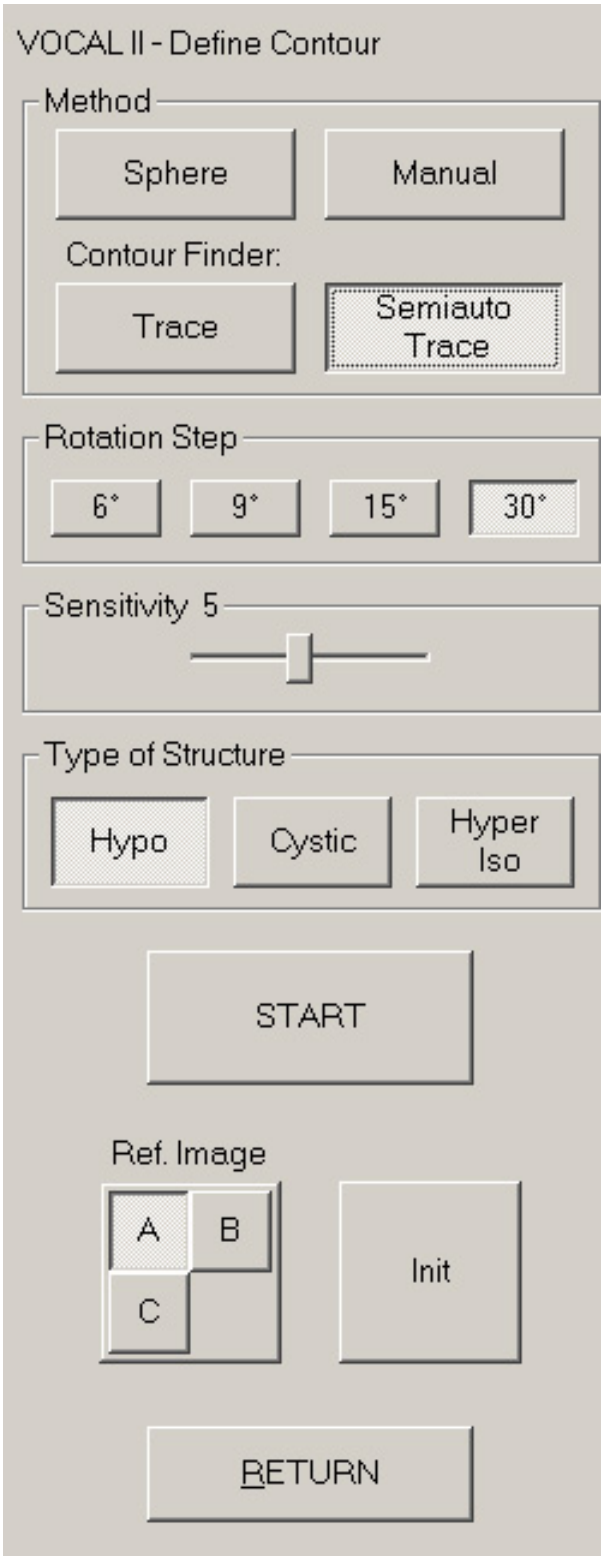
The main contour axis should be positioned at the center of the 3D lesion. (The 3D object should be centered with respect to the rotation axis.)

A 2D contour is only valid if the rotation axis is crossed exactly twice.

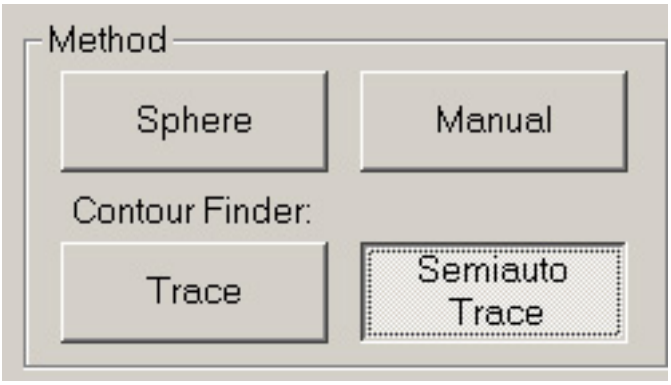
For automated contours, the green arrows mark the two contour points on the main contour axis for all 2D contours, i.e., all defined contours (in different planes) intersect the main contour axis at the position of the green arrows.

For manual contours the first 2D contour specifies where the green arrows will be positioned on the main contour axis.

**Main steps for generating a (shell) contour:**



### 11.2.1 Selection of a Contour Generation Mode



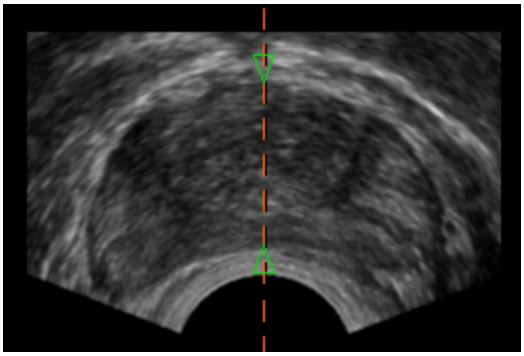

**Attention:**

The main contour axis should be positioned at the center of the 3D lesion. (The 3D object should be centered with respect to the rotation axis.) If this is not the case, change the position of the image by using the right mouse key.

*Sphere (automated contour mode)*

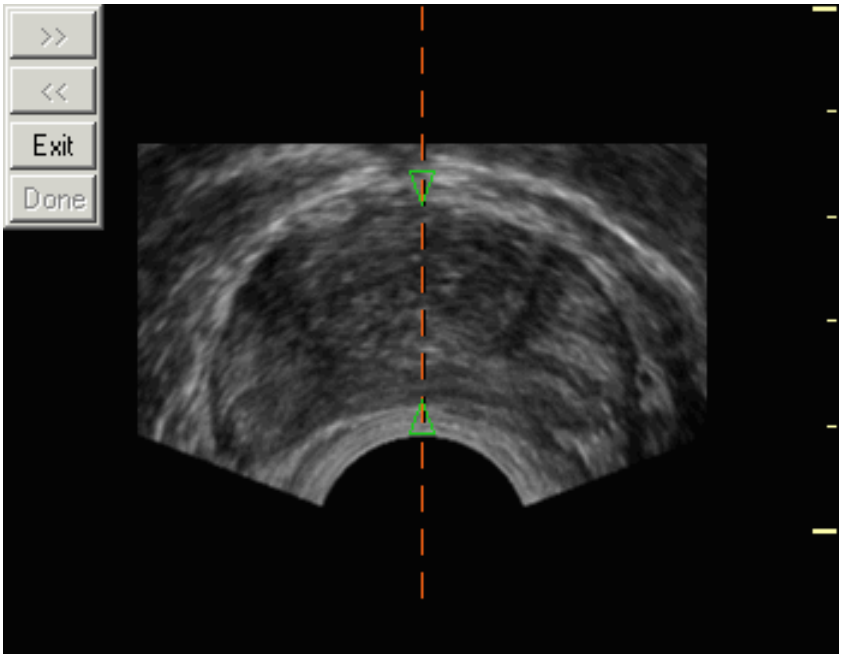
For the automated contour mode "Sphere," two contour points must be marked in the image plane(s) along the main contour axis in order to define the poles of the (shell) contour. (All generated contours in the image planes cross the main contour axis at these two points.)

Adjust the two contour points (characterized by two green arrows) with the mouse by positioning the cursor on one of the green arrows, pressing either the left or right mouse button, and moving the mouse to the desired position. Additionally, the green arrows can also be positioned using the "Pole 1" and "Pole 2"slider at the bottom left corner of the 4D View window.



When using this contour mode a sphere around the main contour axis is generated. Its diameter is determined using the two green arrows.

*Manual Contour Mode*




This contour mode allows the outline of any connected lesion to be drawn. The number of manually generated contours depends on the rotation step selected.

The mouse is restricted to the selected reference plane and a menu bar appears at the corner of the window, as shown in the image above.

The next step is to outline the first contour by keeping the left mouse button pressed and moving the mouse. The two green arrows are automatically positioned accordingly on the main contour axis.

The outlined contour is only valid if, and only if, the rotation axis is crossed twice.

Select the next image plane by using the forward button (arrows right).

The contour is automatically copied to the next image plane and can be redefined by marking a new contour. Every time a new contour is started, the previous contour in the current image plane is replaced by the new contour.

Press the “Clear” button in order to delete the contour in the current image plane.

After a contour has been defined in each image plane, the “Done” button is enabled for the first time. When clicking this button, the result is shown and the “VOCAL II - Edit Contour” menu appears.

In order to make changes to the contour in any image plane, use the reverse button (arrows left) and redefine the contour by marking a new contour.

In order to leave this mode at any time, click the “Exit” button.

*Contour Finder - Trace*

This mode works very similar to the manual contour mode, but instead of drawing the contour right where the mouse is, a sophisticated algorithm helps to find the correct contour of the lesion. The number of contours generated with the help of this algorithm depends on the rotation step selected.

The mouse is restricted to the selected reference plane and a menu bar appears at the corner of the window, as shown in the image above.

The next step is to outline the first contour by keeping the left mouse button pressed and moving the mouse. The two green arrows are automatically positioned accordingly on the main contour axis.

Move the mouse approximately along the border of the region, the algorithm looks in the neighborhood of the mouse cursor for the border of the lesion. How large the area used for looking for this border is, depends on the “Sensitivity” setting. Use the “Sensitivity” slider in the VOCAL$^{TM}$II menu to adjust this setting.

It is possible to cut away part of the contour by pressing the right mouse button and moving the mouse, or by starting outside the gray line, pressing the left mouse button and moving the mouse inside the gray line.

The outlined contour is only valid if, and only if, the rotation axis is crossed twice.

Select the next image plane by using the forward button (arrows right).

The contour is automatically copied to the next image plane and can be redefined by marking a new contour. Every time a new contour is started, the previous contour in the current image plane is replaced by the new contour.

Press the “Clear” button in order to delete the contour in the current image plane.

After a contour has been defined in each image plane, the “Done” button is enabled for the first time. When clicking this button, the result is shown and the “VOCAL II - Edit Contour” menu appears.

In order to make changes to the contour in any image plane, use the reverse button (arrows left) and redefine the contour by marking a new contour.

In order to leave this mode at any time, click the “Exit” button.

*Contour Finder - SemiAuto Trace*

This mode works very similar to the Contour Finder - Trace mode, but instead having to trace the outline in all slices, only two orthogonal slices have to be traced. The number of contours automatically generated afterwards depends on selected the rotation step.

The algorithm can be adapted for certain types of structures by choosing between “Hypo”, “Cystic” and “Hyper-Iso”.

The mouse is restricted to the selected reference plane and a menu bar appears at the corner of the window, as shown in the image above.

The next step is to outline the first contour by keeping the left mouse button pressed and moving the mouse. The two green arrows are automatically positioned accordingly on the main contour axis.

Move the mouse approximately along the border of the region, the algorithm looks in the neighborhood of the mouse cursor for the border of the lesion. How large the area used for looking for this border is, depends on the “Sensitivity” setting. Use the “Sensitivity” slider in the VOCAL$^{TM}$II menu to adjust this setting.

It is possible to cut away part of the contour by pressing the right mouse button and moving the mouse, or by starting outside the gray line, pressing the left mouse button and moving the mouse inside the gray line.

The outlined contour is only valid if, and only if, the rotation axis is crossed twice.

Select the second image plane by using the forward button (arrows right).

The contour is automatically copied to the next image plane and can be redefined by marking a new contour. Every time a new contour is started, the previous contour in the current image plane is replaced by the new contour.

Press the “Clear” button in order to delete the contour in the current image plane.

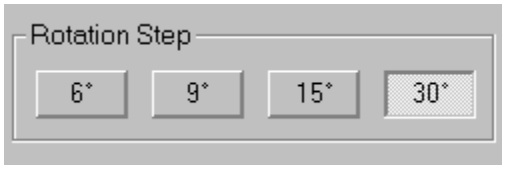
After a contour has been defined in two image planes, the “Done” button is enabled for the first time. When clicking this button, the remaining planes are calculated and the “VOCAL II - Edit Contour” menu appears.

**Note:** If no valid contour is found by the algorithm, the system returns to the “VOCAL II - Define Contour” menu.

In order to make changes to the contour in any image plane, use the reverse button (arrows left) and redefine the contour by marking a new contour.

In order to leave this mode at any time, click the “Exit” button.

### 11.2.2 Selection of a Rotation Step



The rotation step parameter defines the number of contour planes available. (How many contours are generated.)

Number of contour planes = 180° / rotation step. E.g., for a rotation step of 15°, 12 contour planes are available (= 180 / 15)

### 11.2.3 Selection of the Reference Image

The selection of the reference image defines the image plane(s) used for generating the contours.

In order to generate the contours, the reference image is rotated around the

- vertical axis (for reference image A or B),
- horizontal axis (for reference image C).

which is positioned at the center of the image (red dotted line).

The rotation angle of the reference image is defined by the rotation step.

### 11.2.4 Pressing "Start"

After having chosen between the available methods and having adjusted the settings for the selected method, press the "START" button.

Now the actual generation of the contour is started:

**Sphere:** The sphere with all its contours is calculated automatically.

**Manual Contour Mode:** Manually draw the contours as described above and press "Done".

**Contour Finder - Trace:** Create the contours as described above and press "Done".

**Contour Finder - SemiAuto Trace:** Create two contours as described above and press "Done". The remaining contours are calculated automatically.

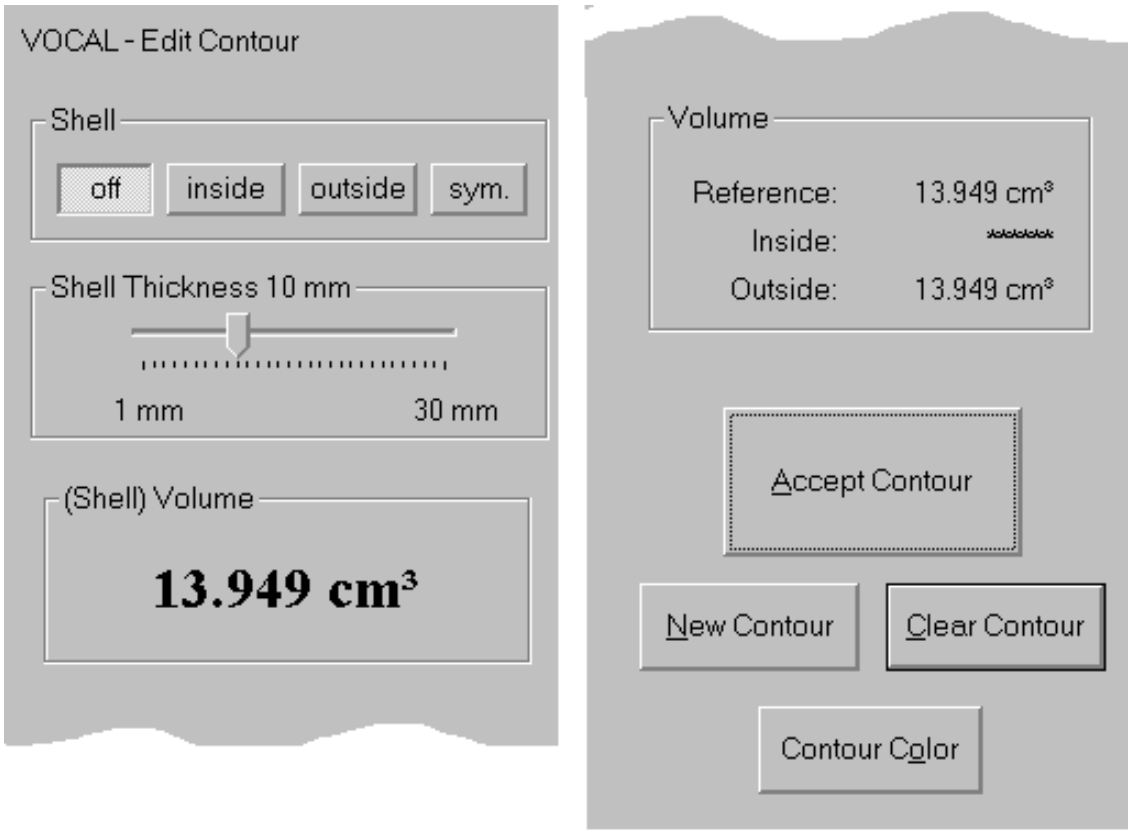
## 11.3 VOCAL II - Edit Contour

In order to understand the concept of *VOCAL$^{TM}$II* (Glossary), please read the chapter *"Principle Explanations - The VOCAL$^{TM}$ II Concept"* (Section 3.6) first.

This menu is entered by clicking on the "Edit VOCAL" button in the main menu.

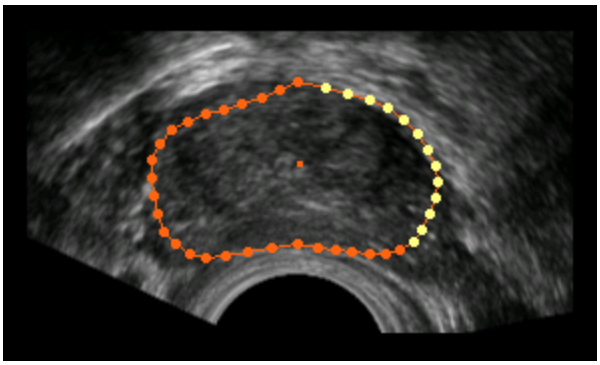
In the "VOCAL Edit Contour" menu the generated contours can be manipulated.

### 11.3.1 The VOCAL Contour Editor

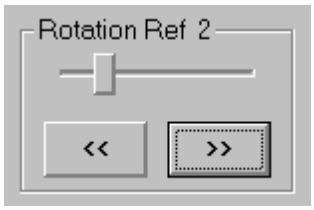



When entering this menu the screen appears as described here:

- The reference image shows the first contour generated, outlined with red dots.
- In the orthogonal slices the intersection curves between the *shell geometry* (Section 3.6) and the different image planes are outlined as a solid yellow contour.
- The *shell geometry* (Section 3.6) is visualized in the lower right quadrant.

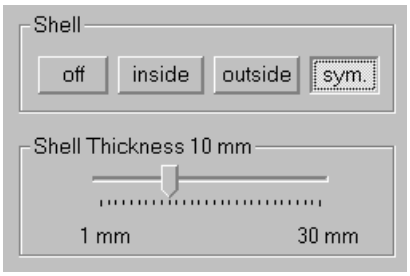


When moving the mouse, some red dots of the contour line in the reference image change their color to yellow depending on the position of the mouse cursor. If the mouse is positioned close to the contour only one dot becomes yellow. When the distance is increased, more dots become yellow. By keeping the left mouse button pressed and simultaneously moving the mouse, the yellow dots can be adjusted to fit the lesion. Changing the contour automatically updates all relevant results (shell contour, volume, etc.).




Now select the next image plane by using the arrow buttons in the "Rotation Ref section."

### 11.3.2 Defining a Shell Contour (Shell Geometry)

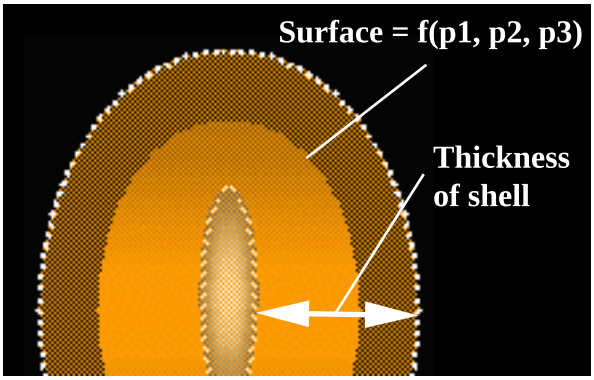



By default the generated contours in the *"VOCAL II - Define Contour"* (Section 11.2) menu define a shell contour, meaning that

- the outside surface is equal to the generated contours (reference surface geometry), and
- the inside surface is represented by an inner point (inside surface is degenerated).

This state is automatically generated when "Shell off" is selected.

**Selections of Other Shell States:**




*inside*

- The outside surface is equal to the reference surface geometry.
- The inside surface is the surface geometry of the inner "parallel" contours with a distance of "Shell Thickness" in mm.

If one of the inside contours is not valid, the inside surface is represented by an inner point (inside surface is degenerated). (A contour is valid only if the rotation axis is crossed exactly twice.)

*outside*

- The outside surface is the surface geometry of the outer "parallel" contours with a distance of "Shell Thickness" in mm.
- The inside surface is equal to the reference surface geometry.

*symmetric*

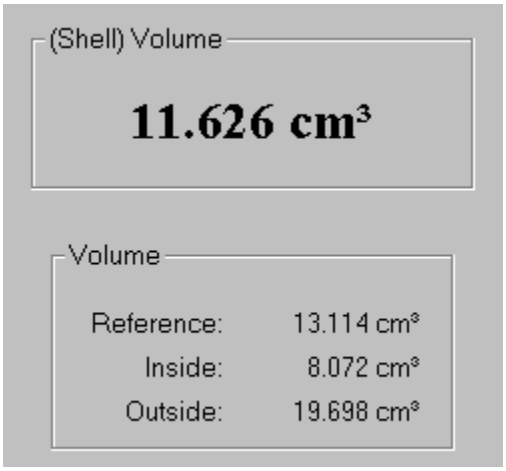
- The outside surface is the surface geometry of the outer "parallel" contours with a distance of half of "Shell Thickness" in mm.
- The inside surface is the surface geometry of the inner "parallel" contours with a distance of half of "Shell Thickness" in mm.

If one of the inside contours is not valid, the inside surface is represented by an inner point (inside surface is degenerated). (A contour is valid only if the rotation axis is crossed exactly twice.)

**Of course only valid reference contours generate a valid shell contour.**

The thickness of the shell can be adjusted by using the "Shell Thickness" slider.

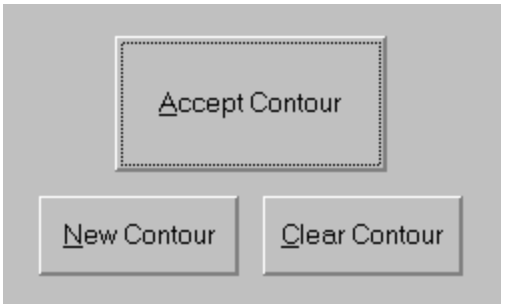
### 11.3.3 Displaying the (Shell) Volume




The (shell) volume is defined as the difference between the volume defined by the outer surface (of the shell geometry) and the volume defined by the inner surface (of the shell geometry). In the "Volume" field the volume of the reference surface geometry is displayed. If the inner surface (of the shell geometry) is degenerated, the volume amount is zero. A degenerated surface is symbolized in the display with *****.

If the reference surface geometry is not valid, all volumes are invalid and displayed with *****.

### 11.3.4 Accept, New or Clear Contour




Clicking on one of these buttons ends the "VOCAL Edit" menu.

**Accept Contour** The shell contour is accepted and stored.

**New Contour** The shell contour is not accepted and the *"VOCAL II - Define Contour"* (Section 11.2) menu appears, where a new contour can be defined.

**Clear Contour** The shell contour is deleted and the main menu appears.

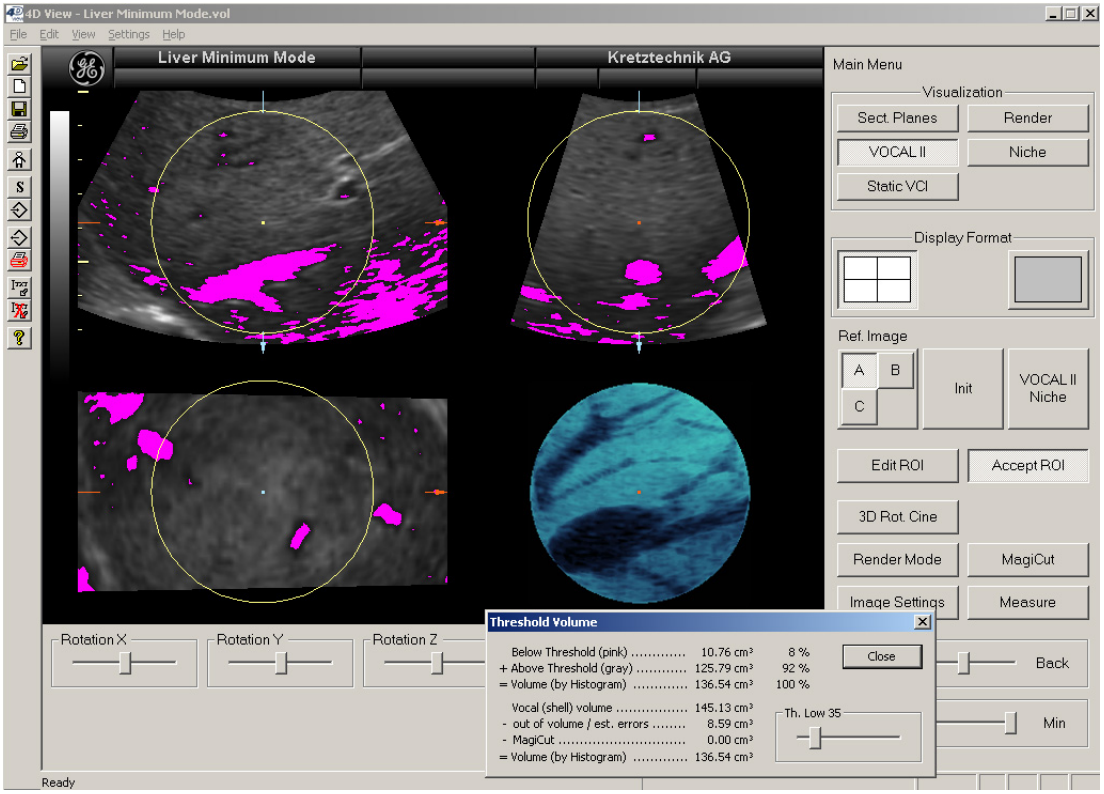
### 11.3.5 Changing the Color of the Contour

Review *"Image Settings - Contour Color"* (Section 9.6).

## 11.4 Threshold Volume

Once a VOCAL$^{TM}$II has been created, it is possible to choose "Threshold Volume" from the *"View"* (Section 5.3) menu.

The screen changes to look like this:




The "Threshold Volume" functionality provides the user with a tool to measure the part of a volume that lies below a certain threshold, the part of the same volume that lies above the same threshold and the complete volume. And compare these measurements.

The pink areas are the areas below the threshold. The gray areas are the areas above the threshold.

The dialog that appears provides the results. It is possible to move the result dialog anywhere on the screen to avoid that it hides part of the image on wants to evaluate.

Move the “Th. Low” slider to change the value of the threshold. The results in the result dialog and the pink part of the image changes accordingly.

Press the “Close” button to return to the VOCAL menu.

# Chapter 12

# Histogram

## 12.1 Histogram Display

For calculating a histogram select "Histogram" in the *"View" menu* (Section 5.3) on the menu bar.

The calculation is possible in the "3D Image Rendering" display modes and in the "VOCAL™II" display modes, but not in the "VOCAL™ II Niche" mode. The calculation of a histogram is possible in the "Render" and "VOCAL™II" display modes only for "B" and "Power Doppler" mode volumes (CFM is not supported yet). For an overview of display modes, review *"Visualization Types"* (Section 6.1).

**3D Image Rendering Display Modes:**
The histogram is calculated from the content of the *Region of Interest (ROI)* (Section 3.3).

**VOCAL™ II Display Modes:**
If a *shell* (Section 3.6) is defined, the histogram is calculated from the content of the shell. If a *contour* (Section 3.6) without a shell is defined, the histogram is calculated from the content of the contour.

**Explanation of displayed values:**

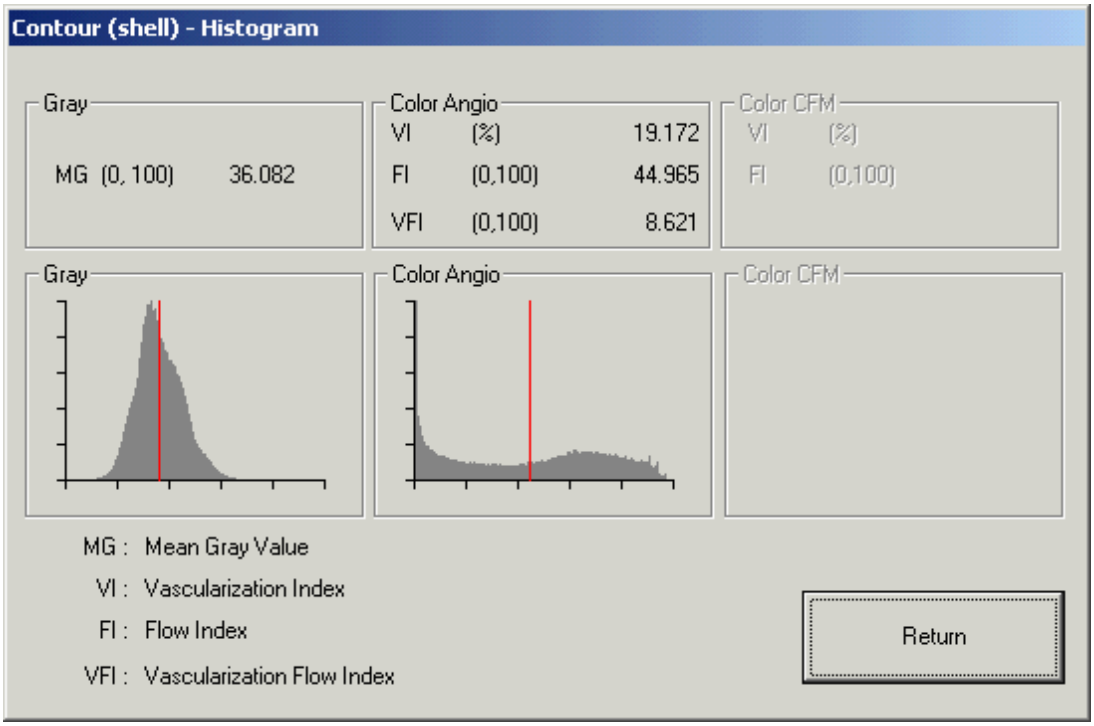
**MG** Mean Gray Value (vertical red line)

**VI** Vascularization Index

**FI** Flow Index (vertical red line)

**VFI** Vascularization Flow Index

**Sample display (Power-Doppler/Angio):**




In color histograms is is possible to suppress low speed values by increasing the "Power Threshold" in the *"Image Settings"* (Section 9.1) dialog ("Image Settings Overview").

### 12.1.1 Formulas

#### Definitions

**g** gray-scale value in ultrasound image normalized to 0 ... 100
low intensity ... 1
high intensity ... 100

**c** color value in ultrasound image (ANGIO mode) normalized to 0 ... 100
low intensity ... 0
high intensity ... 100

**hg(x)** frequency of gray value x in ultrasound image

**hc(x)** frequency of color value x in ultrasound image (ANGIO mode)

$$MG = \frac{\sum_{g=1}^{100} g \cdot hg(g)}{\sum_{g=1}^{100} hg(g)}$$

$$VI = \frac{\sum_{c=1}^{100} hc(c)}{\sum_{g=1}^{100} hg(g) + \sum_{c=1}^{100} hc(c)}(\text{ANGIO})$$

$$FI = \frac{\sum_{c=1}^{100} c \cdot hc(c)}{\sum_{c=1}^{100} hc(c)}(\text{ANGIO})$$

$$VFI = \frac{\sum_{c=1}^{100} c \cdot hc(c)}{\sum_{g=1}^{100} hg(g) + \sum_{c=1}^{100} hc(c)}(\text{ANGIO})$$

$$VFI = VI \times FI(\text{ANGIO})$$

# Chapter 13

# Generic Measurements

## 13.1 Measurements - General Information

The 4D View software has been developed to allow application specific generic and application-specific calculation measurements. By selecting the "Measure" button situated on the right-hand side of the main dialog area, the measurement menu is activated.

**Measurement Button:**

**Note:** When starting the measurement package, there may be a few seconds delay. As the measurement package has such a wide range of possibilities, it can take some time to load it from the hard disk into the memory of the PC.

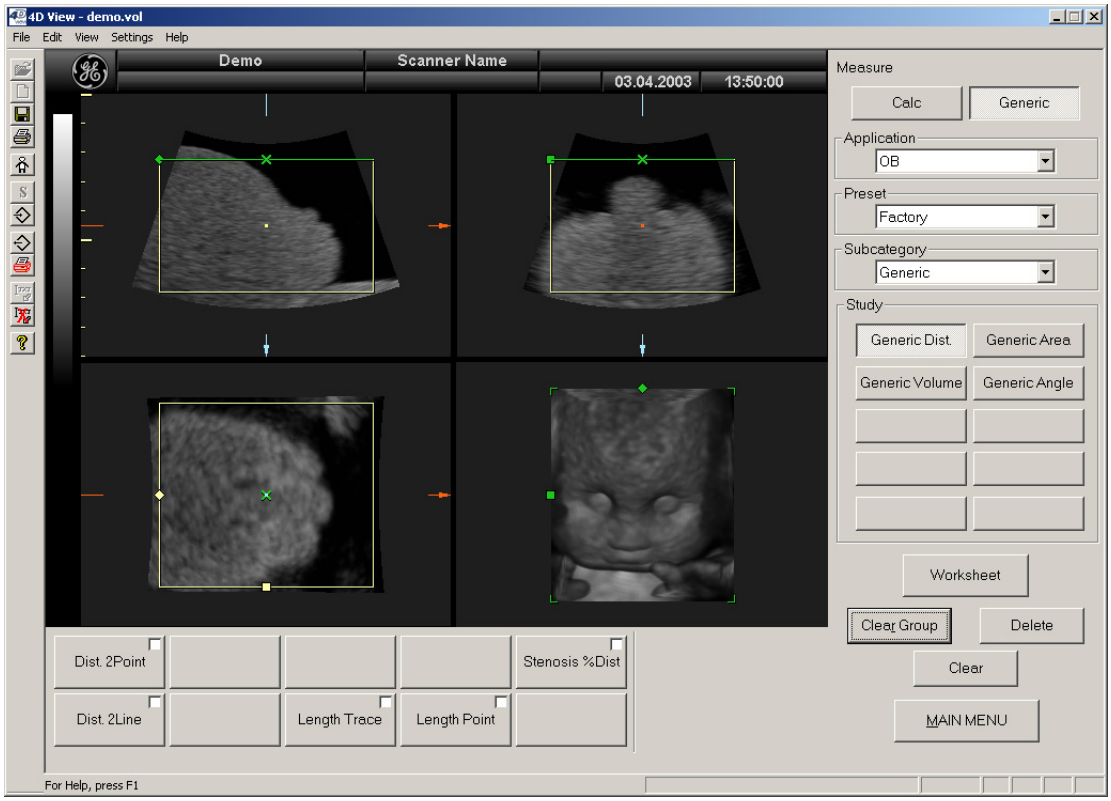
**Hint:** Generic and calculation measurements can be performed without entering patient data. However, in order to produce a patient report/worksheet for a specific patient as result of measurements, patient data must be entered. Also, if the basic patient data of "patient ID" and "patient name" is entered, the measurements are stored in a database and can be retrieved for future reference. Therefore, before starting measurements, ensure the correctness of the patient data.

If patient information is not registered, do it using the *"Patient and Exam Info"* (Section 22.1.3) dialog.

Open this dialog in the "Edit" menu or with the "Person" button in the toolbar.

In the *"Patient and Exam Info"* (Section 22.1.3) dialog select the appropriate application and enter the patient data.

**Measurement Main Menu:**




## 13.2 Generic Measurements

Select the “Generic” button in the upper right corner of the Measurement Menu to start generic measurements.

Select the desired “Application”, “Preset” and “Subcategory”. Now select a “Study” by pressing the according button. Per default there are four predefined studies in the generic measurement menu:

- *Generic Dist.* (Section 13.4)
- *Generic Area* (Section 13.5)
- *Generic Volume* (Section 13.6)
- *Generic Angle* (Section 13.7)

Studies or measurements can be edited in the *Mesure Setup Menu* (Section 16).

Now start a measurement by pressing the according button at the bottom of the screen.

**Note:**Additionally, volumes can be measured using $VOCAL^{TM}II$ (Section 11.1).

**Mouse Buttons:**
After selecting a mode of measurement, position the cursor at the initial point of measurement and press the **left** mouse button. All measurements are completed with the **left** mouse button. The **right** mouse button is of use only during measurements. Between starting and finishing a measurement, the position of the cursors may also be changed with the **right** mouse button.

**Worksheet:**
The results of the generic measurements are included in the worksheet. View the "Generic" section of the worksheet by pressing the "Worksheet" button in the lower right corner of the measurement menu.

## 13.3 Calculation Method and Accuracy

### 13.3.1 Measurement Method

All measurements are performed using pixel resolution on the screen. All distances are calculated in screen coordinates. The accuracy of the method depends on the resolution of the dataset and the "zoom" of the image on the screen. This means that larger, "zoomed" datasets lead to a finer resolution than smaller, "zoomed" datasets. Therefore, a larger, "zoomed" image on screen leads to more accurate measurements than a smaller, "zoomed" image.

Accordingly, the overall accuracy depends on the accuracy of the ultrasound, the "zoom" of the volume dataset and the "zoom" of the image on the screen.

For **distance and circumference measurements** the distance of screen points is calculated and converted to "mm" *ultrasound units* (Glossary).

For **area measurements** the area of the marked polygon points on the screen is calculated. The result is converted to "$cm^2$" *ultrasound units* (Glossary).

**Volume measurements** are performed by integration of polygon areas marked in parallel planes. The method used for the integration of the polygon areas is given by:

$$Vol = \frac{1}{2} \cdot [\sum_{i=2}^{N} (A_{i-1} + A_i) \cdot d_{i-1,i}]$$

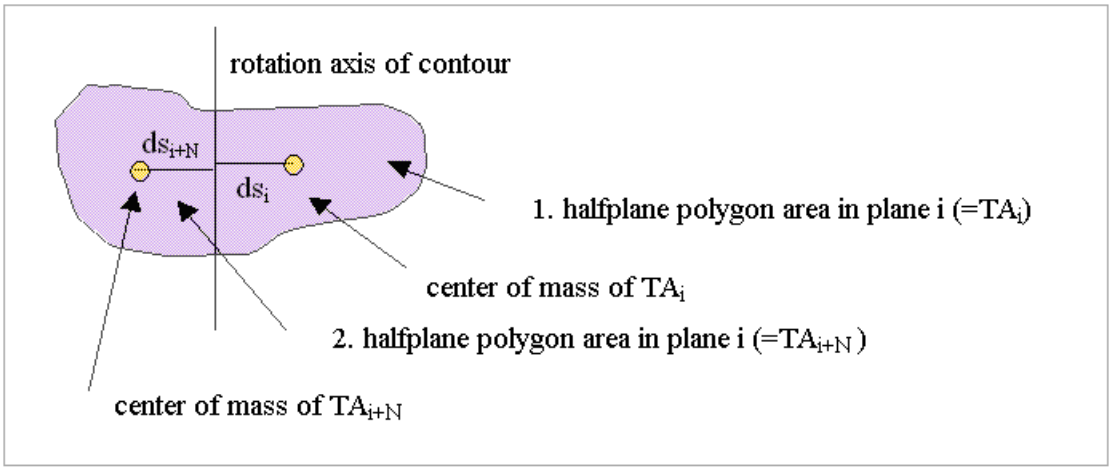
$N \ldots$ number of marked polygon areas
$A_i \ldots$ polygon area in plane $i$
$d_{i,j} \ldots$ distance between plane $i$ and plane $j$
the sort order of planes $1, \ldots, N$ is given by $d_{1,2} \leq d_{1,3} \leq \ldots \leq d_{1,N}$

The result is converted to “ml” or “$cm^3$” *ultrasound units* (Glossary).

$VOCAL^{TM}II$ **(Glossary) measurements** are performed by integration of polygon areas generated by rotation around a fixed axis (rotation axis of contours). The method used for the integration of the polygon areas is given by:

$$Vol = \frac{\pi}{N} \cdot [\sum_{i=1}^{2 \cdot N} TA_i \cdot ds_i]$$

$N \ldots$ number of marked contours
$TA_i \ldots$
if $i \leq N \ldots$ 1. halfplane polygon in plane $i$
else 2. halfplane polygon in plane $i - N$
$ds_i \ldots$ distance between center of mass of $TA_i$ and rotation axis of contour




The result is converted to “ml” or “$cm^3$” *ultrasound units* (Glossary).

### 13.3.2 Measurement Accuracy

Accurate positioning of the measuring cursor respective to the measuring dots is necessary especially with area/circumference measurements. Despite high technical accuracy of the scan geometry of the Voluson® 730 series equipment one must, however, be aware of inaccuracies caused by the ultrasound beam properties and the physiological properties of the scanned structures, tissues and fluids. For the reason of improved lateral resolution choose the proper element for the depth range of the structure to be measured.

The table shows the inaccuracies to be taken into account for measurements.

| | Accuracy |
|---|---|
| Distance | +/- 3 % (or max. 1mm for object ¡ 30mm) |
| Area | +/- 6 % |
| Circumference | +/- 3 % |
| Volume | +/- 9 % |

The distance accuracy range is according to German KBV regulations

**Explanation:**

**Distance error and Circumference error:** ¡ +/- 3% (or max. 1mm for object ¡ 30mm)

**Area:** ¡ +/- 6% = Distance 1 x Distance 2

**Volume:** ¡ +/- 9% = Distance 1 x Distance 2 x Distance 3

a) Test Phantom: Multi-purpose phantom, Model 539, from ATS Laboratories Inc.
b) Wire grid phantom in water bath at 47° C, accuracy of wire spacing 0.2 mm.

## 13.4 Distance Measurements (Generic Dist.)

Several different measurement methods are available. The measurement will be drawn on the screen identified with a special graphic. The corresponding result will be displayed in the result field located at the bottom left of the screen.

### 13.4.1 Distance 2 Point Measurement

Begin measuring by placing the mouse cursor at the initial point of measurement in one of the three orthogonal planes, and click the left mouse button once. Move the mouse cursor to the final point of measurement, and click the left mouse button once again.

### 13.4.2 Distance 2 Line Measurement

A horizontal line appears on the screen. Place the line on the initial point of measurement and click the left mouse button. Rotate the line by moving the mouse. If the line is aligned correctly with the image click the left mouse button once again. A parallel line appears. Move the mouse to position the second line. Click the left mouse button to finalize this measurement.

### 13.4.3 Length Trace

Begin measuring by placing the mouse cursor at the initial point of measurement in one of the three orthogonal planes. Click the left mouse button and move the cursor along the structure

that should be measured. To finish the trace, click the left mouse button again.

### 13.4.4 Length Point

Begin measuring by placing the mouse cursor at the initial point of measurement in one of the three orthogonal planes. Click the left mouse button and move the cursor to the next point of measurement. Click the left mouse button to connect the two measurement points. Repeat this process until the measurement is finished. Finalize the measurement by doubleclicking the left mouse button at the last measurement point.

### 13.4.5 Stenosis % Distance

Begin measuring by placing the mouse cursor at the initial point of measurement in one of the three orthogonal planes, and click the left mouse button once. Move the mouse cursor to the final point of measurement, and click the left mouse button once again. Repeat this procedure for the second distance.

## 13.5 Area and Circumference Measurements (Generic Area)

Several different measurement methods are available. The measurement will be drawn on the screen identified with a special graphic. The corresponding result will be displayed in the result field located at the bottom left of the screen.

### 13.5.1 Area Trace

Begin measuring by placing the mouse cursor at the initial point of measurement in one of the three orthogonal planes. Click the left mouse button and move the move the mouse along the circumference of the area of interest. To finish the trace, click the left mouse button again. If an area trace is not closed completely after finishing the trace, the trace will be automatically completed with a straight line from the end point to the start point. Circumference and area of the figure are displayed in the result field.

### 13.5.2 Ellipse

With one click of the left mouse button fix one diameter of the ellipse, with another click of the left mouse button fix the other diameter. Move the mouse to expand the ellipse and click the left mouse button to finish the measurement. Circumference and area of the figure are displayed in the result field.

### 13.5.3 Area Point

Begin measuring by placing the mouse cursor at the initial point of measurement in one of the three orthogonal planes. Click the left mouse button and move the cursor to the next point of measurement. Click the left mouse button to connect the two measurement points. Repeat this process until the measurement is finished. Finalize the measurement by doubleclicking the left mouse button at the last measurement point. If an area is not closed completely after finishing the measurement, the first and the last measurement point will be automatically connected with a straight line. Circumference and area of the figure are displayed in the result field.

### 13.5.4 Area 2 Line

Begin measuring by placing the mouse cursor at the initial point of measurement in one of the three orthogonal planes, and click the left mouse button once. Move the mouse cursor to the final point of measurement, and click the left mouse button once again. Repeat this process to draw the second line. The area and circumference defined by the two lines are displayed on the screen.

### 13.5.5 Stenosis % Area

With one click of the left mouse button fix one diameter of the ellipse, with another click of the left mouse button fix the other diameter. Move the mouse to expand the ellipse and click the left mouse button to finish the measurement. Repeat this process for the second area measurement.

## 13.6 Volume Measurements (Generic Volume)

Several different measurement methods are available. The measurement will be drawn on the screen identified with a special graphic. The corresponding result will be displayed in the result field located at the bottom left of the screen.

### 13.6.1 3 Distances

Draw the distances in the same manner as drawing lines described in *"Distance Measurements"* (Section 13.4). The volume of the ellipsoid described by three distances is displayed.

### 13.6.2 Ellipse

Draw an ellipse as described in *"Ellipse Measurements"* (Section 13.5). The volume of the ellipsoid described by the ellipse is displayed in the result field.

### 13.6.3 1 Distance and Ellipse

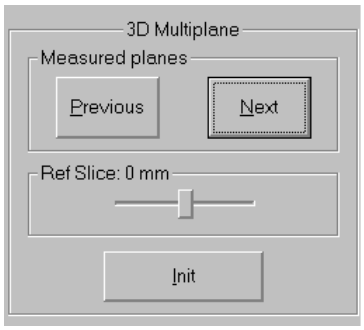
Draw the distances in the same manner as drawing lines described in *"Distance Measurements"* (Section 13.4). Then draw an ellipse as described in *"Ellipse Measurements"* (Section 13.5). The volume of the ellipsoid described by the ellipse and the distance is displayed in the result field.

### 13.6.4 1 Distance

Draw the distances in the same manner as drawing lines, described in *"Distance Measurements"* (Section 13.4). The distance is used as diameter for a sphere and the volume of the sphere is calculated and displayed.

### 13.6.5 3D Multiplane

For this measurement method a submenu appears, to perform the definition of a volume:




In this method different areas around the object of interest must be defined in parallel slices. In order to mark an area review the *"Area and Circumference Measurements"* (Section 13.5) method.

The mouse will be restricted to the selected image plane. The image plane can be selected in the "Main" menu with the three "Ref Image" buttons.

Marked areas are displayed in green when the image plane is in the same slice. Use the "Ref Slice" slider to change image slices. By moving forward or backward, the outline of the area changes to yellow. Using the "Previous" or "Next" button, the area of the nearest marked slice is displayed. Note that in any single slice only one area can be marked. This means, by marking a new area, the previous one (if one exists) is replaced by the new area trace. Each marked area is represented in the orthogonal planes as a point, a line and an arrow in the corresponding location. Use the "Previous" or "Next" buttons to move to these planes.

The volume is calculated using all marked areas and connecting them in order to form a volume.

**For best results:**
The object of interest should be aligned in its main axis position. If the outline of the area displayed in yellow does not fit the area structure on the screen, a new area should be marked. A marked area can always be redrawn when it appears in green. The final result depends on the accuracy of the marked areas.

**Note:** During this measurement mode, all other measurements on screen will be temporarily removed, and will reappear when the specific measurement mode is selected again.

Additionally, volumes can be measured using *VOCAL*$^{TM}$*II* (Section 11.1).

## 13.7 Angle Measurements (Generic Angle)

Several different measurement methods are available. The measurement will be drawn on the screen identified with a special graphic. The corresponding result will be displayed in the result field located at the bottom left of the screen.

### 13.7.1 Angle 3 Point

Start by placing the cursor at the initial measurement point and clicking the left mouse button. Move the mouse to the second measurement point and click the left mouse button to draw the first line. Now finalize the measurement by moving the mouse to the third measurement point and clicking the left mouse button again. The second line is drawn. The angle between these two lines is displayed in the result area.

### 13.7.2 Angle 2 Line

To begin measurement, move the cursor to the image where angle calculation will be performed and draw a line as described in *"Distance Measurements"* (Section 13.4). Draw a second line in the same way. The angle between these two lines is displayed in the result area.

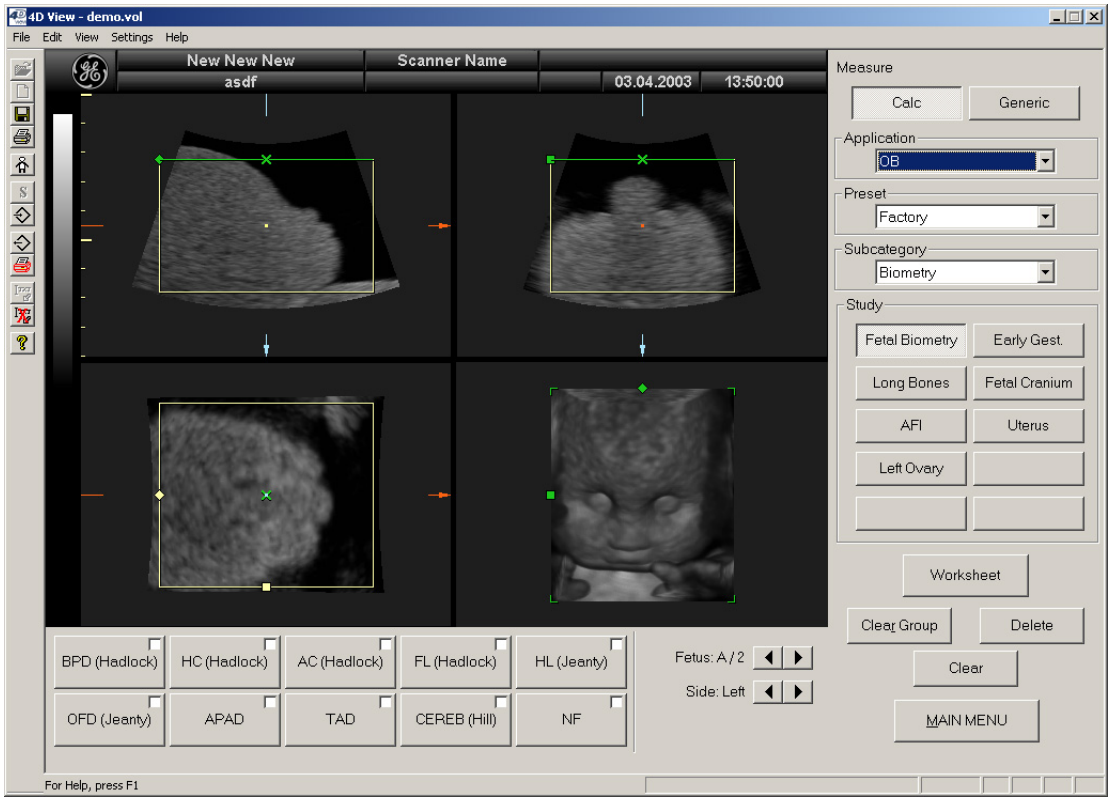
# Chapter 14

# Calculation Measurements

## 14.1 Calculation Measurements

In order to start **calculation measurements** click on the “Calc” button at the top of the “Measure” menu.

The menu now looks similar to the image below:



The “Fetus” control at the bottom of the screen is displayed only if the application is OB and a number of fetuses greater than 1 has been entered in the *“Patient and Exam Info”* (Section 22.1.3) dialog.

Select the desired “Application”, “Preset” and “Subcategory”. Now select a “Study” by pressing the according button.

Studies or measurements can be edited in the *Mesure Setup Menu* (Section 16).

Now start a measurement by pressing the according button at the bottom of the screen.

## 14.2 Clearing Calculation Measurements

Clear a measurement that is started but not yet finished with the “Cancel” button.

Clear the actual group of measurements with the “Clear Group” button.

## 14.3 OB Calculations

### 14.3.1 The Items of OB Calculations

Per default the items of OB calculations are briefly divided into “Fetal Biometry,” “Early Gestation,” “ Long Bones,” “Fetal Cranium,” “AFI,” “Uterus” and “Left/Right Ovary.”

To switch between left and right ovary use the “Side” control at the bottom of the screen.

**Fetal Biometry per default contains:** BPD, OFD, HC, APAD, AC, TAD, FL, CEREB, HL, NF.

**Early Gestation per default contains:** CRL, GS, YS, BPD, FL, NT.

**Long Bones per default contains:** HL, RAD, ULNA, TIB, FIB, CLAV.

**Fetal Cranium per default contains:** CEREB, CM, BOD, IOD, NT, Va, Vp, HEM, C.S.P., NF.

**AFI per default contains:** Q1, Q2, Q3 and Q4.

**Uterus per default contains:** Length, Height, Width, Endo. Thickn and Cervix Length.

**Left/Right Ovary per default contains:** Length, Height, Width.

### 14.3.2 OB Calculation Measurements

As input for OB calculations distances and circumferences/areas are measured. For most of the items in the OB calculations a *distance* (Section 14.3.3) is measured (e.g., BPD). The items that use a *circumference* (Section 14.3.4) as input include "HC," and "AC" for example. In the case of *"AFI"* (Section 14.3.5), four distances are measured.

### 14.3.3 OB Calculations with Distance

**example BPD**

1. After obtaining the desired image, click the "Measure" button and then in the "Measure" menu click the "Calculation" button.
2. Select the application "OB."
3. Select the desired study. In the case of "BPD," select "Fetal Biometry."
4. Select the desired item "BPD."
5. Measurements are performed using the mouse. (For details please refer to the section *"Distance Measurements"* (Section 13.4))

The results appear in the image area and are included in the worksheet. In order to clear the measurements of a currently selected study, click the "Clear Group" button.

### 14.3.4 OB Calculations with Circumference

**example HC**

1. After obtaining the desired image, click the "Measure" button and then in the "Measure" menu click the "Calculation" button.
2. Select the application "OB."
3. Select the desired study. In the case of "HC," select "Fetal Biometry."
4. Select the desired item "HC."
5. Measurements are performed using the mouse.(For details please refer to the section *"Area and Circumference Measurement"* (Section 13.5))

The results appear in the image area and are included in the worksheet. In order to clear the measurements of a currently selected study, click the "Clear Group" button.

### 14.3.5 Calculation of AFI

1. After obtaining the desired image, click the "Measure" button and then in the "Measurement" menu click the "Calculation" button.
2. Select the application "OB."
3. Select the study "AFI."
4. Select the desired item.
5. Measurements are performed using the mouse. Four distance measurements can be made and displayed in the result field. (For details please refer to the section *"Distance Measurements"* (Section 13.4))

The results appear in the image area and are included in the worksheet. In order to clear the measurements of a currently selected study, click the "Clear Group" button.

## 14.4 Abdomen Calculations

### 14.4.1 The Items of Abdomen Calculations

Per default the items of Abdomen calculations are briefly divided into "Liver," "Gall Bladder," "Pancreas," "Spleen," "Left/Right Kidney," "Left/Right Renal A.," "Prox/Mid/Dist Aorta" and "Vessel."

To switch between left and right use the "Side" control at the bottom of the screen. To switch between prox, mid, dist and no position use the "Pos" control at the bottom of the screen.

**Liver per default contains:** Length, Height, Width, Portal V. Dia.

**Gall Bladder per default contains:** Length, Height, Width, Wall, CBD.

**Pancreas per default contains:** Duct, Head, Body, Tail.

**Spleen per default contains:** Length, Height, Width, Access.Spleen.

**Left/Right Kidney per default contains:** Length, Height, Width.

**Left/Right Renal Artery, Aorta and Vessel per default contain:** Vessel Area, Vessel Diameter, Stenosis Area, Stenosis Diameter, Flow Diameter.

### 14.4.2 Abdomen Calculation Measurements

As input for OB calculations distances and circumferences/areas are measured. For most of the items in the Abdomen calculations a *distance* (Section 14.3.3) is measured (e.g., Length, height, Width). The items that use a *circumference/area* (Section 14.3.4) as input include "Vessel Area," and "Stenosis Area" for example.

## 14.5 Small Parts Calculations

### 14.5.1 The Items of Small Parts Calculations

Per default the items of Small Parts calculations are briefly divided into "Left/Right Thyroid," "Left/Right Testicle," and "Vessel."

To switch between left and right use the "Side" control at the bottom of the screen.

**Left/Right Thyroid and Left/Right Testicle per default contain:** Length, Height, Width.

**Vessel per default contains:** Vessel Area, Vessel Diameter, Stenosis Area, Stenosis Diameter.

### 14.5.2 Small Parts Calculation Measurements

As input for Small Parts calculations distances and circumferences/areas are measured. For most of the items in the Abdomen calculations a *distance* (Section 14.3.3) is measured (e.g., Length, Height, Width). The items that use a *circumference/area* (Section 14.3.4) as input include "Vessel Area," and "Stenosis Area" for example.

## 14.6 Cardio Calculations

### 14.6.1 The Items of Cardio Calculations

Per default the items of Cardio calculations are briefly divided into "LV Simpson," "Vol A/L," "LV," "LV Mass," "LVOT," "RVOT," "MV," "TV," "AV/LA," and "PV."

**LV Simpson per default contains:** A4C Dias., A2C Dias., A4C Syst., A2C Syst..

**Vol A/L per default contains:** LV Vol Diast., LV Vol Syst..

**LV per default contains:** IVSd, LVDd, LVPWd, RVDd, IVSs, LVDs, LVPWs.

**LV Mass per default contains:** Epi Area, Endo Area, LV Length.

**LVOT per default contains:** LVOT Diameter.

**RVOT per default contains:** RVOT Diameter.

**MV per default contains:** Dist A, Dist B, Area.

**TV per default contain:** TV Diam.

**AV/LV per default contain:** Ao Root Diam., LA Diam.

**PV per default contains:** PV Diameter.

## 14.7 Uro Calculations

### 14.7.1 The Items of Uro Calculations

Per default the items of Uro calculations are briefly divided into "Left/Right Kidney," "Left/Right Testicle," "Bladder," "Prostate," "Left/Right Renal Artery," "Left/Right Dor. Pen Artery," and "Vessel."

To switch between left and right use the "Side" control at the bottom of the screen.

**Left/Right Kidney, Bladder, Prostate and Left/Right Testicle per default contain:** Length, Height, Width.

**Left/Right Renal Artery, Left/Right Dor.PenA and Vessel per default contain** : Vessel Area, Vessel Diameter, Stenosis Area, Stenosis Diameter.

### 14.7.2 Uro Calculation Measurements

As input for Uro calculations distances and circumferences/areas are measured. For most of the items in the Uro calculations a *distance* (Section 14.3.3) is measured (e.g., Length, Height, Width). The items that use a *circumference/area* (Section 14.3.4) as input include "Vessel Area," and "Stenosis Area" for example.

## 14.8 Vascular Calculations

### 14.8.1 The Items of Vascular Calculations

Per default the items of Vascular calculations are briefly divided into "Left/Right Prox/Mid/Dist CCA," "Left/Right Prox/Mid/Dist ECA," "Left/Right Prox/Mid/Dist ICA," "Left/Right Bulb," "Left/Right Vertebral," "Left/Right Subclav.," and "Vessel."

To switch between left and right use the "Side" control at the bottom of the screen. To switch between prox, mid, dist and no position use the "Pos" control at the bottom of the screen.

**Left/Right Prox/Mid/Dist CCA per default contains:** Vessel Area, Vessel Diameter, Stenosis Area, Stenosis Diameter, Intima, Flow Diameter.

**Left/Right Prox/Mid/Dist ECA per default contains:** Vessel Area, Vessel Diameter, Stenosis Area, Stenosis Diameter, Intima, Flow Diameter.

**Left/Right Prox/Mid/Dist ICA per default contains:** Vessel Area, Vessel Diameter, Stenosis Area, Stenosis Diameter, Intima, Flow Diameter.

**Left/Right Bulb per default contains:** Vessel Area, Vessel Diameter, Stenosis Area, Stenosis Diameter, Intima, Flow Diameter.

**Left/Right Vertebral per default contains:** Vessel Area, Vessel Diameter, Stenosis Area, Stenosis Diameter, Intima, Flow Diameter.

**Left/Right Subclav per default contains:** Vessel Area, Vessel Diameter, Stenosis Area, Stenosis Diameter, Intima, Flow Diameter.

**Vessel per default contains:** Vessel Area, Vessel Diameter, Stenosis Area, Stenosis Diameter, Intima, Flow Diameter.

### 14.8.2 Vascular Calculation Measurements

As input for Vascular calculations distances and circumferences/areas are measured. For most of the items in the Vascular calculations a *distance* (Section 14.3.3) is measured (e.g., "Vessel Diameter" and "Stenosis Diameter"). The items that use a *circumference/area* (Section 14.3.4) as input include "Vessel Area," and "Stenosis Area" for example.

## 14.9 GYN Calculations

### 14.9.1 The Items of Gyn Calculations

Per default the items of Gyn calculations are briefly divided into "Uterus," "Left/Right Ovary," "Left/Right Follicle," and "Fibroid."

To switch between left and right use the "Side" control at the bottom of the screen.

**Uterus per default contains:** Length, Height, Width, Endo. Thickness, Cervix Length.

**Left/Right Follicle per default contains:** 1-10.

**Fibroid per default contains:** 1-10.

**Left/Right Ovary per default contains:** Length, Height, Width.

### 14.9.2 GYN Calculation Measurements

For all GYN calculations the basis is a *measurement of distance* (Section 13.4).

When "Left/Right Follicle" or "Fibroid" are chosen as study, up to ten follicles can be measured. After measuring the diameter, the follicle volume is automatically calculated by using the formula for a sphere.

## 14.10 Ped Calculations

### 14.10.1 The Items of Ped Calculations

Per default there is only one study for Pediatric Calculations: "Left/Right HIP"

To switch between left and right use the "Side" control at the bottom of the screen.

**Left/Right HIP per default contains:** Hip Joint.

### 14.10.2 Ped Calculation Measurements

The basis for the Hip Joint calculation are three lines. The angles between these lines are calculated and displayed on screen.

## 14.11 Neuro Calculations

### 14.11.1 The Items of Neuro Calculations

Per default the items of Neuro calculations are briefly divided into "Left/Right Prox/Mid/Dist CCA," "Left/Right Prox/Mid/Dist ICA," "Left/Right ACA," "Left/Right Vertebral," "Left/Right MCA," "Left/Right PCA," "Basilar," "A Com A," "Left/Right P Com A," and "Vessel."

To switch between left and right use the "Side" control at the bottom of the screen. To switch between prox, mid, dist and no position use the "Pos" control at the bottom of the screen.

**Left/Right Prox/Mid/Dist CCA per default contains:** Vessel Area, Vessel Diameter, Stenosis Area, Stenosis Diameter, Intima, Flow Diameter.

**Left/Right Prox/Mid/Dist ACA per default contains:** Vessel Area, Vessel Diameter, Stenosis Area, Stenosis Diameter, Intima, Flow Diameter.

**Left/Right Prox/Mid/Dist ICA per default contains:** Vessel Area, Vessel Diameter, Stenosis Area, Stenosis Diameter, Intima, Flow Diameter.

**Left/Right Prox/Mid/Dist MCA per default contains:** Vessel Area, Vessel Diameter, Stenosis Area, Stenosis Diameter, Intima, Flow Diameter.

**Left/Right Prox/Mid/Dist PCA per default contains:** Vessel Area, Vessel Diameter, Stenosis Area, Stenosis Diameter, Intima, Flow Diameter.

**Left/Right Vertebral per default contains:** Vessel Area, Vessel Diameter, Stenosis Area, Stenosis Diameter, Intima, Flow Diameter.

**Basilar per default contains:** Vessel Area, Vessel Diameter, Stenosis Area, Stenosis Diameter, Intima, Flow Diameter.

**A Com A. per default contains:** Vessel Area, Vessel Diameter, Stenosis Area, Stenosis Diameter, Intima, Flow Diameter.

**Left/Right P Com A. per default contains:** Vessel Area, Vessel Diameter, Stenosis Area, Stenosis Diameter, Intima, Flow Diameter.

**Vessel per default contains:** Vessel Area, Vessel Diameter, Stenosis Area, Stenosis Diameter, Intima, Flow Diameter.

### 14.11.2 Neuro Calculation Measurements

As input for Neuro calculations distances and circumferences/areas are measured. For most of the items in the Vascular calculations a *distance* (Section 14.3.3) is measured (e.g., "Vessel Diameter" and "Stenosis Diameter"). The items that use a *circumference/area* (Section 14.3.4) as input include "Vessel Area," and "Stenosis Area" for example.

## 14.12 Ortho Calculations

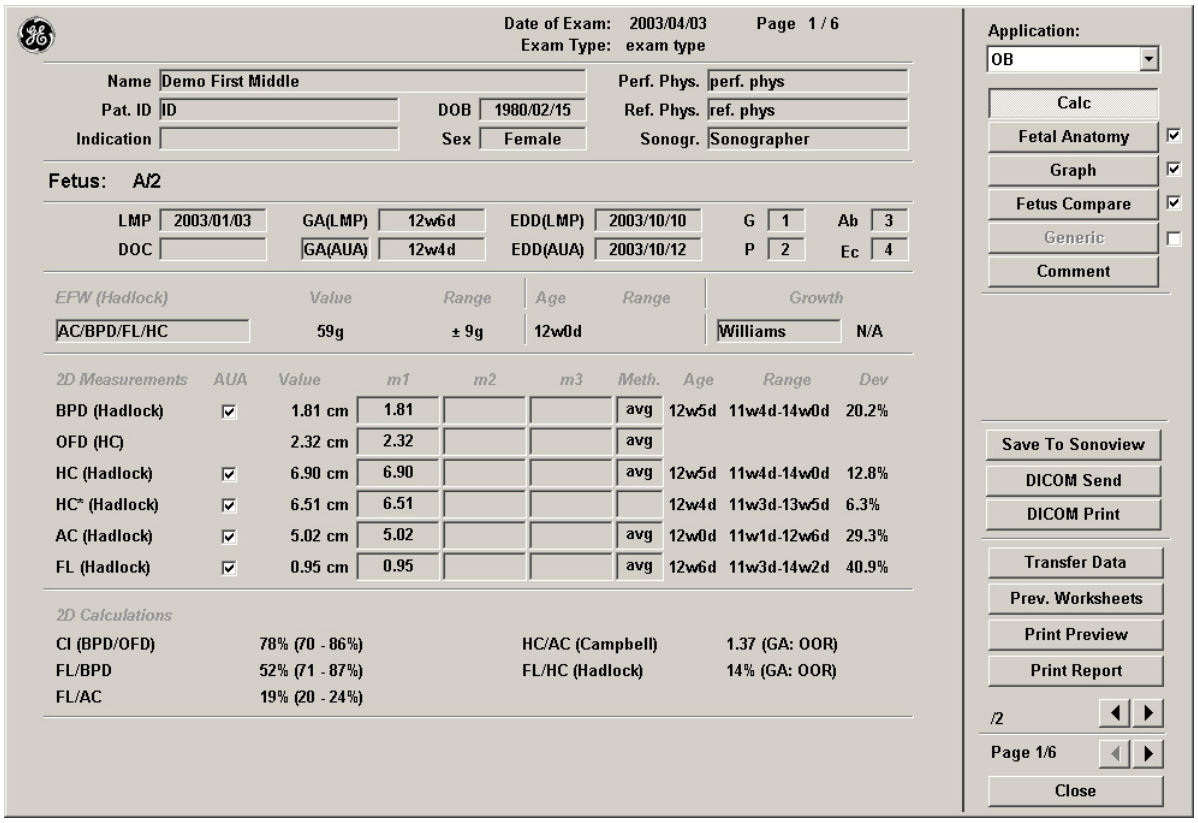
### 14.12.1 The Items of Ortho Calculations

Per default there are no items and studies in Ortho calculations.

# Chapter 15

# Worksheet

## 15.1 View the Worksheet




To open the worksheet simply click the “Worksheet” button in the “Measurement” menu.

In order to exit the worksheet select the “Close” button in the worksheet window.

The worksheet data will be removed from memory in the following events:

- Closing of the current file.
- Opening of a new volume file.
- Exiting of 4D View.

In these events, if a “Patient ID” and a “Patient Name” have already been entered, the worksheet data is stored in the database.

The range column gives the range of the measured value in a population.

A variety of calculation equations and tables is available for selection in order to find those that fit best for a particular population.

Choose tables and equations using *“Measure Setup - Measure & Calc”* (Section 16.1) from *“Settings”* (Section 5.4) in the menu bar.

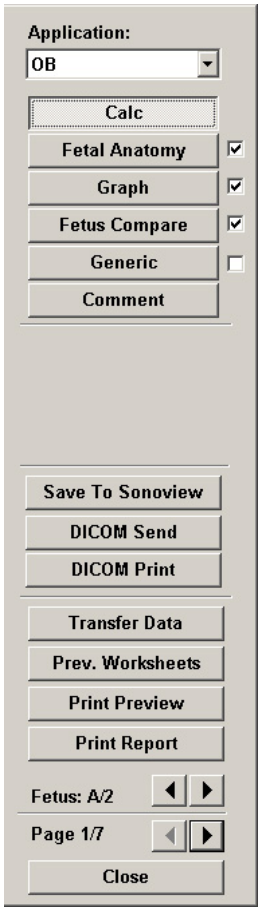
The references of the tables and equations including the sources can be found in *“Obstetrics Equations and Tables”* (Section 17.1.1), *“Cardiology 2D”* (Section 17.2.1) and *“Vascular Reference”* (Section 17.3.1).

Edit a measurement by simply clicking into the field that contains the measurement to be edited. Type the corrected value and press [Enter]. The edited values are marked with an asterix “*.”

Select whether to display the average (“Avg”) value of measurements, the minimum (“Min”) or the maximum (“Max”) by clicking in the method field and choosing from the appearing menu.

## 15.2 The Worksheet Menu

On the right side of the worksheet the worksheet menu can be found:




**Application:** Select the desired application from the drop down menu.

**Calc:** Display results of calculation measurements.

**Fetal Anatomy:** Only available if application is "OB". Display "Fetal Anatomy" page. On this page enter details on the fetal anatomy. Place checkmark next to this button or press the "Include in Report" button to include this page in the printed report.

**Graph:** Only available if application is "OB". Display *"Graph"* (Section 15.3) page. Place checkmark next to this button or press the "Include in Report" button to include this page in the printed report.

**Fetus Compare:** Only available if application is "OB" and more than one fetus is selected in the *"Patient Information Dialog"* (Section 22.1.3). Display "Fetus Compare" page. On this page the results of the calculation measurements of each fetus are presented next

to each other to simplify comparison. Place checkmark next to this button or press the "Include in Report" button to include this page in the printed report.

**Generic:** Display results of generic measurements. Place checkmark next to this button or press the "Include in Report" button to include this page in the printed report.

**Comment:** Display the *"Comment"* (Section 15.4) page.

**Save to SonoView:** Save a screenshot of the currently displayed worksheet page to SonoView.

**DICOM Send:** Send a screenshot of the currently displayed worksheet page to the currently selected DICOM Servers.

**DICOM Print:** Print a screenshot of the currently displayed worksheet page on the currently selected DICOM Printer.

**Transfer Data:** Only available if application is "OB" or "Gyn". *Transfer* (Section 23.8) the worksheet data to a remote station.

**Previous Worksheets:** View the worksheet of a previous exam of the current patient. For details see *View Previous Worksheets* (Section 15.5).

**Print Preview:** View a *preview* (Section 15.6) of what will be printed to the printer.

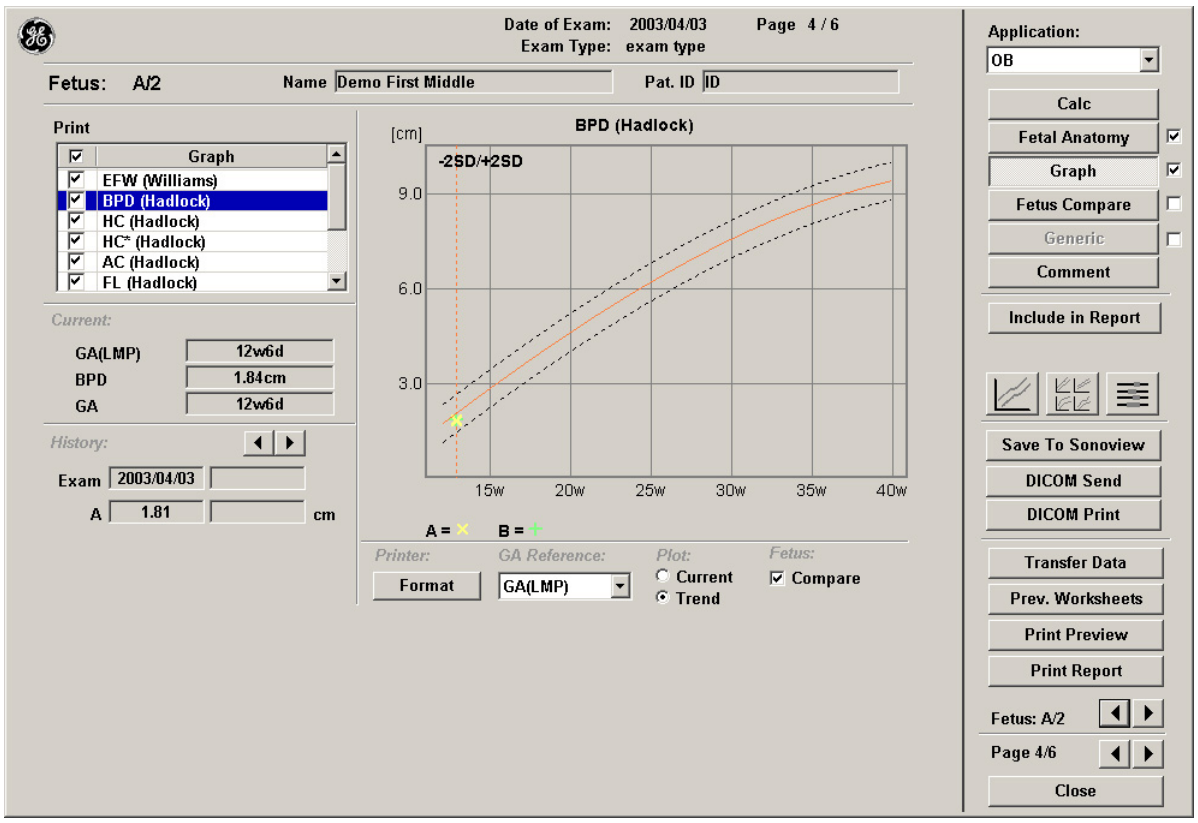
**Print Report:** Print the worksheet data.

**Fetus:** Only available if application is "OB" and more than one fetus is selected in the *"Patient Information Dialog"* (Section 22.1.3). Switch between the results of the different fetuses. The current fetus is displayed in the worksheet at the upper left side of the page.

**Page:** Step through the pages of the worksheet page by page.

**Close:** Close the current worksheet.

## 15.3 Graph Display



In order to enter this window click the “Graph” button in the worksheet menu.

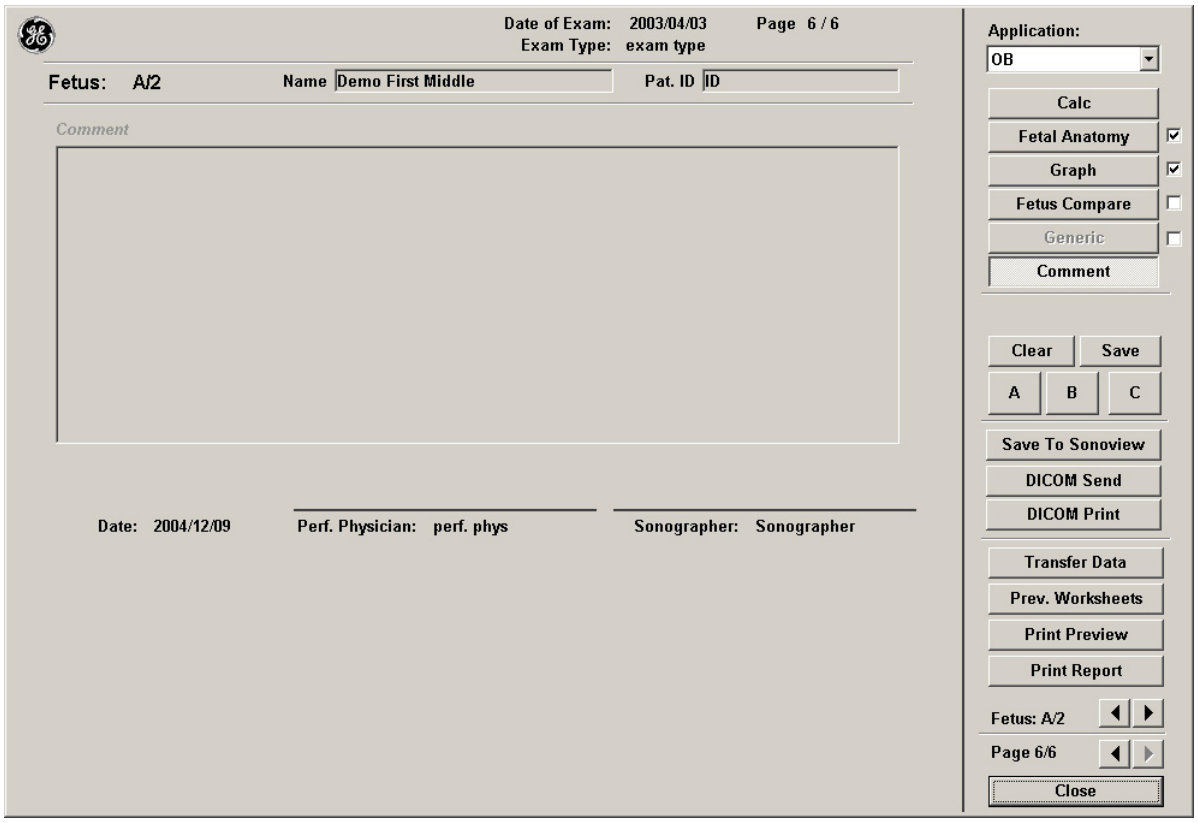
In the “Graph” window the results of measurements can be compared in the obstetrics report to the normal range in a particular population using curve or bar graphs. The curve graphs show an upper and a lower limit for a biometric value at a given gestational age.

If an LMP was entered in the *“Patient and Exam”* (Section 22.1.3) dialog box, a marker is seen in the graph, which indicates the measured value of the fetus. There are different markers for up to four fetuses.

On the left side, graphs can be selected for printing by checking the relevant box. The format in which the graphs are printed can be selected by pressing the “Format” button and selecting the desired format.

Use these three buttons in the worksheet menu to switch between “Single Display”, “Quad Display” and “Bar Graph Display”.

## 15.4 Comment




Enter a comment into the "Comment" field by simply clicking into the field and typing the desired text.

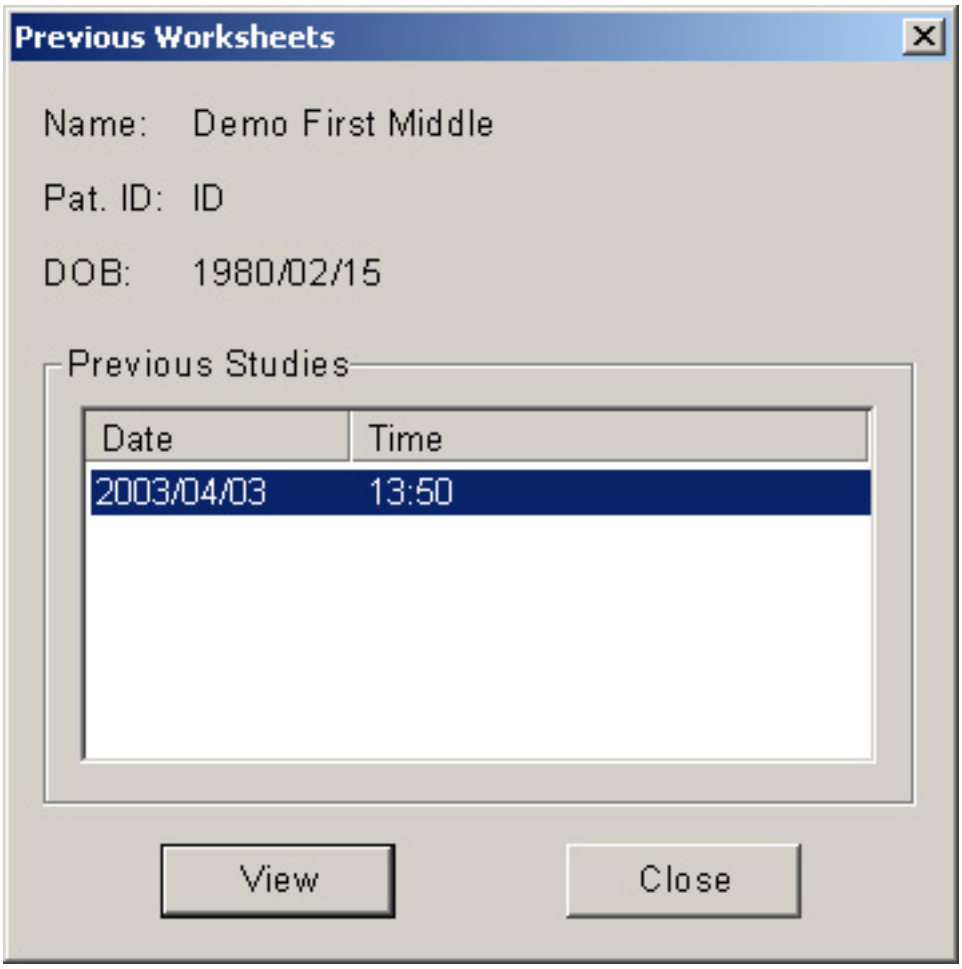
Use these buttons in the worksheet menu to store comment text into presets, invoke those presets and clear the comment field.

**Store Comment Preset:** Type some text into the comment field. Then press the "Save" button and the button of the preset, i.e. "A," "B" or "C." The text in the comment field is now stored in the select preset button, i.e. "A," "B" or "C."

**Invoke Comment Preset:** Simply press "A," "B" or "C." The comment stored in the according preset button is now added to the comment field.

**Clear:** Press the "Clear" button to remove all text from the comment field

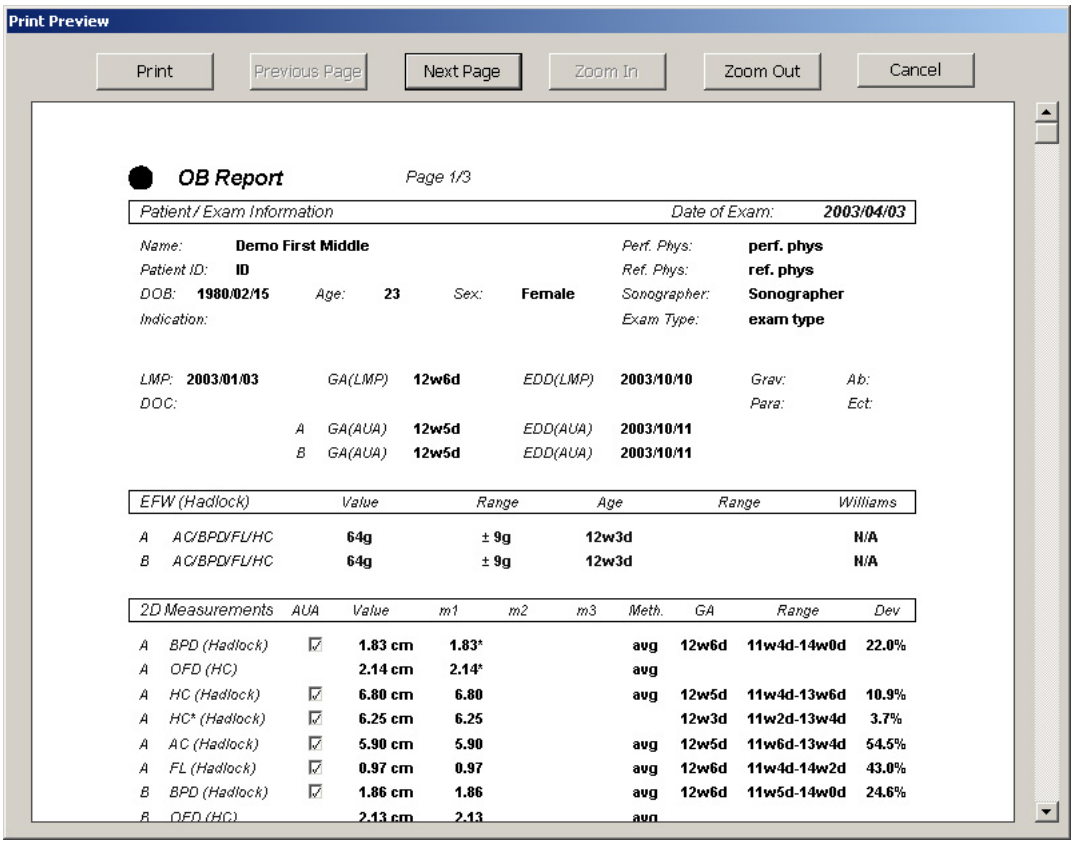
## 15.5 Previous Worksheets



In order to get to the above dialog box click the "Prev. Worksheets" button in the worksheet menu.

Select a worksheet by exam date and time and press "View". In order to close the previous worksheet and return to the current worksheet press the "Close" button in the worksheet menu.

## 15.6 Print Preview



In order to view the above dialog click the “Print Preview” button in the worksheet menu.

This dialog displays a representation of what will be printed to the printer if the “Print” button is pressed. Use “Next Page” and “Previous Page” to navigate through the different pages of the worksheet. Use “Zoom In” and “Zoom Out” to zoom the page and “Cancel” to close the dialog without printing the report.

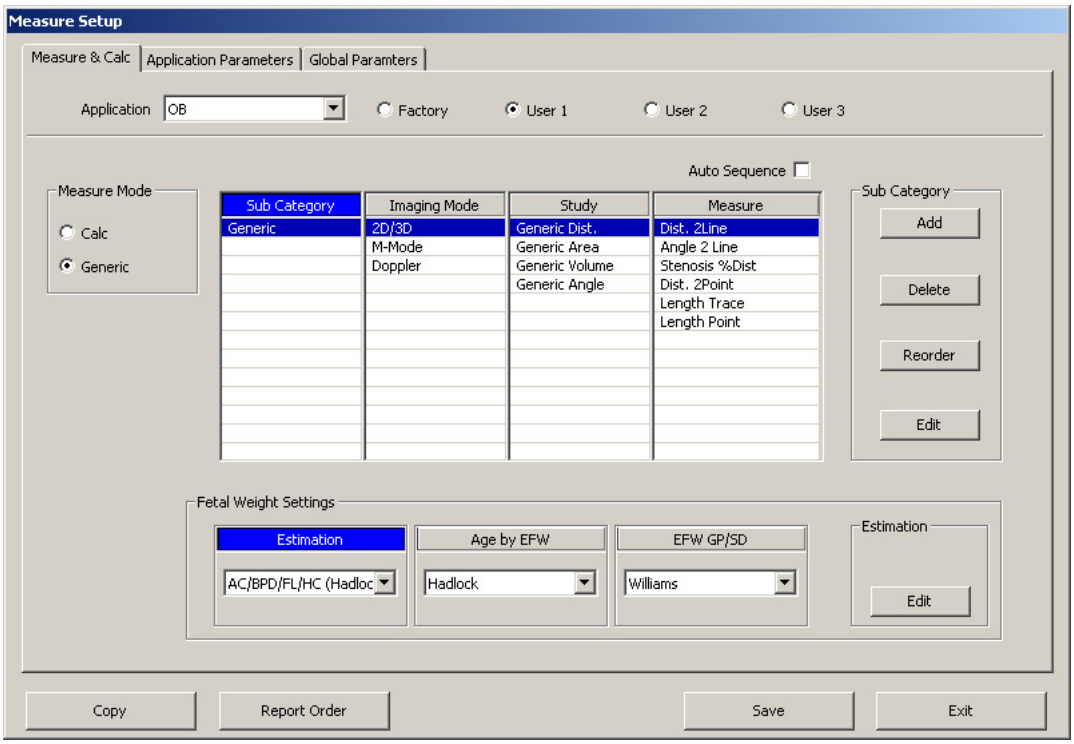
# Chapter 16

# Measurement Setup

Via the *"Settings" menu* (Section 5.4) enter the measurement setup area by selecting "Measure Setup."

**Note:** When the measurement setup is started and measurements have not been used previously in the current working session with 4D View, there can be a delay of a few seconds. As the measurement package does have a wide range of possibilities it takes some time to load from the hard disk into the memory of the PC.

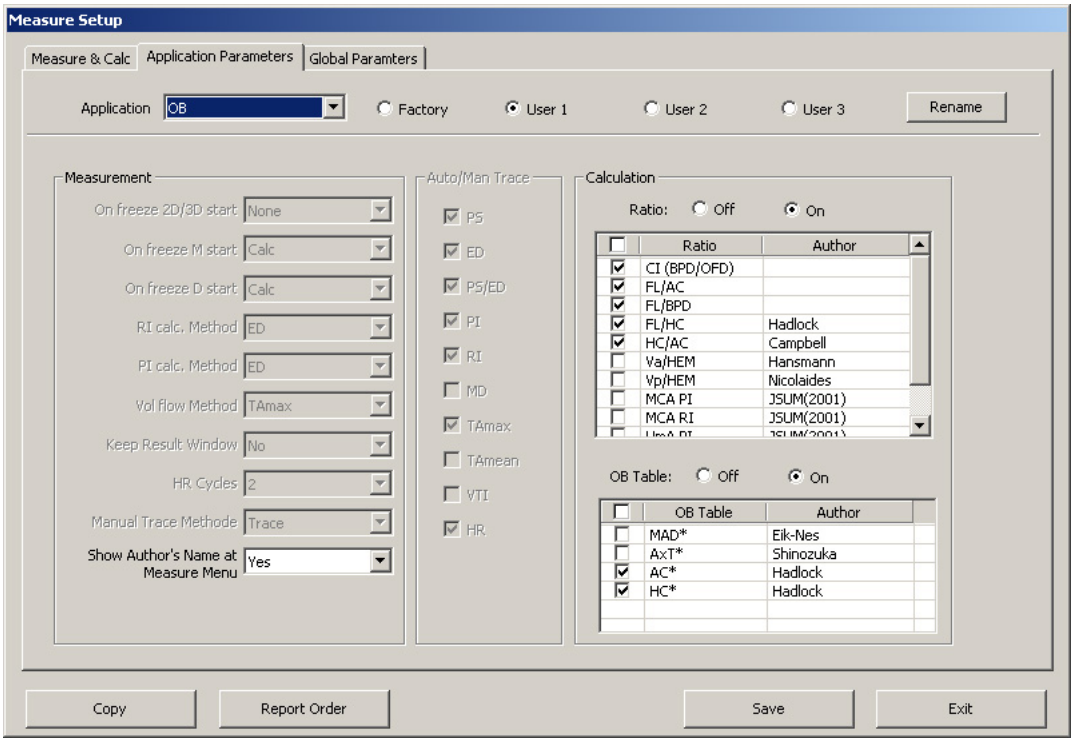
## 16.1 Tab “Measure & calc”




This tab is used to select which measurements will be available in the *Generic Measurement Menu* (Section 13) and in the *Calculation Measurement Menu.* (Section 14) In addition it is possible to add new measurements and tables, edit existing measurements and tables and define autosequences.

For more details on how to work with the functionality of this tab please refer to the BT04 V730 series basic user manual Section 18.3.1.

## 16.2 Tab “Application Parameters”




This tab is used to for measurement settings that are application dependent.

**On Freeze 2D/3D start:** Not applicable in 4D View

**On Freeze M start:** Not applicable in 4D View

**On Freeze D start:** Not applicable in 4D View

**RI Calc Method:** Not applicable in 4D View

**PI Calc Method:** Not applicable in 4D View

**Vol Flow Method:** Not applicable in 4D View

**Keep Result Window:** Not applicable in 4D View

**HR cycles:** Not applicable in 4D View

**Manual Trace Method:** Not applicable in 4D View

**Show Author’s Name at Measure Menu:** Select if the measurement items in the OB Calculation Menu will be shown with or without the Author’s name.

**Auto/Manual Trace** : Not applicable in 4D View

**Calculation - Ratio:** Select either: Off or On

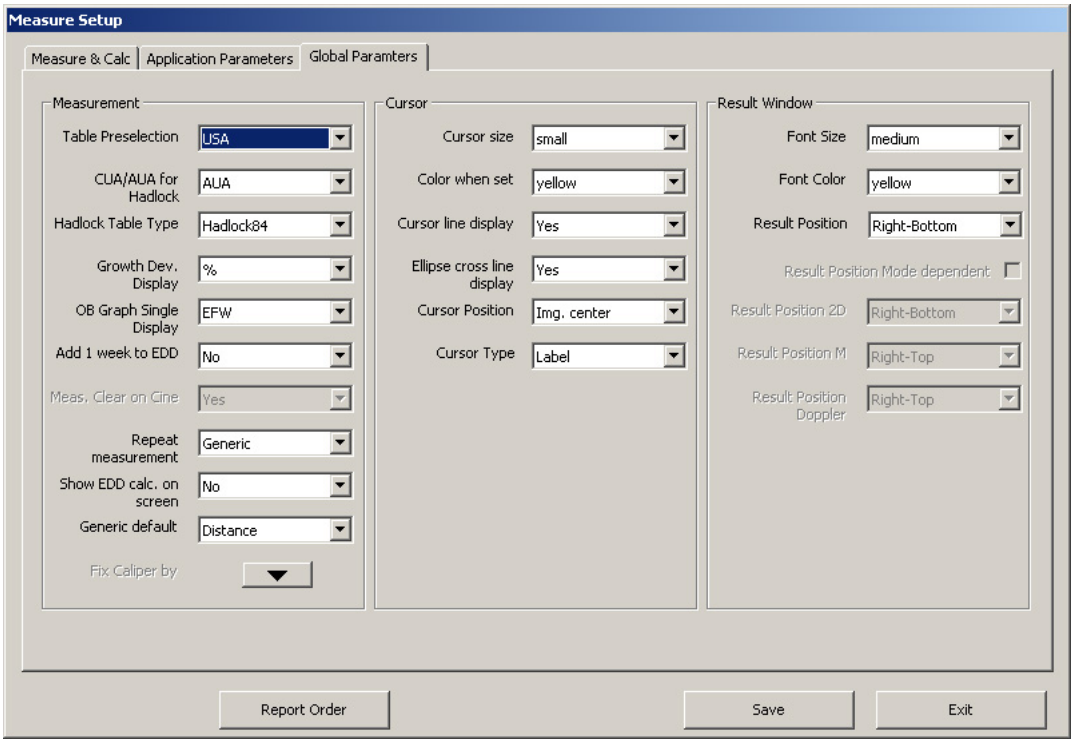
If Ratio is “On” (check mark visible), select the desired ratio calculations that should be displayed in the Patient worklist. (Either select the ratios individual or set only one check mark directly into the “black” box to mark them all.)

**OB Table:** Select either: Off or On

If OB Table is “On” (check mark visible), select the desired tables that should be displayed in the Patient worklist. (Either select the tables individual or set only one check mark directly into the “black” box to mark them all.)

For more details on how to work with the functionality of this tab please refer to the BT04 V730 series basic user manual Section 18.3.2.

## 16.3 Tab “Global Parameters”




This tab is used to for global measurement settings.

**Table Preselection:** Select the desired combination of measurements that fulfill the needs of the respective country.

**CUA/AUA for Hadlock:** Select to use CUA (Composite Ultrasound Age) or AUA (Average Ultrasound Age) as default.

**Hadlock Table Type:** Select the desired Table Type.

**Growth Dev. Display:** Select SD (Standard Deviation) or %.

**OB Graph Single Display:** Select Last or EFW

**Add 1 week to EDD:** Select Yes or No (to add additional week to estimate data of delivery)

**Meas. Clear on Cine:** Not applicable in 4D View

**Repeat measurement:** Select if each measurement should be repeated (= Yes), or not (= No)

**Show EDD calc. on screen:** Select if EDD (Estimated Day of Delivery) should be calculated and displayed on the screen (= Yes), or not (= No)

**Generic default:** Select Distance or Last Used

**Fix Caliper by:** Not applicable in 4D view

**Cursor size:** Select the size of the measurement cursor (small or large).

**Color when set:** Select the color of a fixed measurement cursor.

**Cursor line display:** Select if the cursor line is displayed (= Yes), or if only the cursor number is displayed (= No) after completing a measurement.

**Ellipse cross line display:** Select Yes or No

**Cursor Position:** Select 1st cursor, 2nd cursor or Image center

**Cursor Type:** Select Number, Label or Number & Label

**Font Size:** Select the font size used in the resulting window (small, medium, large)

**Font Color:** Select the font color used in the resulting window

**Result Position:** Select the measurement result location on the monitor display.

**Result Position Mode dependent:** Not applicable in 4D Viwe

For more details on how to work with the functionality of this tab please refer to the BT04 V730 series basic user manual Section 18.3.3.

# Chapter 17

# Reference for Calculation Measurements

## 17.1 Obstetrics

### 17.1.1 Obstetrics Equations and Tables

The mathematical methods in obstetrics which are used in 4D View are identical to those used in the Voluson® 730 series ultrasound scanners.

The reference for mathematical methods in obstetrics can be viewed in the online help of 4D View, from where it can also be printed. This information can also be found in the Voluson® 730 series Advanced Reference Manual.

When printed, this chapter will be about 100 pages, depending on paper format and printer settings.

## 17.2 Cardiac

### 17.2.1 Cardiology 2D

**Note:** The mathematical methods used in 4D View are identical to those used in the Voluson® 730 series ultrasound scanners. For compatibility reasons this reference chapter is identical to the corresponding chapter in the Voluson® 730 series Advanced Reference Manual, although only a subset of the calculation measurements that are possible with a Voluson® 730 series ultrasound scanner is also possible with 4D View.

### BSA (Body Surface Area)

BSA is calculated by entering "Weight" and "Height" in the "Patient and Exam Info" dialog box of 4D View or the user software of a GEMS Kretztechnik ultrasound scanner.

$BSA = H^{0.725} \times W^{0.425} \times 0.007184$

**H:** centimeters

**W:** kilograms

**BSA:** $m^2$

Reference:
*Grossman, W. "Cardiac Catheterization and Angiography." Blood Flow Measurement: Hemodynamic Principles, 1980. Chapter 8, Page 90.*

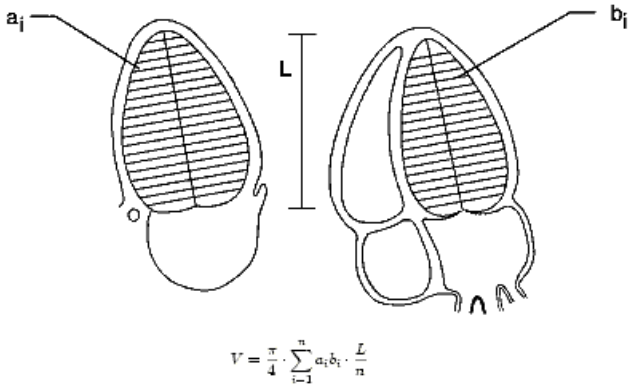
### Simpson's method

Simpson's protocol is used for calculating left ventricular volume from measurements taken in two scan planes.

The calculation of the volume for both methods (2-chamber or the 4-chamber view) results from summation of areas from diameters of 20 cylinders or discs of equal height, apportioned over the left ventricular length.

Left Ventricle Volume:

$$V = \frac{\pi}{4} \cdot \sum_{i-1}^{n} a_i b_i \cdot \frac{L}{n}$$



**LV mass**

$$LVmass = 1.05 \cdot [(\frac{5}{6} \cdot A_1 \cdot L_1) - (\frac{5}{6} \cdot A_2 \cdot L_2)]$$

where,

**A1:** short axis area, Epicardial ($cm^2$)

**A2:** short axis area, Endocardial ($cm^2$)

**L1:** long axis Epicardial length (cm)

**L2:** long axis Endocardial length (cm)

**LVmass:** weight in grams (g)

Epicardial Volume (ml)

$$Epi.V = \frac{5}{6} \cdot A_1 \cdot L_2$$

Endocardial Volume (ml)

$$Endo.V = \frac{5}{6} \cdot A_2 \cdot L_2$$

Reference:
*Harvey Feigenbaum, "Echocardiography," 1995 fifth edition Chapter 3 p. 158, Lea & Febiger*

**Vol A/L**

$$V = 0.85\frac{A^2}{L}$$

**Stroke Volume (SV)**

$$SV = (EDV - ESV)(\text{ml})$$

where,

**EDV:** End Diastolic Volume

**ESV:** End Systolic Volume

**Stroke Volume Index (SI)**

$$SI = \frac{SV}{BSA}$$

**Cardiac Output (CO)**

$$CO = \frac{(SV \cdot HR)}{1000}\text{L/min}$$

**Cardiac Index**

$$CI = \frac{CO}{BSA}$$

**Ejection Fraction (EF)**

$$EF = \frac{(EDV - ESV)}{EDV} \cdot 100\%$$

where,

**EDV:** End Diastolic Volume

**ESV:** End Systolic Volume

Reference:
*Harvey Feigenbaum, "Echocardiography," 1995 fifth edition Chapter 3, p. 144, Lea & Febiger*

**LV Volume diastolic**

$$LVEDV = \frac{7}{(2.4 + LVDD)} \times LVDD^3$$

LV End Diastolic Volume (LVEDV)
Left Ventricle Dimension at Diastole (LVDD)

Reference:
*Teichholz, L.E., Kreulen, T., Hermann, M.V., et. al. "Problems in echocardiographic volume Determinations: echocardiographic-angiographic correlations in the presence or absence of asynergy." American Journal of Cardiology, 1976,37:7.*

**LV Volume systolic**

$$LVESV = \frac{7}{(2.4 + LVDS)} \times LVDS^3$$

LV End Systolic Volume (LVESV)
Left Ventricle Dimension at Systole (LVDS)

Reference:
*Teichholz, L.E., Kreulen, T., Hermann, M.V., et. al. "Problems in echocardiographic volume Determinations: echocardiographic-angiographic correlations in the presence or absence of asynergy." American Journal of Cardiology, 1976,37:7*

**Fractional Shortening (FS) of Left Ventricle internal diameter**

A percent change in LV cavity dimension with systolic contraction

$$FS = \frac{LVIDd - LVIDs}{LVIDd} \times 100\%$$

Reference:
*Harvey Feigenbaum, "Echocardiography," 1995 fifth edition*

## 17.3 Vascular

### 17.3.1 Vascular Reference

**Note:** The mathematical methods that are used in 4D View are identical to those used in the Voluson® 730 series ultrasound scanners. For compatibility reasons this reference chapter is identical to the corresponding chapter in the Voluson® 730 series Advanced Reference Manual, although only a subset of the calculation measurements that are possible with a Voluson® 730 series ultrasound scanner is also possible with 4D View.

**Resistivity Index**

$$RI = \frac{V_{systolic} - V_{diastolic}}{V_{systolic}}$$

Reference:
*Burns, Peter N., "The Physical principles of Doppler Spectral Analysis," Journal of Clinical Ultrasound, Nov./Dec. 1987, Vol.15, No.9,p.586*

### Pulsatility Index

$$PI = \frac{V_{systolic} - V_{diastolic}}{V_{mean}}$$

Reference:
*Burns, Peter N., "The Physical principles of Doppler Spectral Analysis," Journal of Clinical Ultrasound, Nov./Dec. 1987, Vol.15, No.9,p.585*

### SD (systolic, diastolic ratio)

$$SD = \frac{V_{systolic}}{V_{diastolic}} \times 100\%$$

Reference:
*Ameriso S, et al., "Pulseless Transcranial Doppler Finding in Takayasu's Arteritis," J Clin Ultrasound, September 1990; 18:592-6*

### Gradient

$$P = 4 \times V^2 \text{mmHg}$$

where,

**P:** pressure gradient

**V:** the maximum instantaneous velocity (m/sec)

### %STA

$$\%STA = \frac{StenosisArea}{BloodVesselArea} \times 100\%$$

Reference:
*Jacob, Normaan M et, al., "Duplex Carotid Sonography: Criteria for Stenosis, Accuracy, and Pitfalls," Radiology 154: 385-391, 1985.*

# Chapter 18

# 3D Rotation Cine

## 18.1 Calculate Cine Sequences

In order to obtain an overall 3D impression of the rendered object a certain number of calculated views are displayed image by image in a fast sequence. The rendered object is rotating for the observer. In transparent mode the rotation of the object enables a 3D impression due to movement of the structures.

Steps to calculating a *3D Rotation Cine* (Glossary) sequence:

### 18.1.1 Activate the 3D Rotation Cine Mode

In the main menu click the "3D Rot. Cine" button.

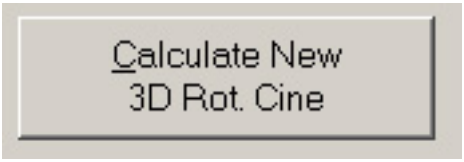
### 18.1.2 Does a 3D Rotation Cine exist?

If a Cine sequence has already been calculated or loaded from a volume file, it is automatically displayed. Either view the old sequence or calculate a new *3D Rotation Cine* (Glossary) sequence. If no *3D Rotation Cine* (Glossary) has been calculated yet, the "Calculate 3D Rotation Cine" window appears automatically.

### 18.1.3 Start Calculation of a New 3D Rotation Cine

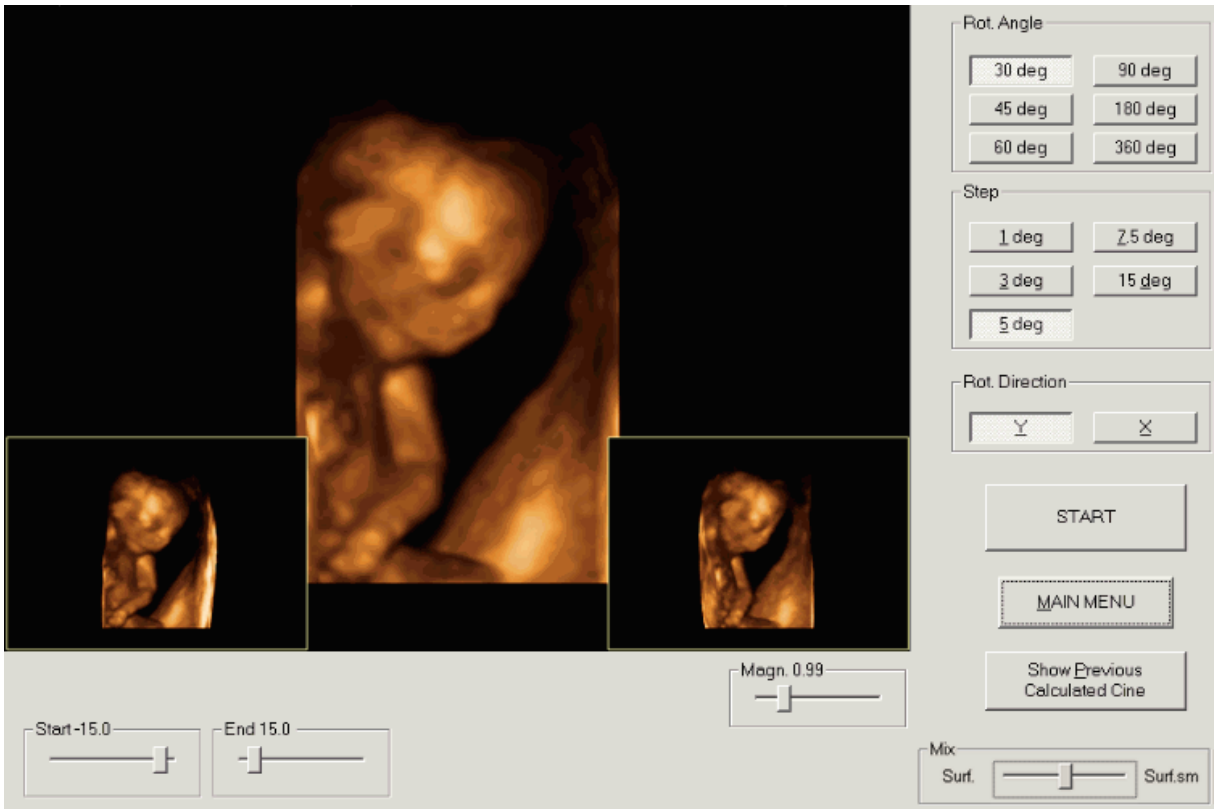
**Note:** A *3D Rotation Cine* (Glossary) sequence which has already been calculated will be lost when calculating a new *3D Rotation Cine* (Glossary) sequence!

Review a previously calculated *3D Rotation Cine* (Glossary) sequence by pressing the "View Previous Calculated Cine" button.




Click on this button to start a new calculation.

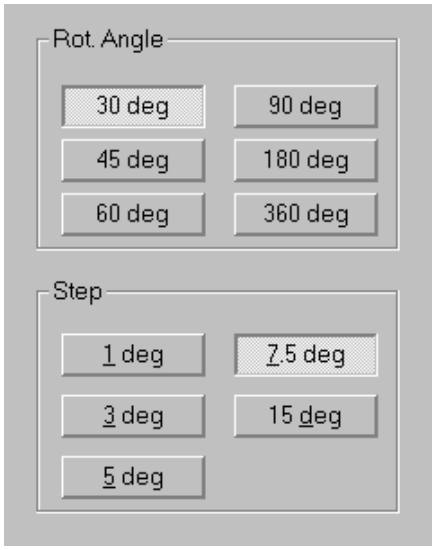
A dialog area appears at the right side of the screen. Various parameters for the *3D Rotation Cine* (Glossary) calculation can be entered here:




The small images show the start and end images of the Cine calculation.

### 18.1.4 Select Step Raster

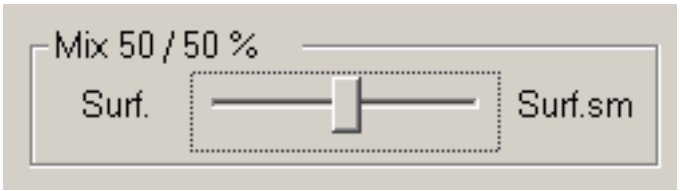
The rotation angle and the step raster define the rotation steps of the *3D Rotation Cine* (Glossary) sequence.




### 18.1.5 Select Rotation Axis

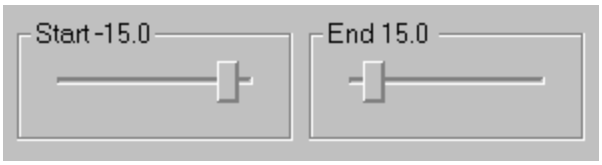
These buttons define whether the Cine sequence should rotate around the horizontal (X) or vertical (Y) axis.

### 18.1.6 Mix Render Mode




With this slider two render modes which were previously selected in the *"Render Mode"* (Section 8.1) dialog area can be mixed. The text at either end of the slider indicate which render modes are selected.

### 18.1.7 Optional Adjustment of Start and End View of 3D Image

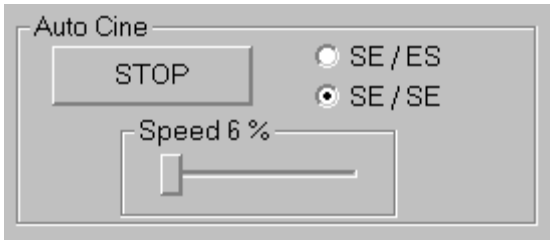



These controls allow a variable and asymmetric rotation angle (e.g., rotation from -15 deg to 75 deg). By using the sliders, the start image and end image can be defined.

### 18.1.8 Start Calculation of the Cine Sequence

During calculation the results are stored in the Cine memory. After the calculating process has finished, the Cine sequence is displayed on the screen.

## 18.2 Display a 3D Rotation Cine




After calculation, the sequence is automatically displayed. In “Transparent” mode the display will produce a true 3D effect.

### 18.2.1 Set Loop Method

**SE / ES** Scan through the image block in both directions: First image to last image, last image to first image, etc.

**SE / SE** Scan through the image block in one direction: First image to last image, first image to last image, etc.

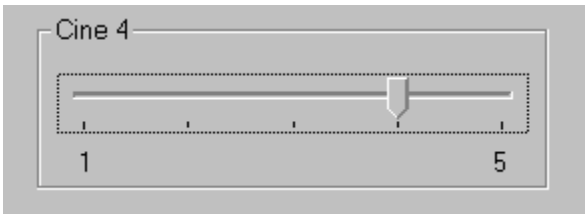
### 18.2.2 Select Rotating Speed

The speed at which the Cine sequence is displayed can be set between 6 and 400 percent.

### 18.2.3 Select Aspect Ratio

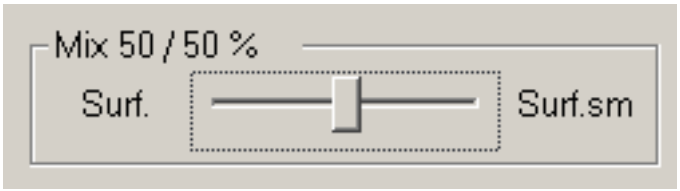
The 3D image's magnification can be varied by changing its aspect ratio.

### 18.2.4 Selection of Single Images




With this control select any single image one at a time. This control is only visible if the animation is stopped. It disappears as soon as the animation is started.

### 18.2.5 Mix Calculated Modes




The mixture between two calculated modes that were previously selected in the "Render Mode" dialog area can be adjusted even while the *3D Rotation Cine* (Glossary) sequence is being displayed.

### 18.2.6 Controlling the Timeline

Use the timeline underneath the display of the *3D Rotation Cine* (Glossary), to control the animation. The animation consists of several still images, which are displayed in a row in order to create the illusion of movement. Each vertical line in the timeline represents one image.

In the above example there are seven images (five short lines in the middle of the timeline and one at the begining and end). The numbers next to timeline indicate how many images there are and which image is displayed. In the timeline below, there are 5/7, the fifth of seven images is displayed.

As soon as the animation is stopped, a gray marker appears which indicates the image currently displayed.

Select single images using this gray marker, as if using the “Cine” slider. Move the mouse over the gray marker until the mouse cursor changes its shape to look like the sign on the left, press the left mouse key and drag the gray marker to the desired position, while keeping the left mouse key pressed.

Restart the animation by simply moving the mouse over the timeline until its cursor changes its shape to look like the “Play” sign on the left, and click the left mouse button. The animation will start with the image currently displayed.

The animation can be stopped anytime by simply moving the mouse over the timeline again until its cursor changes its shape to look like the “Pause” sign on the left, and click the left mouse button. The animation will stop.

When clicking anywhere else in the image, the mouse cursor changes its shape to display the “Forbidden” sign on the left. This indicates that clicking here has no effect whatsoever.

# Chapter 19

# 4D Image Cine

## 19.1 Display a 4D Image Cine Sequence

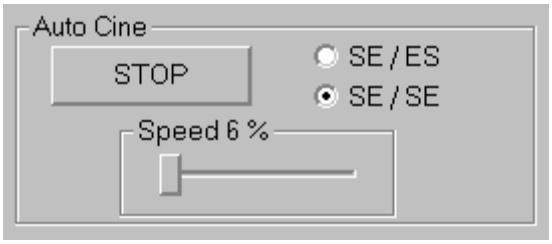
A *4D Image Cine* (Glossary) sequence can be created with a Voluson® 730 series machine of GEMS Kretztechnik in the "RealTime 4D" or in the "Live 3D" acquisition modes and can be included in a GEMS Kretztechnik volume file. With 4D View a *4D Image Cine* (Glossary) sequence can be examined.

Sample:

See youngfetus.avi.

Load the data and press the “4D Img. Cine” button. A new set of controls appears.

### 19.1.1 Set Loop Method



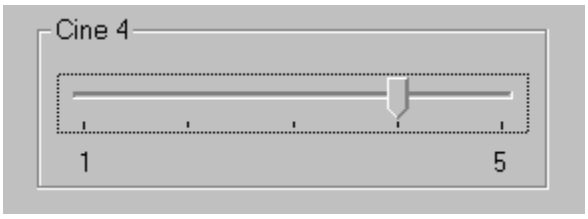

**SE / ES** Scan through the image block in both directions: First image to last image, last image to first image, etc.

**SE / SE** Scan through the image block in one direction: First image to last image, first image to last image, etc.

### 19.1.2 Select Display Speed

The speed at which the Cine sequence is displayed can be set between 6 and 400 percent.

### 19.1.3 Selection of Single Images




With this control it is possible to select any single image one at a time. This control is only visible if the animation is stopped. It disappears as soon as the animation is started.

### 19.1.4 Controlling the Timeline

Use the timeline underneath the display of the *4D Image Cine* (Glossary) to control the animation. The animation consists of several still images, which are displayed in a row in order to create the illusion of movement. Each vertical line in the timeline represents one image.

In the above example there are have seven images (five small lines in the middle of the timeline and one at the begining and end).

As soon as the animation is stopped, a gray marker appears which indicates the image currently displayed.

Select single images using this gray marker, as if using the “Cine” slider. Move the mouse over the gray marker until the mouse cursor changes its shape to look like the sign on the left, press the left mouse key and drag the gray marker to the desired position, while keeping the left mouse key pressed.

Restart the animation by simply moving the mouse over the timeline until its cursor changes its shape to look like the “Play” sign on the left, and click the left mouse button. The animation will start with the image currently displayed.

Stop the animation anytime by simply moving the mouse over the timeline again until its cursor changes its shape to look like the “Pause” sign on the left, and click the left mouse button. The animation will stop.

When clicking anywhere else in the image, the mouse cursor changes its shape to display the “Forbidden” sign on the left. This indicates that clicking here has no effect whatsoever.

# Chapter 20

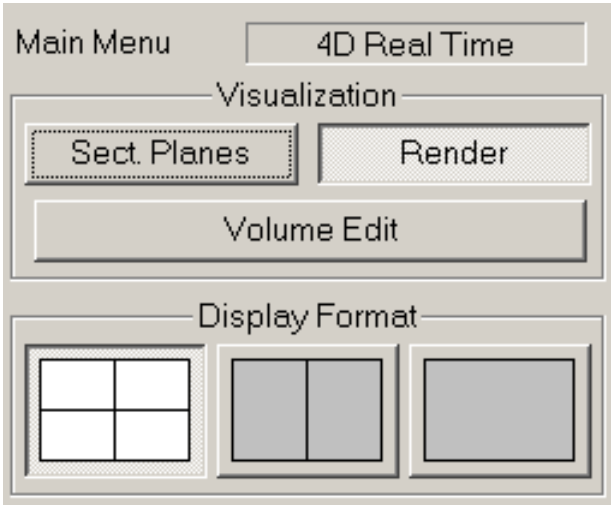
# 4D Volume Cine

## 20.1 4D Volume Cine - General Information

*4D Volume Cine* (Glossary) data (4D Volume) can be generated using the Voluson® 730 Expert only. A *4D Volume Cine* (Glossary) dataset contains up to 128 volumes captured in 4D mode. In comparison to a *4D Image Cine* (Glossary), which contains the last volume and only bitmaps of the rest of the acquisition, every single volume of the entire *4D Volume Cine* (Glossary) can be examined. For more details on the *4D Volume Cine* (Glossary) concept, please review the Voluson® 730 Expert "Operation Manual."

### 20.1.1 The 4D Volume Cine Menu

When opening a volume file which contains *4D Volume Cine* (Glossary) data, the main menu looks slightly different from the normal main menu.



Listed at the top is the type of *4D Volume Cine* (Glossary) opened. In the example is is a "4D Real Time" Cine. The selection of visualization modes is also limited. Depending upon the type of *4D Volume Cine* (Glossary), choose between "Sectional Planes" and "Render" mode, or, there may be a limitation to one of those two modes. See the remaining sections of this chapter for more information on the different types of 4D Volume Cines. To use a mode not provided in "4D Volume Cine" mode, e.g., VOCAL II, please change to "Volume Edit" mode.

Press the "Volume Edit" button to return to the normal 4D View main menu, in order to work with the current volume of the *4D Volume Cine* (Glossary), as with any static 3D volume.

Press the "4D Vol. Cine" button in the main menu to return to the "4D Volume Cine" menu. If the volume contains a *4D Image Cine* (Glossary) and *4D Volume Cine* (Glossary), only the 4D Volume Cine can be accessed.

**Note** Any changes of the settings done in "4D Volume Cine" mode are applied to the entire dataset; changes done in "Volume Edit" mode are applied only to the single volume being edited and vanish, with the return to "4D Volume Cine" mode. However, changes made to the "Image Settings" are always applied to the entire dataset.

A single volume from a *4D Volume Cine* (Glossary) can be saved as a static volume by changing to "Volume Edit" mode and pressing the "Save" toolbar button.

Currently, only one 3D Rotation Cine of one volume from the 4D Volume Cine can be computed. As soon as a new one is computed using a different volume from the *4D Volume Cine* (Glossary), the last one is deleted. Also, if a 3D Rotation Cine is included when saving a static volume, the stored 3D Rotation Cine will be the last one computed, even if the volume saved is different from the one used as a source for the 3D Rotation Cine.

In some *4D Volume Cine* (Glossary) modes an additional *display format* (Section 6.2) can be chosen, the "Split-Screen" format. If this format is activated, a normal 2D ultrasound image is seen on the left side of the screen and the rendered image on the right half of the screen.

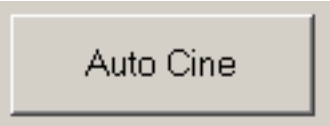
**Render Mode:**

The quality of the rendered 3D image can be selected to be "low," "medium" or "high." The better the quality, the higher the resolution of the rendered image, but the slower the animation.

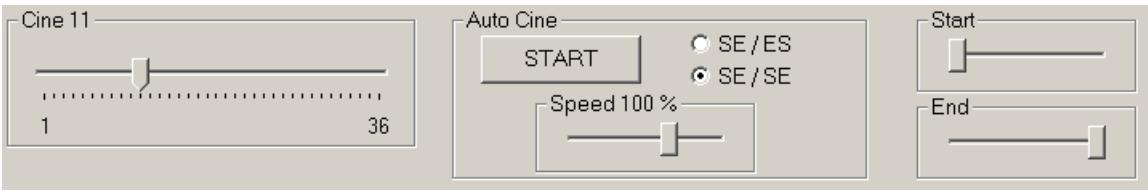
**Measure:**

Currently, “3D Multiplane” measurements are not possible in “4D Volume Cine” mode. To use this feature, please change to “Volume Edit” mode and perform the measurements there.

### 20.1.2 The Auto Cine Mode




Press the “Auto Cine” button to replace the controls beneath the display area with sliders for controlling the animation.




Use the “Cine” slider to select any single image one at a time. This control is only visible if the animation is stopped. It disappears as soon as the animation is started.

In the “Auto Cine” area, start and stop the animation, control its speed and decide how to connect two loops of the animation:

**SE / ES** Scan through the image block in both directions: First image to last image, last image to first image, etc.

**SE / SE** Scan through the image block in one direction: First image to last image, first image to last image, etc.

By using the “Start” and “End” sliders the start and end volume of the animation can be set. Simply move the sliders and watch the timeline. The brackets in the timeline include the part that is being displayed. These sliders are only displayed while the animation is stopped. As soon as the animation is started, the sliders disappear.

See also *“Controlling the Timeline”* (Section 20.1.3).

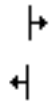
Press the “Auto Cine” button again to hide the “Auto Cine” controls and return to the 4D Volume Cine menu.

### 20.1.3 Controlling the Timeline

Using the timeline below the display of the *4D Volume Cine* (Glossary), the animation can be controled as with the "Auto Cine" menu. The animation consists of several volumes, which are displayed in a row in order to create the illusion of movement. Each mark in the timeline represents one volume.

The above example shows seven volumes (five vertical marks in the middle of the timeline and one at the beginning and end).

As soon as the animation is stopped, a gray marker appears, which indicates the volume currently displayed.



Set the start and end volume of the animation by moving the mouse over the end (right bracket) or beginning of the timeline (left bracket) until the mouse cursor changes its shape to look like one of the two arrows on the left. Press and hold the left mouse key and drag the selected bracket to the desired position.

Select single volumes using this gray marker, as if using the "Cine" slider in "Auto Cine" mode. Move the mouse over the gray marker until the mouse cursor changes its shape to look like the sign on the left, press the left mouse key and drag the gray marker to the desired position, while keeping the left mouse key pressed.

Start the animation by simply moving the mouse over the timeline until its cursor changes its shape to look like the "Play" sign on the left, and click the left mouse button. The animation will start with the volume currently displayed.

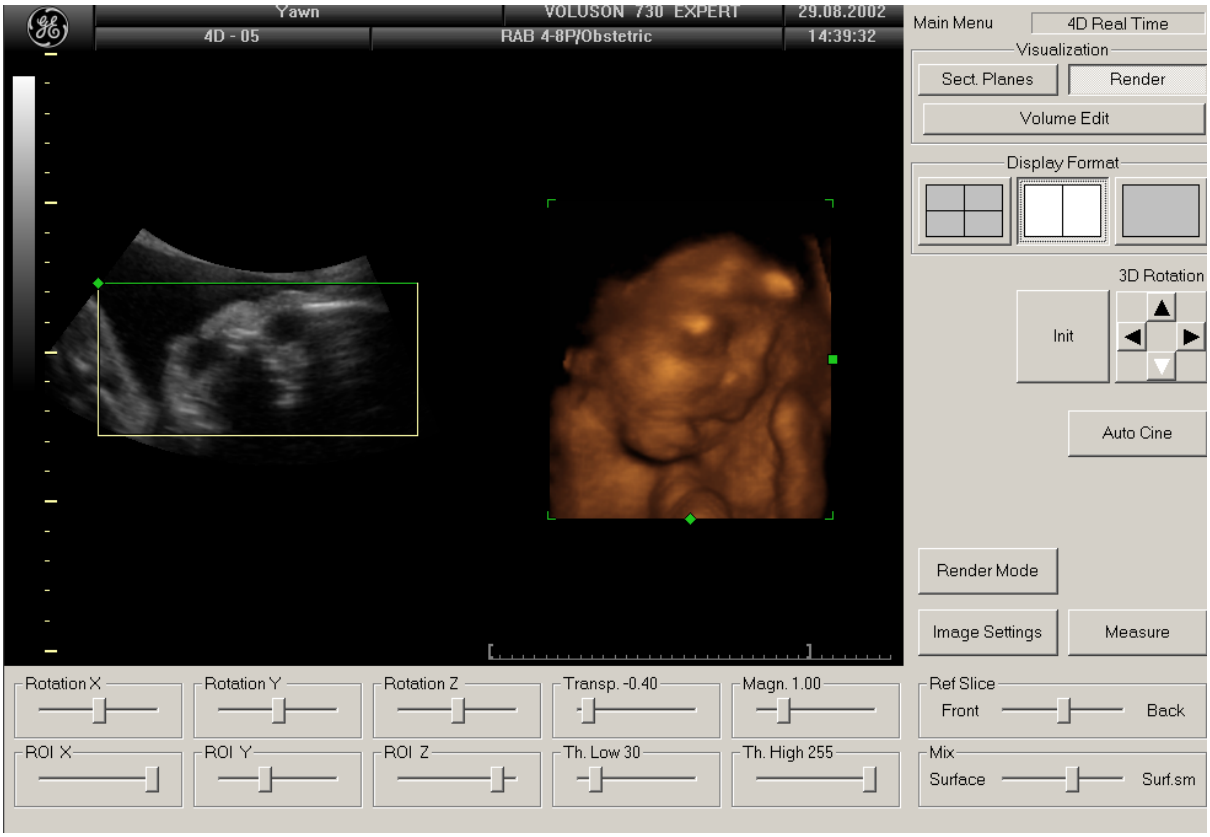
Stop the animation anytime by simply moving the mouse over the timeline again until its cursor changes its shape to look like the "Pause" sign on the left, and click the left mouse button. The animation will stop.

If the position of the mouse cursor is not associated with an action and the mouse key is pressed, the mouse cursor changes its shape to display the "Forbidden" sign on the left. This indicates that clicking here has no effect whatsoever.

See also *"The Auto Cine Mode"* (Section 20.1.2).

## 20.2 4D Real Time

A "4D Real Time" *4D Volume Cine* (Glossary) is created using the "RealTime 4D" feature of the Voluson® 730 Expert. The volumes captured during acquisition are stored and exported as a *4D Volume Cine* (Glossary). A "4D Real Time" *4D Volume Cine* (Glossary) contains a series of 3D volumes, one aquired after the other, and shown as a "movie." For more information please review the Voluson® 730 Expert "Operation Manual."



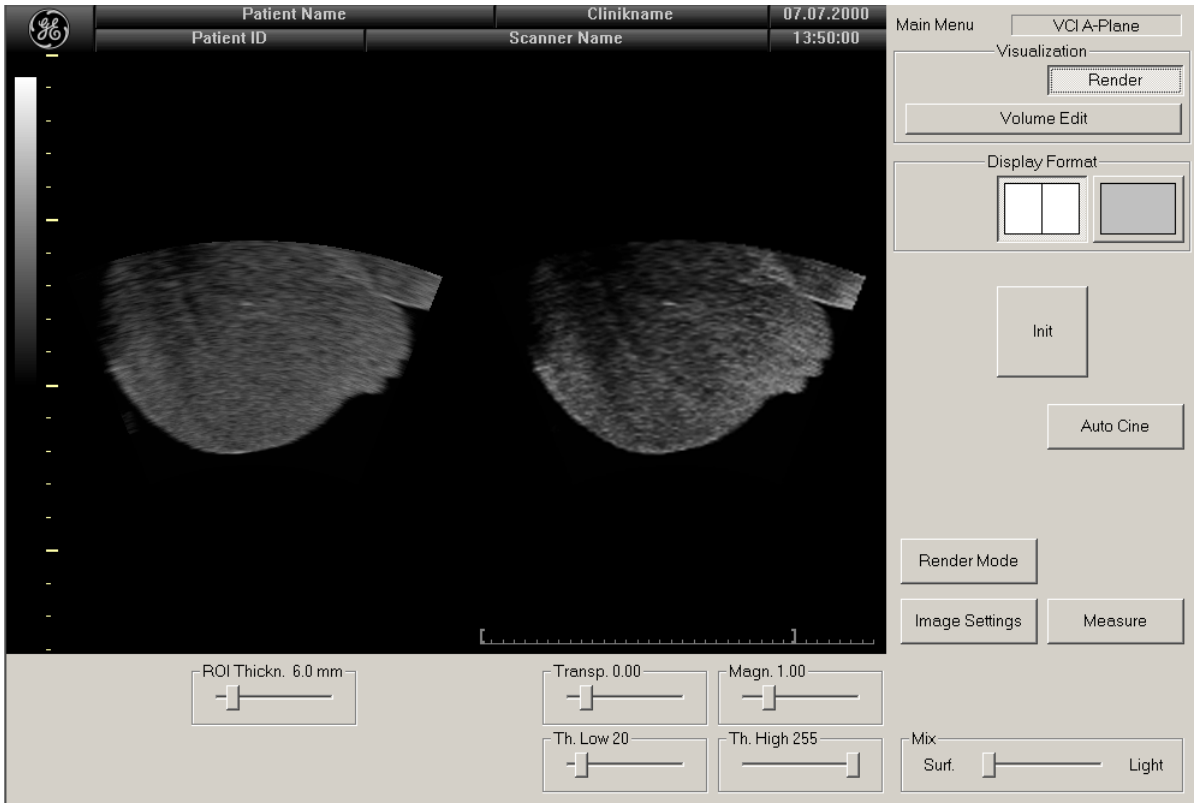

When opening such a *4D Volume Cine* (Glossary) dataset with 4D View, choose between the "Sectional Planes" and the "Render" *visualization mode* (Section 6.2). In both modes it is possible to work with the volume and the *render box* (Section 7.2) as with a static 3D volume.

Additionally, the "Split-Screen" display format can be chosen when in "Render" mode. Using this format, the reference image containing the render box is on the left side of the screen and the rendered image on the right. In "Sectional Planes" mode, an "Orientation Help" can also be displayed. Please review *"Display Format"* (Section 6.2) for more details.

## 20.3 VCI

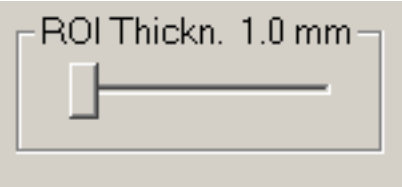
A “VCI A-plane” or a “VCI C-plane” *4D Volume Cine* (Glossary) is created using the “VCI-A” or “VCI-C” feature of the Voluson® 730 Expert. VCI displays a “Pseudo-2D” image which is created by using a very small render box in order to create a contrast-enhanced A or C-plane. For more information please review the Voluson® 730 Expert “Operation Manual.”

### 20.3.1 VCI - A Plane




When opening such a *4D Volume Cine* (Glossary) with 4D View the *visualization mode* (Section 6.2) is set to “Render.” It is not possible to select a different mode.

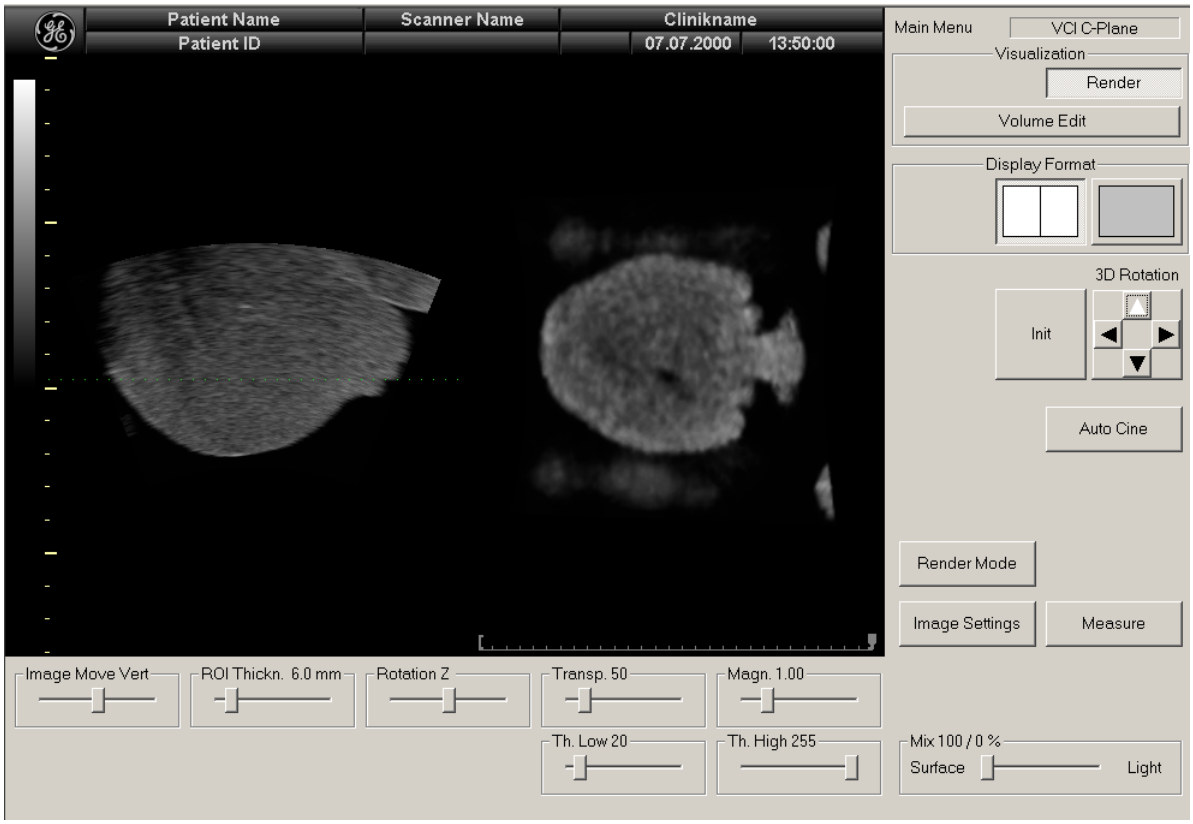
Choose between the “Split-Screen” and the “Full-Screen” display format. In “Split-Screen” mode the normal A plane is on the left and on the right is the rendered and thereby enhanced, pseudo-2D A plane. In “Full-Screen” mode only the rendered A plane is displayed. Please review *“Display Format”* (Section 6.2) for more details.




Use the “ROI Thickness” slider to change the thickness of the render box used for generating the pseudo-2D image plane.

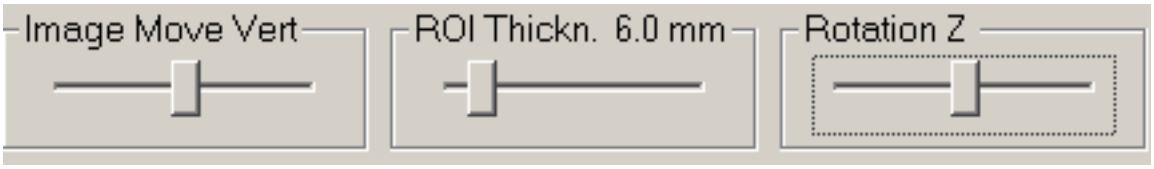
When entering “Image Settings” note that an additional button for “VCI” is visible. After pressing this button, only the image settings for the VCI image can be changed, without changing the settings of the 2D image. Return to the “4D Volume Cine” menu again, by pressing the “Main Menu” button.

### 20.3.2 VCI - C plane




When opening such a *4D Volume Cine* (Glossary) dataset with 4D View, the *visualization mode* (Section 6.2) is set to “Render.” It is not possible to select a different mode.

Choose between the “Split-Screen” and the “Full-Screen” display format. In “Split-Screen” mode the A plane is on the left with a green dotted line representing the rendered plane, and on the right is the rendered and thereby enhanced pseudo-2D C plane. In “Full-Screen” mode only the rendered C plane is displayed. Please review *“Display Format”* (Section 6.2) for more details.




Use the “ROI Thickness” slider to change the thickness of the render box used for generating the pseudo-2D image plane.

Use the “Image Move Vert” Slider to move the render plane up and down, just as if using the mouse (see below for a description of the mouse functionality).

Use the “Rotation Z” Slider to rotate the render plane, just as if using the mouse (see below for a description of the mouse functionality).

**Mouse Functionality:**

Move the mouse cursor over the green dotted line in the 2D image, it changes its shape to look like the two arrows on the left.

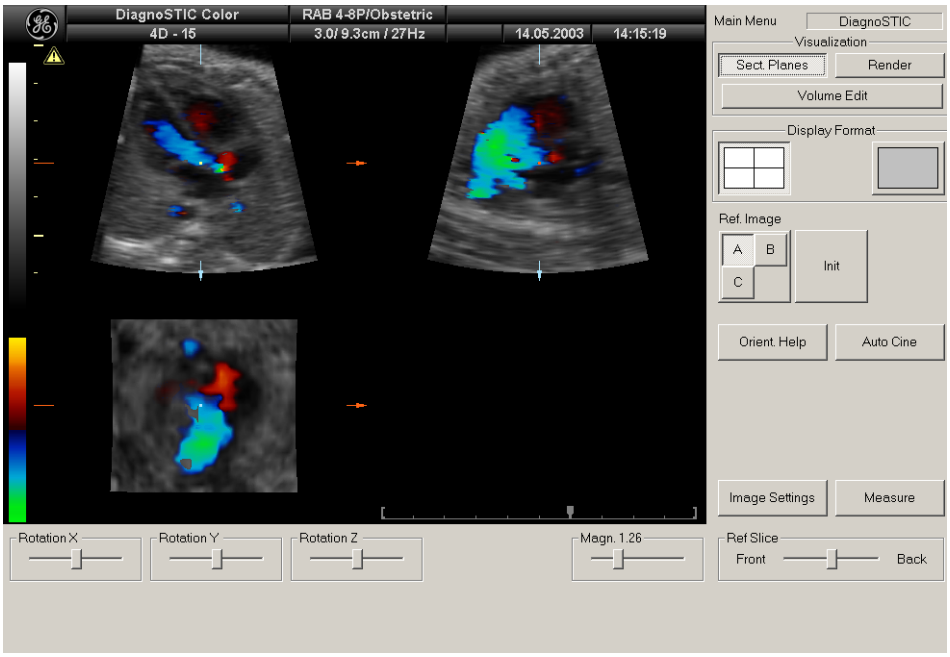
Now press the left mouse key, the yellow arrow disappears and the cursor looks like the double-pointed arrow on the left. By moving the mouse up and down while pressing the left mouse key the render plane can be rotated, i.e., change the angle of the green dotted line.

Press the right mouse key, the blue arrow disappears and the cursor looks like the double-pointed arrow on the left. By moving the mouse up and down while pressing the right mouse key, move the render plane, i.e., change the position of the green dotted line.

When entering “Image Settings” note that an additional button for “VCI” is visible. Press this button to change the image settings for the VCI image only, without changing the settings of the 2D image. Return to the “4D Volume Cine” menu again by pressing the “Main Menu” button.

## 20.4 STIC/STIC Color/STIC B-Flow

A “STIC Fetal Cardio” *4D Volume Cine* (Glossary) is created using the “STIC” feature of the Voluson® 730 Expert. Several heart beat cycles of one slow sweep are reconstructed to an animation of a single heart beat. For more information please review the Voluson® 730 Expert “Operation Manual.”




When opening such a *4D Volume Cine* (Glossary) with 4D View, choose between the “Sectional Planes” and the “Render” *visualization mode* (Section 6.2). In both modes it is possible to work with the volume and the *render box* (Section 7.2) as with any other static 3D volume.

Additionally, the “Split-Screen” display format can be chosen when in “Render” mode. Using this format, note that the reference image containing the render box is on the left side of the screen and the rendered image is on the right. In “Sectional Planes” mode, an “Orientation Help” can be displayed. Please review *“Display Format”* (Section 6.2) for more details.

If the STIC data sets were generated with a V730 Expert Diamond release, measurement is possible. This is indicated by a yellow triangle next to the ruler (see image above). The yellow triangle is always positioned next to the current reference image.

**ATTENTION:** The yellow triangle indicates that measurements taken from this data sets might not be suited for diagnostic purposes. Movement during acquisition can lead to measurement inaccuracies. Every measurement taken in a STIC data set has to be verified in a different acqusition mode (e.g. B-mode). For more details see the User Manual of the V730 Expert Diamond Release.

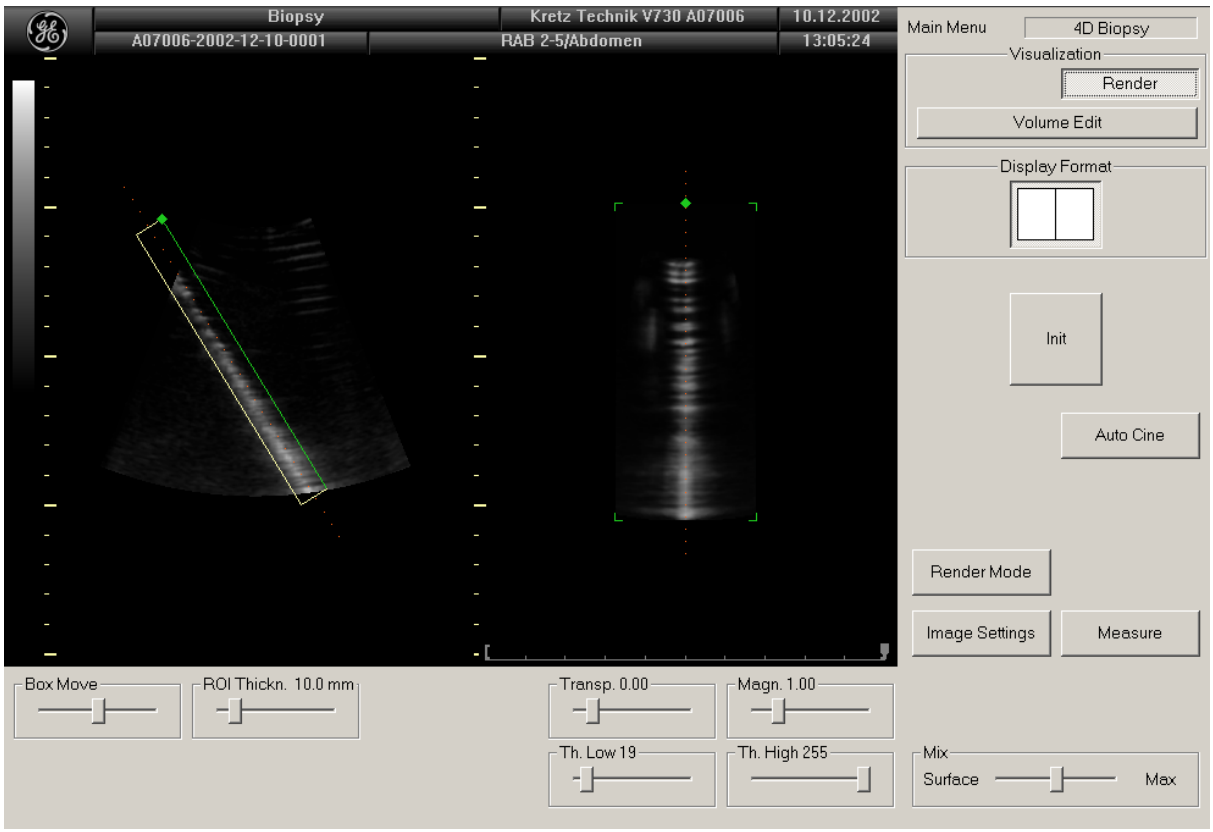
## 20.5 4D Biopsy

A “4D Biopsy” *4D Volume Cine* (Glossary) is created using the “4D Biopsy” feature of the Voluson® 730 Expert. This mode aids in observing and controling the movement of the needle during a biopsy. There are different “4D Biopsy” modes, depending on the selected transducer and biopsy guide, which are described below. For more information please review the Voluson® 730 Expert “Operation Manual.”

### 20.5.1 General Biopsy

With most transducers (Small Parts, Abdomen, Vaginal) there is a choice “Guided” and “Free-hand Biopsy,” depending on whether biopsy guides are used or not. In “Guided” biopsy (using a biopsy guide), the path of the needle is displayed as a red dotted line. The render box is positioned with the needle as its center at the beginning. When using the “Freehand” setting (no biopsy guide), the render box can be positioned.

#### Guided Biopsy

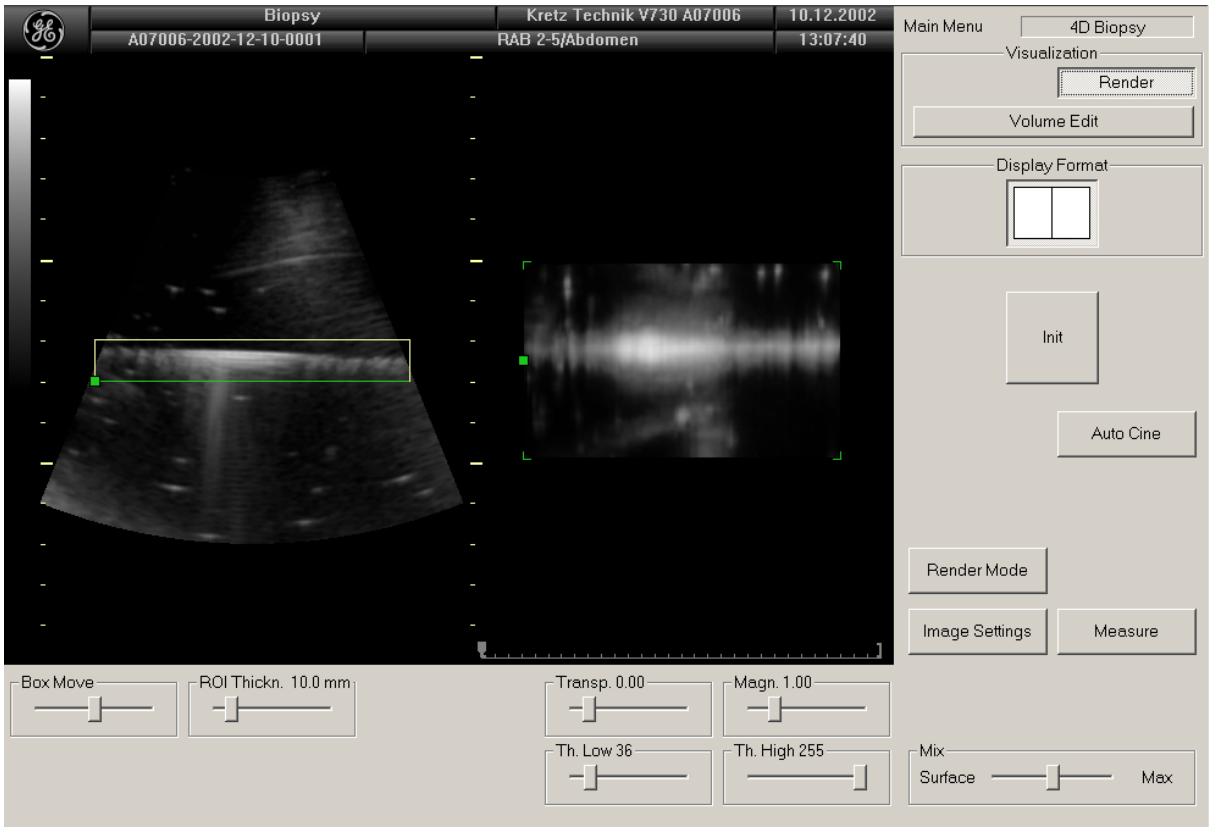


When opening a "4D Biopsy" *4D Volume Cine* (Glossary) captured in "Guided" mode with 4D View, the *visualization mode* (Section 6.2) is set to "Render." It is not possible to select a different mode.

Only the "Split-Screen" display format is available. In "Split-Screen" mode the normal A plane is on the left and on the right is the rendered view. Please review *"Display Format"* (Section 6.2) for more details.

Use the "ROI Thickness" slider to change the thickness of the render box used for generating the pseudo-2D image plane. Use the "Box Move" slider to move the render box.

### Freehand Biopsy



When opening a “4D Biopsy” *4D Volume Cine* (Glossary) acquired in “Freehand” mode with 4D View the *visualization mode* (Section 6.2) is set to “Render.” It is not possible to select a different mode.

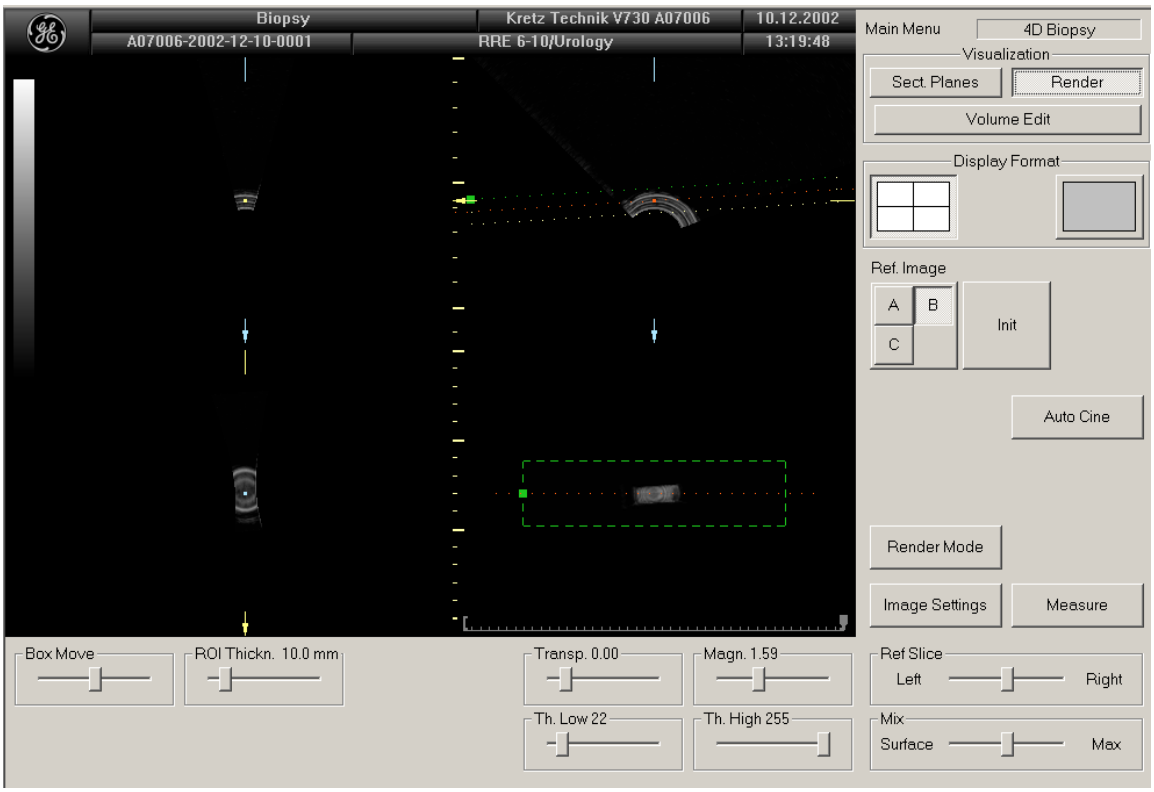
Only the “Split-Screen” display format is available. In “Split-Screen” mode the normal A plane is on the left and on the right is the rendered view. Please review *“Display Format”* (Section 6.2) for more details.

Use the “ROI Thickness” slider to change the thickness of the render box used for generating the pseudo-2D image plane. Use the “Box Move” slider to move the render box. There is no mouse functionality in “4D Biopsy” mode, i.e.. it is not possible to 0move or change the render box using the mouse.

### 20.5.2 Biopsy - Rectal

There are slightly different versions of the "4D Biopsy" mode when using a rectal transducer, which are "Rectal," "Grid" and "Perineal." These modes correspond to different methods of guiding the needle. All three modes display the path of the needle as a red dotted line and allows movement and modification of the render box.

#### Rectal

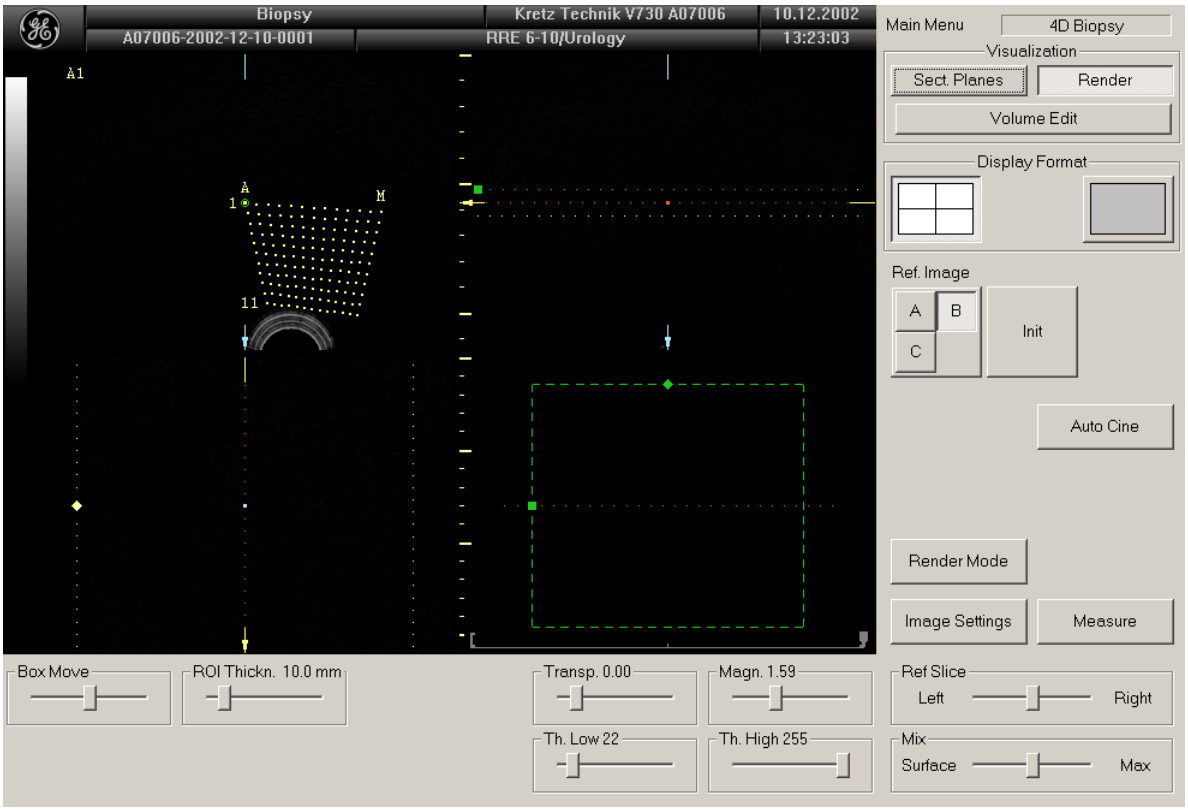



When opening a "4D Biopsy" *4D Volume Cine* (Glossary) captured in "Rectal" mode with 4D View the *visualization mode* (Section 6.2) can be selected as either "Sectional Planes" or "Render."

Choose between the "Quad-Screen" and the "Full-Screen" display format. In "Quad-Screen" mode note A and B planes, showing the needle, and C plane. The render box is positioned in the B plane and the rendered image is also displayed. In "Full-Screen" mode, only the rendered image is seen. Please review *"Display Format"* (Section 6.2) for more details.

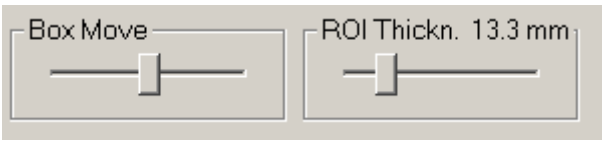
Use the “ROI Thickness” slider to change the thickness of the render box used for generating the pseudo-2D image plane. Use the “Box Move” slider to move the render box. There is no mouse functionality in “4D Biopsy” mode, i.e., it is not possible to move or change the render box using the mouse.

### Grid



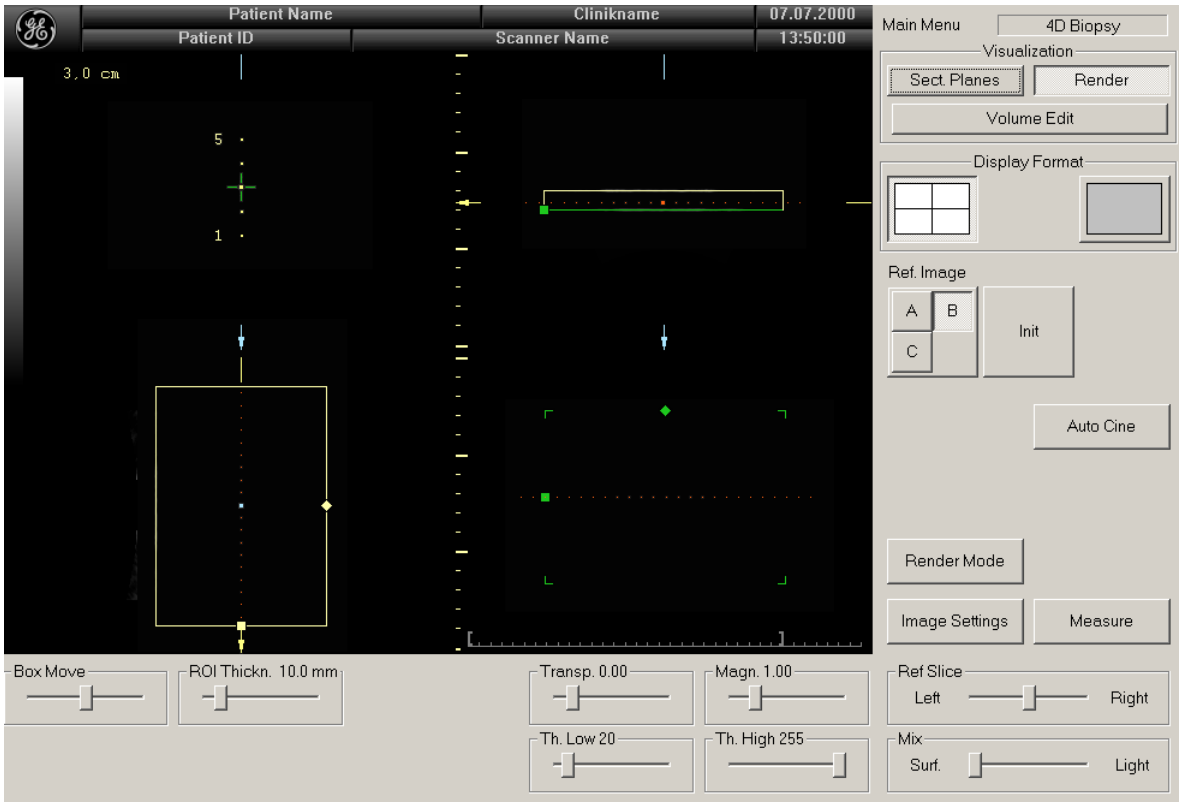

When opening a “4D Biopsy” *4D Volume Cine* (Glossary) acquired in “Grid” mode with 4D View, the *visualization mode* (Section 6.2) can be chosen to be either “Sectional Planes” or “Render.”

Choose between the “Quad-Screen” and the “Full-Screen” display format. In “Quad-Screen” mode note the A plane, showing the grid, B plane, showing the needle, and C plane. The render box is positioned in the B plane and the rendered image is also displayed. In “Full-Screen” mode, only the rendered image is seen. Please review *“Display Format”* (Section 6.2) for more details.



Use the “ROI Thickness” slider to change the thickness of the render box used for generating the pseudo-2D image plane. use the “Box Move” slider to move the render box. There is no mouse functionality in “4D Biopsy” mode, i.e., it is not possible to move or change the render box using the mouse.

### Perineal




When opening a “4D Biopsy” *4D Volume Cine* (Glossary) aquired in “Perineal” mode with 4D View, the *visualization mode* (Section 6.2) can be selected as either “Sectional Planes” or “Render.”

Choose between the “Quad-Screen” and the “Full-Screen” display format. In “Quad-Screen” mode note the A plane, showing the centimeter scale, B plane, showing the needle, and C plane. The render box is positioned in the B plane and the rendered image is also displayed. In “Full-Screen” mode, only the rendered image is seen. Please review *“Display Format”* (Section 6.2) for more details.

Use the “ROI Thickness” slider to change the thickness of the render box used for generating the pseudo-2D image plane. Use the “Box Move” slider to move the render box. There is no mouse functionality in “4D Biopsy” mode, i.e., it is not possible to move or change the render box using the mouse.

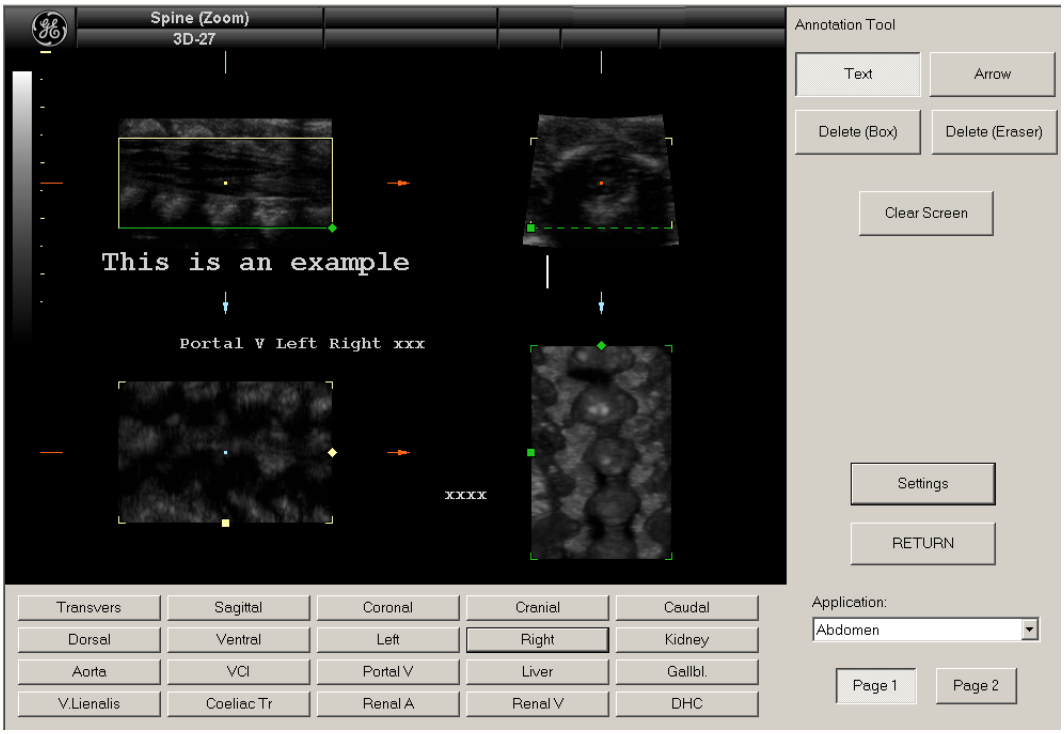
# Chapter 21

# Annotation

Switch to “Annotation” menu by pressing this toolbar button or by going to *“Edit”* (Section 5.2)-“Annotation”.

Delete all annotations at once by pressing this toolbar button or by going to *“Edit”* (Section 5.2)-“Clear Screen”.

## 21.1 Text Annotation



Use this functionality to place text on the ultrasound image. Activate “Text” mode by pressing the “Text” button in the “Annotation” menu.

Place the text cursor by moving the mouse cursor to the desired location and clicking with the left-mouse key. The blinking text cursor appears. Simply enter the text using the keyboard. The typed text appears immediately. The typed text can be deleted using BACKSPACE as long as the cursor is not positioned elsewhere by clicking at a different location. Open the *“Settings”* (Section 21.5) menu for changing font, font color, font size and brightness. Press “Return” to leave the “Annotation” menu again. Press “Clear Screen” to delete all annotations (text and arrows).

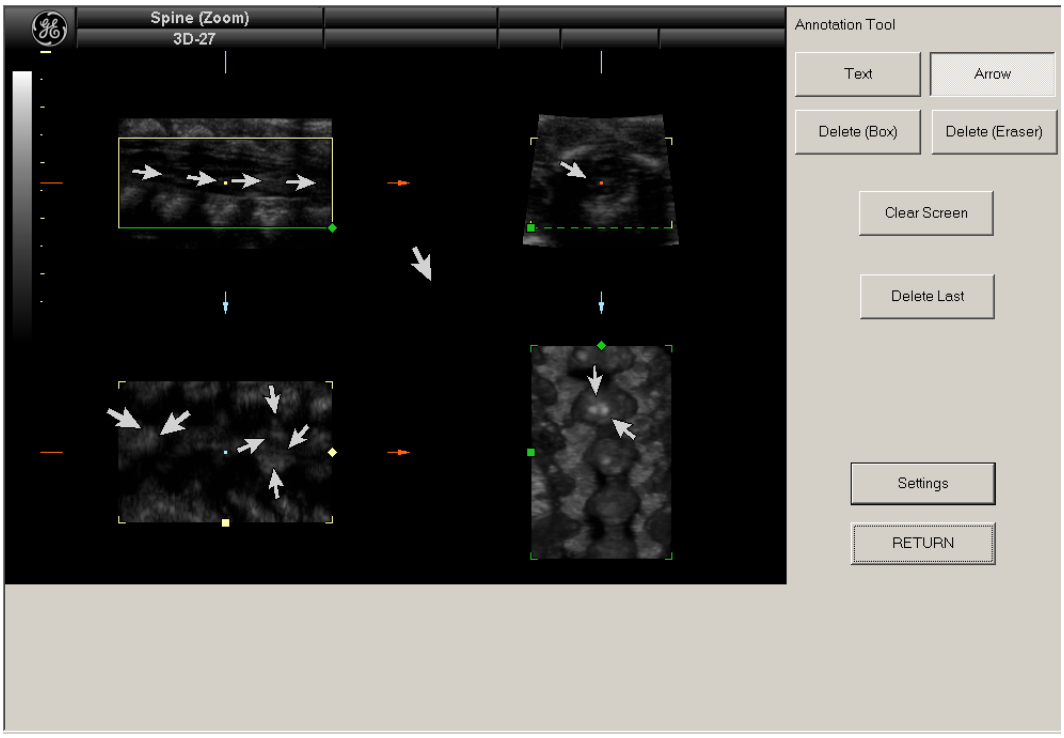
### 21.1.1 Text Presets

The “Text Preset” buttons are only available if the text cursor is positioned on the ultrasound image by moving the mouse cursor to the desired location and clicking with the left-mouse key. The blinking text cursor appears.

Choose an application using the drop-down menu, and switch between the two pages using the “Page1’ and “Page2” buttons. Then simply press the text preset button showing the desired word and the word is inserted at the current cursor position. A space is automatically inserted after the word. It is possible to mix text presets with manually typed text as long as the cursor is not positioned elsewhere by clicking at a different location. Text presets can be deleted letter by letter using the BACKSPACE key.

There are ten applications with two pages each. Each page contains up to twenty presets. The presets can be adjusted by opening the *“Settings”* (Section 21.5) menu, pressing *“Text Presets”* (Section 21.5.1) and entering the desired word into the according field.

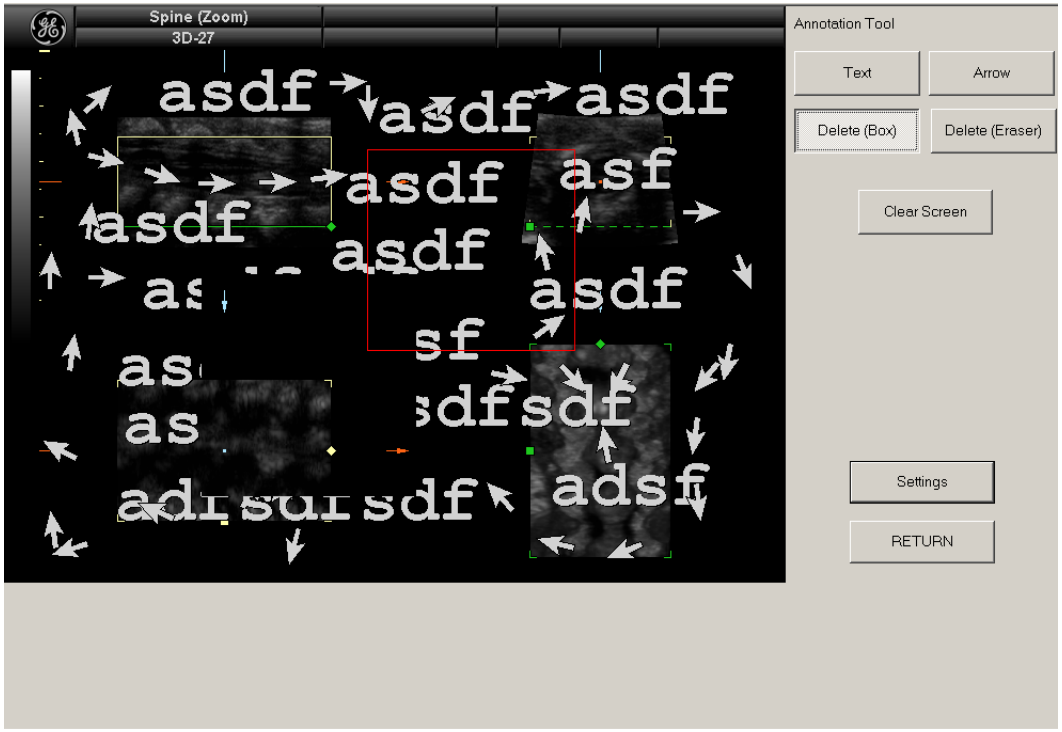
## 21.2 Arrows




Use this functionality to place arrows on the ultrasound image in order to point out different structures. Activate “Arrow” mode by pressing the “Arrow” button in the “Annotation” menu.

Move the mouse over the ultrasound image. The direction of the arrow follows the movement of the mouse. Place the arrow by clicking the left mouse key. Use the “Delete Last” key to delete the last arrow placed on the screen. This way it is possible to delete up to twenty arrows. Open the *“Settings”* (Section 21.5) menu for changing arrow size and brightness. Press “Return” to leave the “Annotation” menu again. Press “Clear Screen” to delete all annotations (text and arrows).

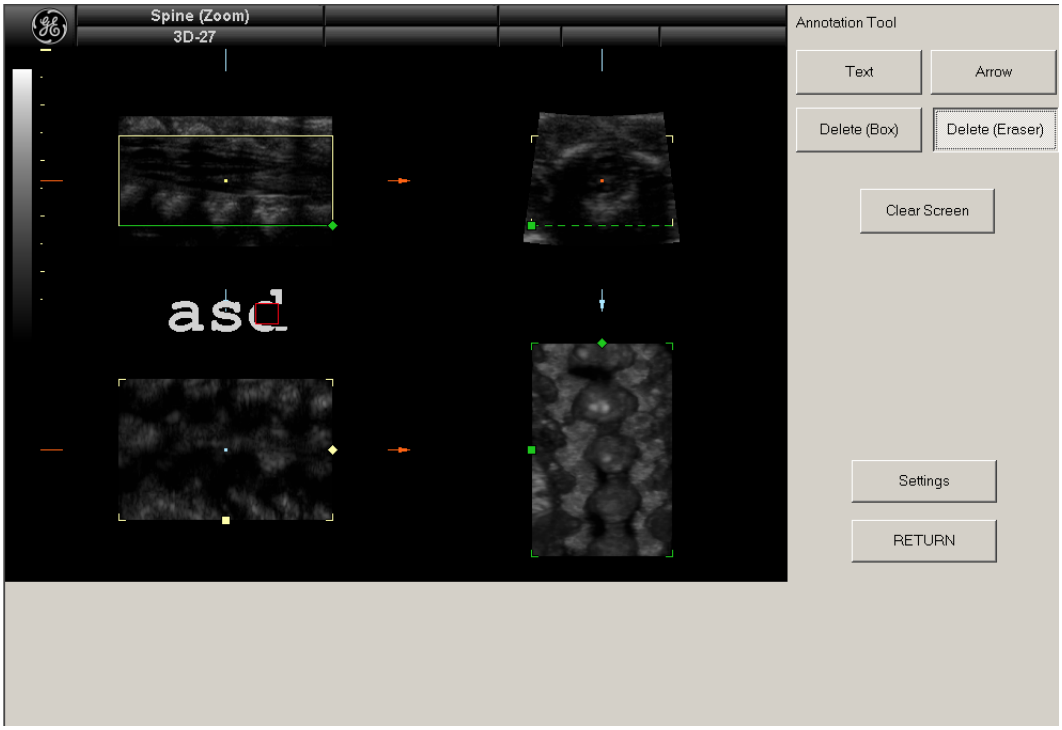
## 21.3 Delete (Box)




Use this functionality to delete annotations. Activate “Delete (Box)” mode by pressing the “Delete (Box)” button in the “Annotation” menu.

Move the mouse over the annotation which should be deleted. Press the left mouse key, hold it down and move the mouse. A rectangle appears. When releasing the mouse key all annotations that are inside the red rectangle are deleted.

## 21.4 Delete (Eraser)

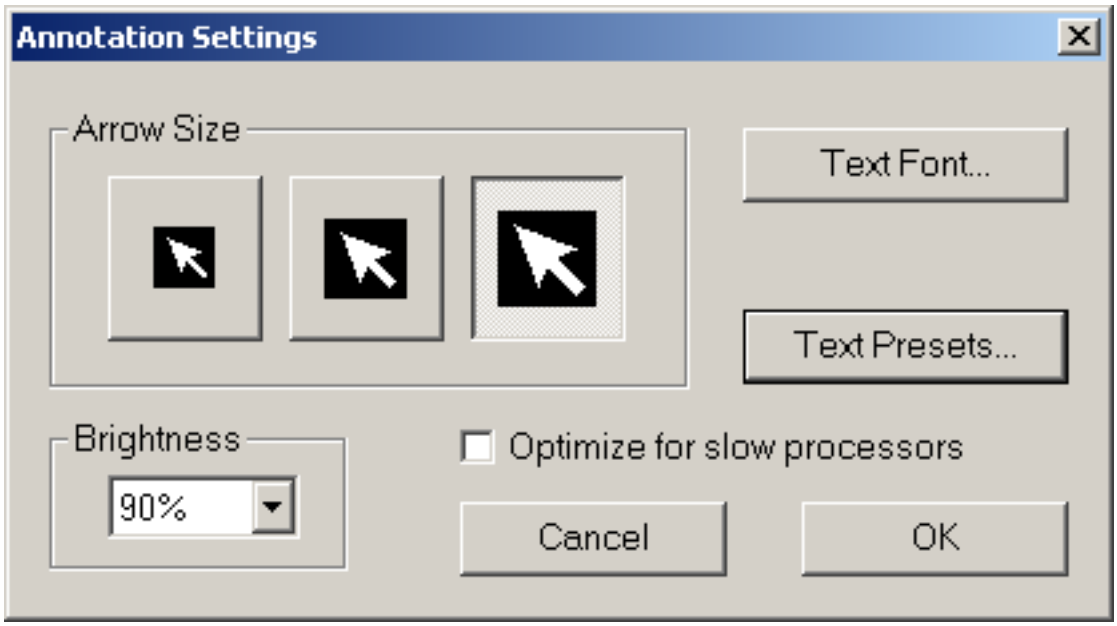



Use this functionality to delete annotations. Activate “Delete (Eraser)” mode by pressing the “Delete (Eraser)” button in the “Annotation” menu.

Move the mouse over the annotation which should be deleted. Press the left mouse key, hold it down and move the mouse. All annotations right beneath the red square are deleted. Press “Return” to leave the “Annotation” menu again. Press “Clear Screen” to delete all annotations (text and arrows).

## 21.5 Annotation Settings

Go to *"Settings"* (Section 5.4)-"Annotation Settings" to change the annotation settings. The "Annotation Settings" dialog appears.




**Arrow Size:** Select one of the three sizes by pressing the appropriate button.

**Brightness:** Select between "100%", "90%" and 80%". Setting applies to text as well as arrows.

**Optimize for slow processors:** Check this box, if annotations slow down the system. This reduces quality of the annotations, but increases performance.

**Text Font:** This button opens the "Font" dialog where font, font size and font style can be selected.

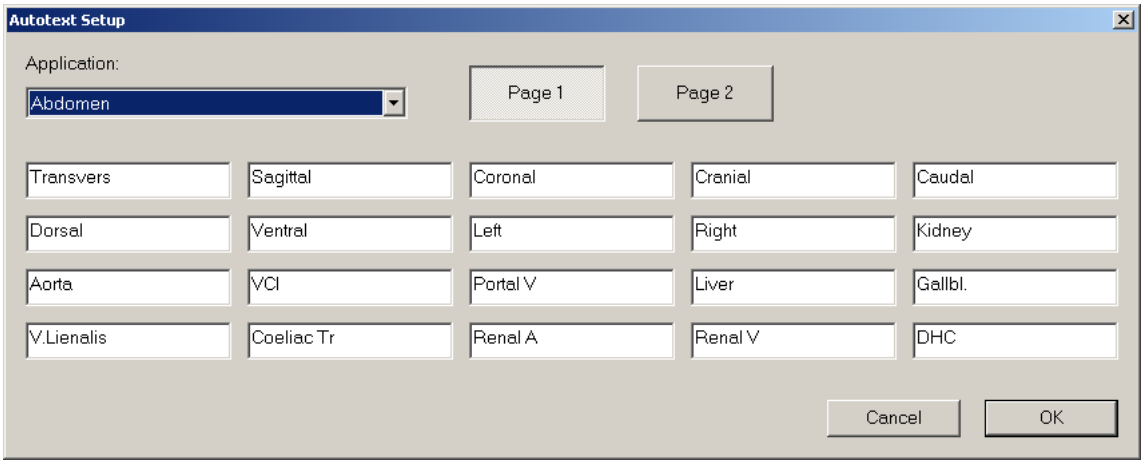
**Text Presets:** Opens the *"Text Preset Settings"* (Section 21.5.1) dialog.

**Cancel:** Close dialog without saving changes.

**OK:** Close dialog and save changes.

### 21.5.1 Text Preset Settings

This dialog is opened from the *"Annotation Settings"* (Section 21.5) dialog by pressing the "Text Presets" button.




Choose an "Application" and select one of the two available pages by pressing the "Page 1" or "Page 2" button. Afterwards simply enter the new preset in one of the empty fields below or edit an existing preset by editing the according text field.

# Chapter 22

# SonoView

## 22.1 SonoView and 4D View

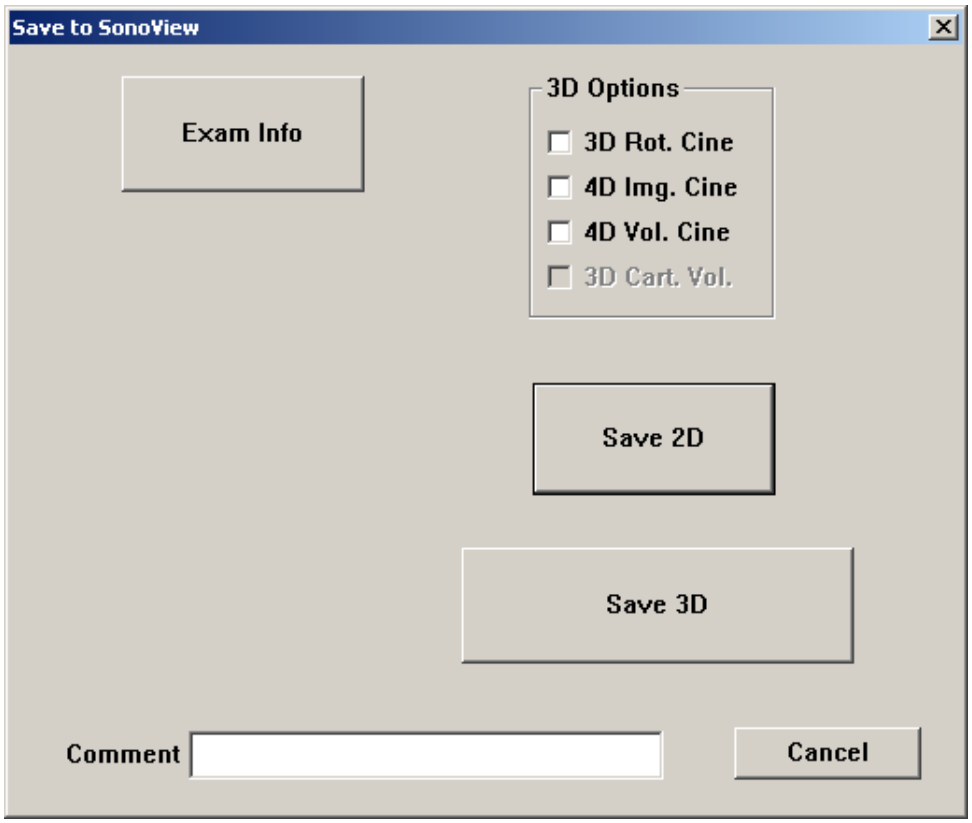
### 22.1.1 Save to SonoView

Use this button to save volumes, images and Cine sequences into the *SonoView™* (Section 22.2.1) database system.

When storing data into SonoView™ certain information is needed for the database entry. If this information is missing, the dialog box asking for *"Patient ID and Exam Info"* (Section 22.1.3) is automatically opened.

Otherwise the dialog box *"Save to SonoView™"* (Section 22.1.2) appears.

### 22.1.2 2D, 3D and Volume Options




In this dialog area select options for saving data into *SonoView*$^{TM}$ (Section 22.1.1).

Choose whether to save a single image with "Save 2D," or an additional GEMS Kretztechnik volume file with "Save 3D." 2D images will be *JPEG* (Glossary)compressed if this is configured in the *"SonoView Configuration" dialog* (Section 23.1).

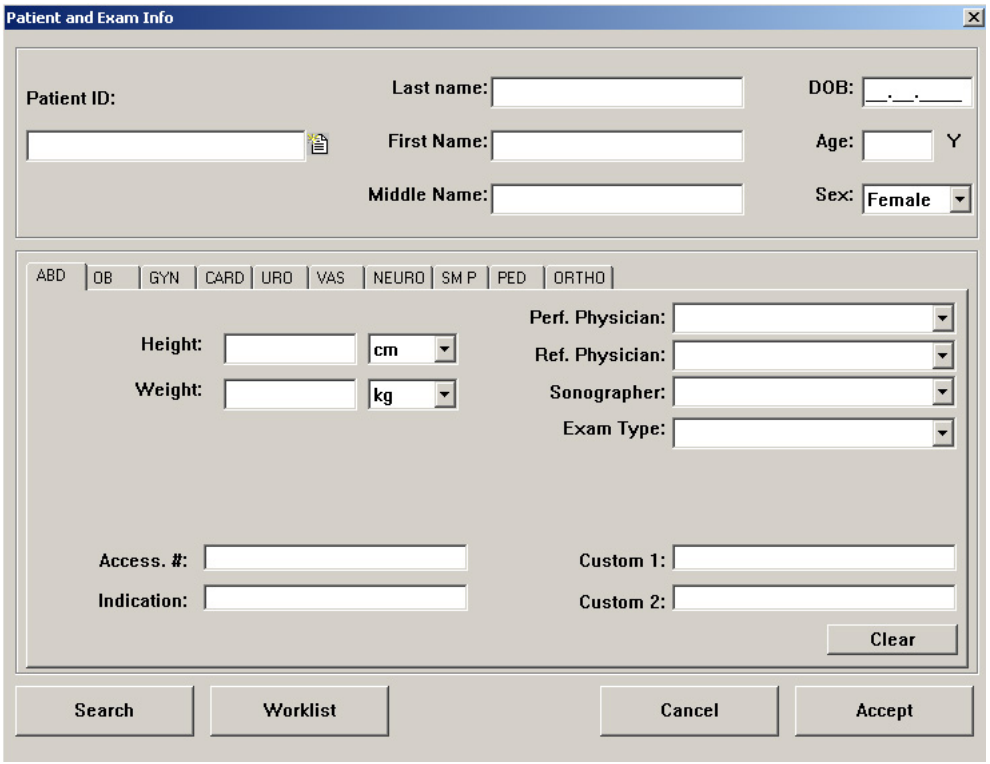
**Save Options:**

In the volume file a *3D Rotation Cine* (Glossary), *4D Image Cine* (Glossary) or *4D Volume Cine* (Glossary) sequence can be included, if these are available. They will be saved in the format, configured in the *"SonoView Configuration" dialog* (Section 23.1). Save a "3D Cartesian Volume" by simply selecting the option "3D Cart. Vol.".

**Note:** How many files are generated depends on the *"SonoView Configuration"* (Section 23.2). If "V730" format is used, *"3D Rotation Cine,"* (Glossary) *"4D Image Cine"* (Glossary) and *"4D Volume Cine"* (Glossary) will be included in one file. However, if "Multiframe" is used, a seperate file has to be generated for each Multiframe object. So if for example, *"3D Rotation Cine,"* (Glossary) and *"4D Image Cine"* (Glossary) are stored as multiframe together with a *"4D Volume Cine"* (Glossary). Three files are generated, one for each of the two multiframe objects and one for the *"4D Volume Cine"* (Glossary).

Click on the "Exam Info" button and a new dialog box appears to edit *patient and exam data* (Section 22.1.3).

### 22.1.3 Patient and Exam Info




Enter this dialog box from the *SonoView™ "Image Save"* (Section 22.1.2) dialog box by clicking the button "Exam Info," or from the *"Edit" Menu* (Section 5.2) by selecting "Patient ID."

There is also a toolbar button for this.

In this dialog area enter data for SonoView™ patient and exam options.

In the upper third of this dialog enter patient data:

The "Patient ID" uniquely characterizes a patient in the SonoView™ database on a PC or on the V730 series ultrasound scanner.

When a "Patient ID" is entered that is already registered in the database a green checkmark appears beside this entry field.
When a "Patient ID" is entered that is new to the database, a symbol appears indicating a new patient.

In the "Patient ID" entry field open a *"Patient Search"* (Section 22.1.4) by pressing the "Search" button.

Click the "Worklist" button to invoke the *"DICOM Worklist"* (Section 23.6) function. (This button is only activated if no patient ID was fixed for the current exam and a DICOM worklist server was entered in the *DICOM configuration dialog* (Section 23.1).)

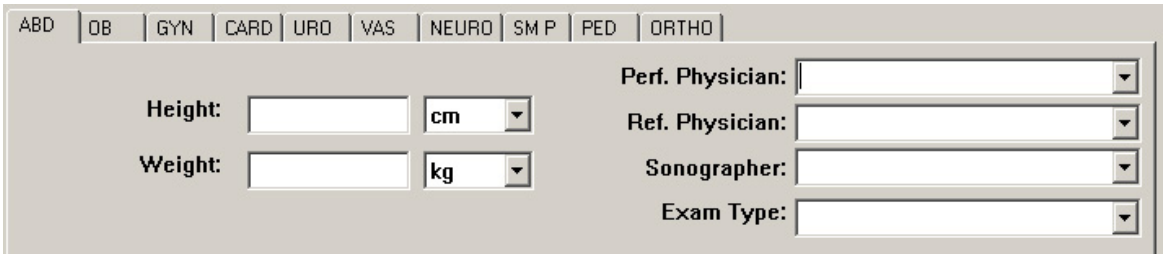
In the "Name" fields, the name of the patient can be entered (Last Name, First Name, Middle Name). If "Capitalize Letter in Patient Names" is activated in the *"Patient Dialog settings" menu* (Section 5.4.5), the first letter, the first letter after a space and the first letter after a dash are capitalized automatically.

When entering a "DOB" (date of birth) for the patient in the date format selected from the menu bar in "Settings" - *"Date Format"* (Section 5.4.4), the "Age" of the patient, at the time the ultrasound image was captured (the volume file was saved), is calculated automatically. Also select the "Sex" of the patient from the drop-down list.

In the lower part of this dialog box there is a space for different data entries, which can be adapted by selecting different applications. Choose between the following applications by clicking on the according tab: "Abd"(omen), "OB"(stetrics), "Gyn"(ecology), "Cardio"(logy), "Uro"(logy), "Vas"(cular), "Neuro"logy, "SM"(all)"P"(arts), "Ped"(iatrics) and "Ortho"(pedics) by clicking on the appropriate button.

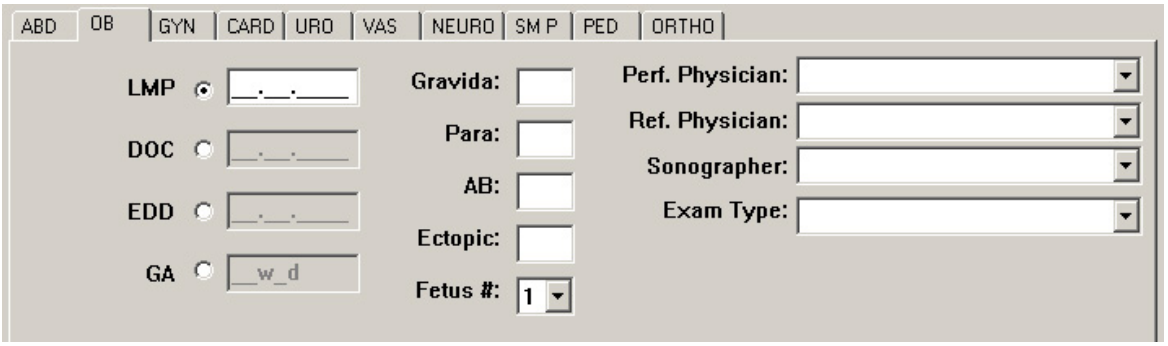
Depending on the application chosen, different data entry fields appear in this part of the dialog box.

### Abdomen




Different units of measurement for the patient's "Height" and "Weight" can be selected. The conversion is adapted automatically.

### Obstetrics




**LMP** means "Last Menstrual Period."

**Note:** The first day of the last period must be entered.
GA and EDD are calculated automatically after entering the LMP date. The labels next to those fields read "GA(LMP)" and "EDD(LMP)" afterwards.

**DOC** means "Date of Conception".

GA and EDD are calculated automatically after entering the DOC. The labels next to those fields read "GA(DOC)" and "EDD(DOC)" afterwards.

**EDD** means "Estimated Date of Delivery."

If EDD is entered GA is calculated automatically. The label next to this field reads "GA(EDD)" afterwards.

**GA** means "Gestational Age" in weeks and days.

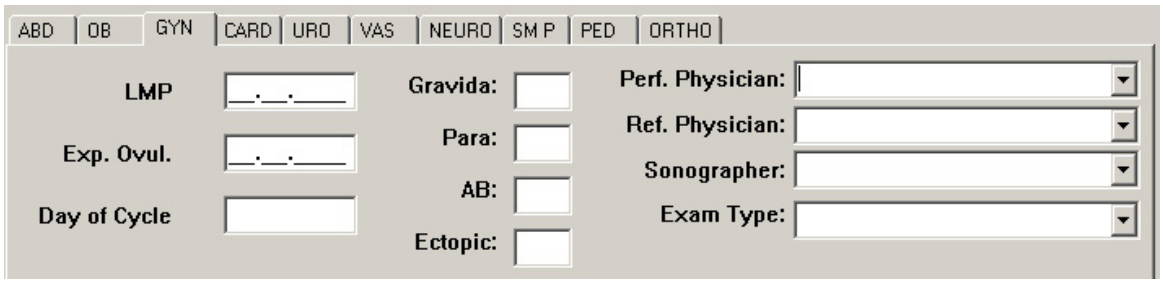
If GA is entered EDD is calculated automatically. DOC is calculated automatically if "Calculate DOC by GA" is activated in the *"Patient Dialog Settings"* (Section 5.4.5). The label next to these fields reads "EDD(GA)" and "DOC(GA)". The label next to the GA field reads "GA(Clin)" to indicate that the GA was entered manually.

**Gravida, Para, Aborta, Ectopic:** Enter the patient's history of pregnancies.

**Gestations:** Select the number of gestations (e.g., for twins, "2").

**Note:** The date format for entering the dates can be changed from the menu bar in "Settings" - *"Date Format"* (Section 5.4.4).

### Gynecology



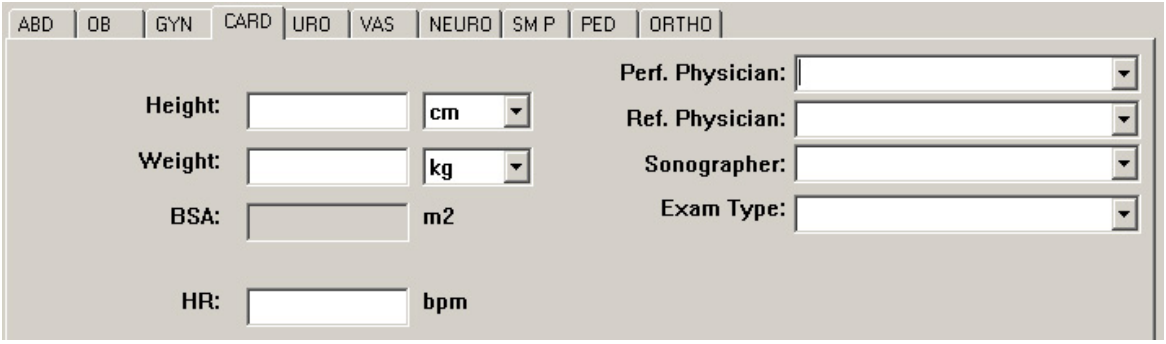

**LMP** Enter the first day of the last menstrual period using the date format selected from the menu bar in "Settings" - *"Date Format"* (Section 5.4.4).
**Note:** The first day of the last period must be entered.

**Exp. Ovul.:** Date of expected ovulation using the date format selected from the menu bar in "Settings" - *"Date Format"* (Section 5.4.4).

**Day of Cycles:** Enter the the current day of the patient's cycle.

**Gravida, Para, Aborta, Ectopic:** Enter the patient's history of pregnancies.

### Cardiology




**Height** Enter the patient's height in one of the specified units (cm, ft, inch).

**Weight** Enter the patient's weight in one of the specified units (kg, lb, oz).

**BSA** Body surface area (calculation value, no input).

**HR** Heart rate.

Select different units of measurement for the patient's "Height" and "Weight." The conversion is adapted automatically.

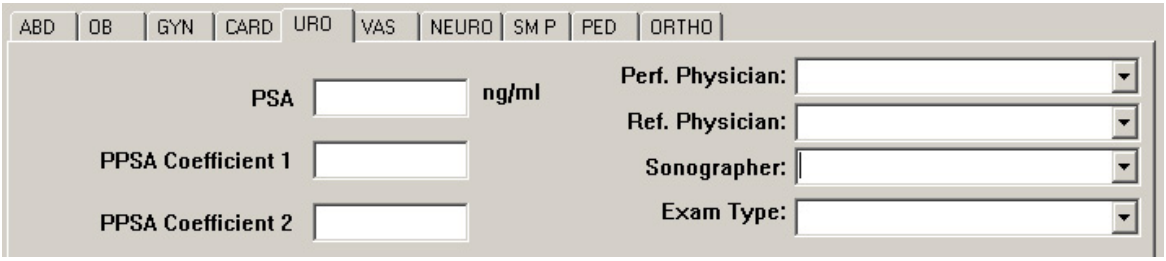
**Note:** The BSA value is calculated automatically, after entering "Height" and "Weight."

### Calculation formula for BSA:

$BSA = H^{0.725} \times W^{0.425} \times 0.007184$

WT[kg]
HT[cm]
BSA[$m^2$]

### Urology

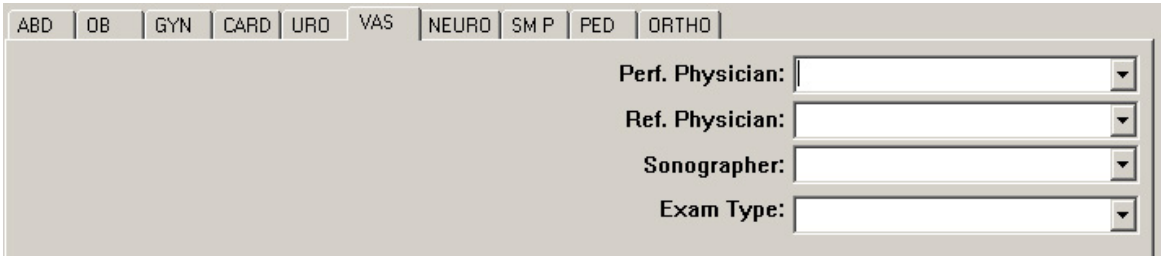



**PSA** Enter the PSA value.

**PPSA Coefficient 1** Enter the first PPSA coefficient.

**PPSA Coefficient 1** Enter the second PPSA coefficient.

### Vascular, Neurology, Small Parts, Pediatrics, Orthopedics



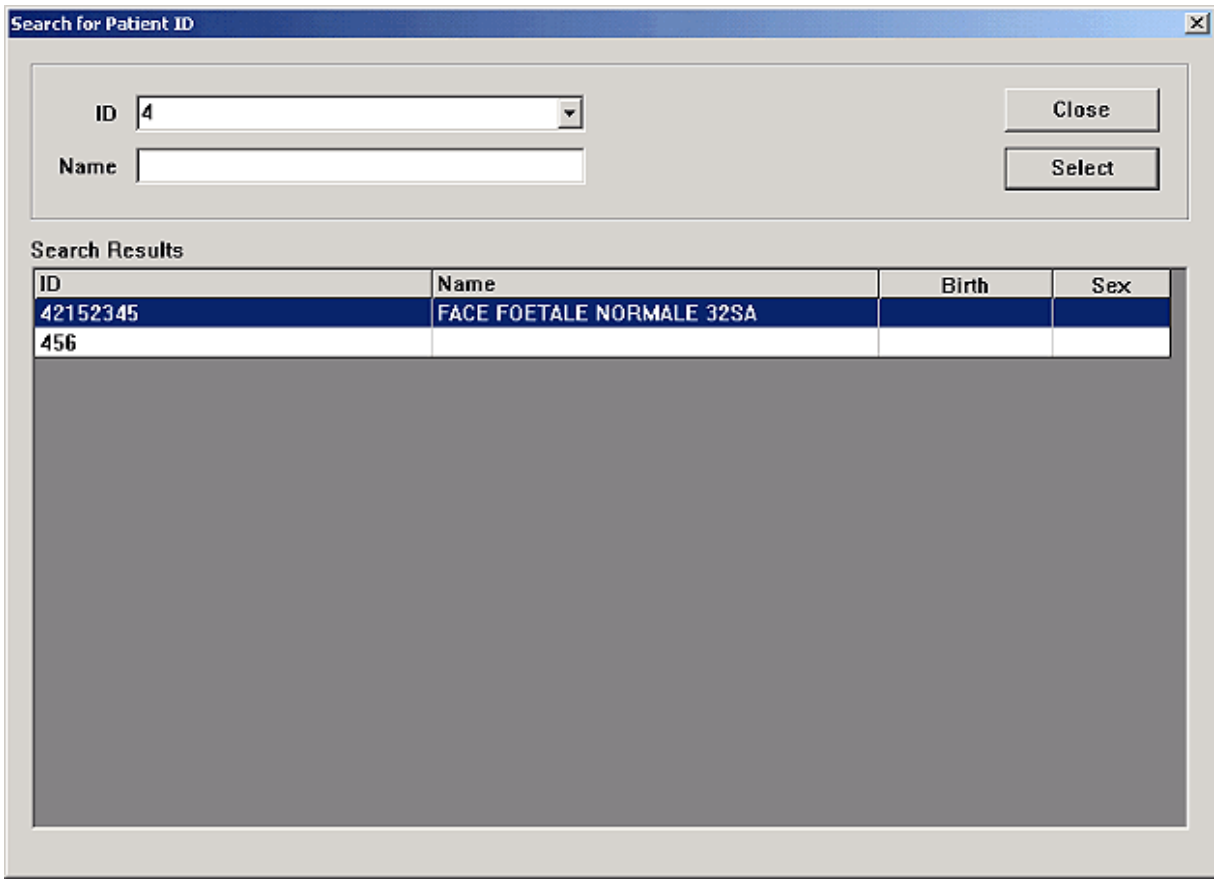

### Additional Exam Data

In the remaining fields of this dialog box enter additional exam data. It is especially useful to characterize an exam in the field "Exam Type" because the "Exam Type" can be seen in the *"Exams List"* (Section 22.3.2) of SonoView™.

Enter the optional "Accession Number" to additionally characterize an exam.

When entries are made in the fields “Diagnostic Physician,” “Referring Physician,” “Performing Physician,” “Sonographer” and “Exam Type,” they are stored in the memory and on hard disk. By selecting the pull-down menu to the right of the entry field, these entries can be seen in new or existing patient files.

### 22.1.4 Patient Search Dialog




The “Patient Search” dialog box allows access to the “Patient” table of the SonoView™ database.

Enter this dialog from the SonoView *“Patient and Exam Info”* (Section 22.1.3) dialog box. Click on the “Search” button.

Once letters and numbers are typed in the “Patient ID” entry field, a selection of the “Patient IDs” in the database which begin with the typed letters and numbers appears.

Select a patient from the database either with the “Select” button or by double-clicking with the left mouse button on the appropriate line.

### 22.1.5 Start SonoView

Click on this button found in the side toolbar to enter *SonoView*$^{TM}$ (Section 22.2.1) and *work with SonoView*$^{TM}$ (Section 22.3.2) files or *retrieve data from SonoView*$^{TM}$. (Section 22.3.12)

## 22.2 Introduction to SonoView

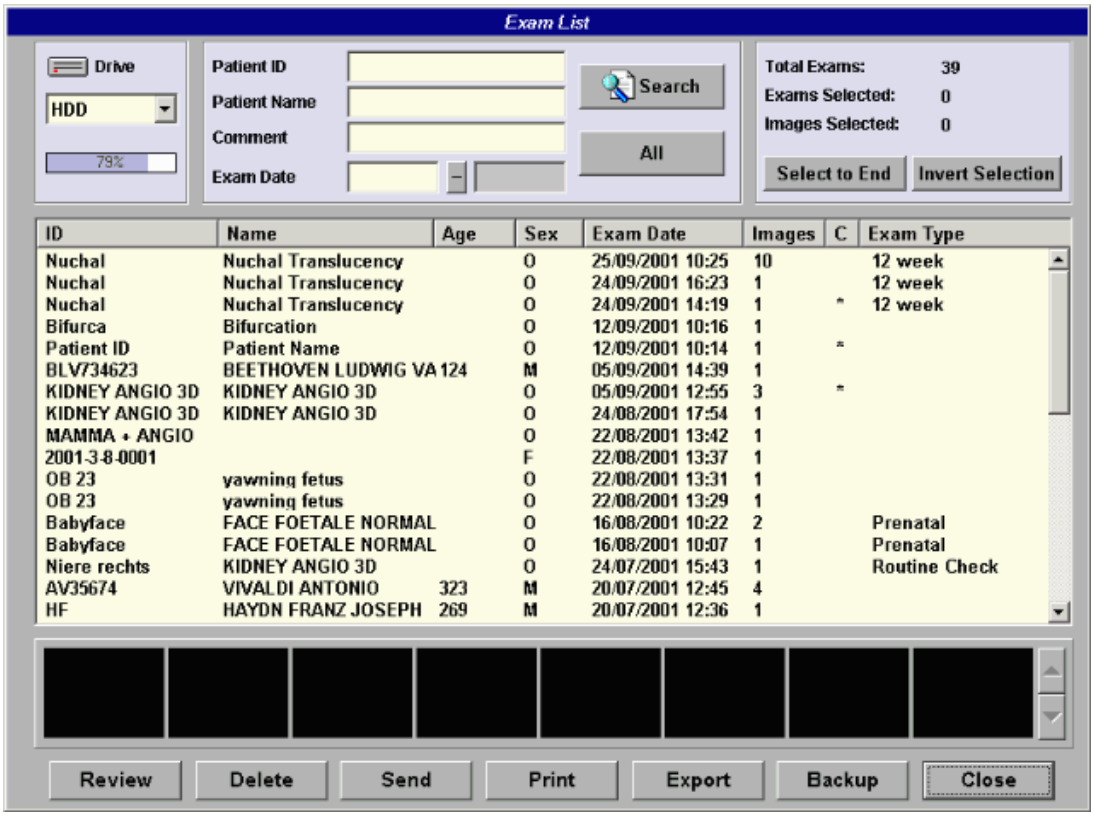
### 22.2.1 General Information About SonoView

SonoView$^{TM}$ is a data storage software for medical data that provides fast and easy management capabilities for images and GEMS Kretztechnik volume files. SonoView$^{TM}$ allows users to store, view, report, and transfer images, volumes and Cine sequences stored in the V730 series ultrasound scanner. In addition, SonoView$^{TM}$ also allows users to send and print images over a DICOM network.

All the data are organized in a database system in a way that they can be *displayed* (Section 22.3.2) and *retrieved* (Section 22.3.12) easily.

### 22.2.2 The Database of SonoView

SonoView$^{TM}$ organizes its data in a database. An overview of this database can be seen in the *"Exam List"* (Section 22.3.2) window. In order to access this database, select the "S" button on the side toolbar of 4D View. Then select "Open" in the side menu of SonoView$^{TM}$.




The most important entity in this database is the patient. A patient is uniquely characterized by his or her "Patient ID," not by his name. The "Patient ID" is shown in the leftmost column of the "Exam List."

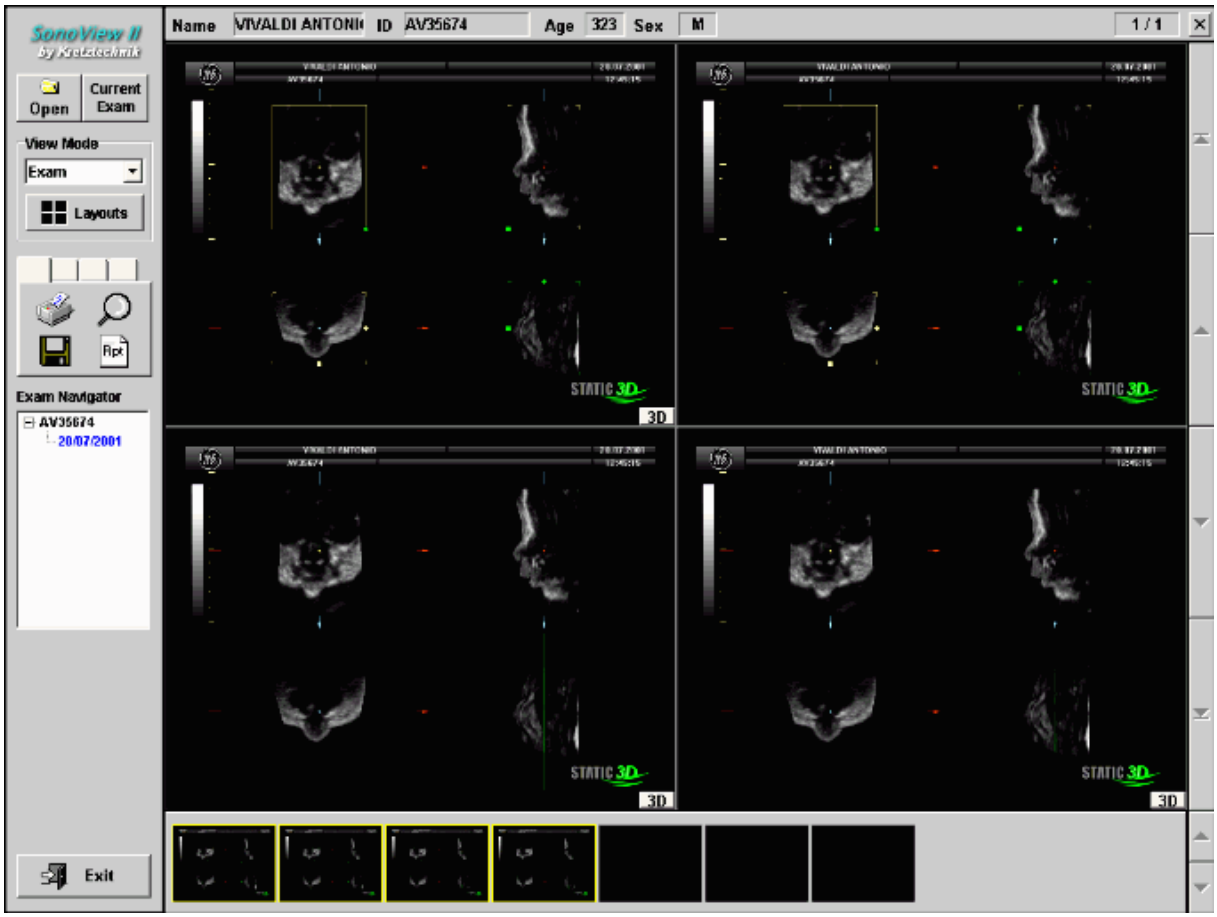
A number of exams can be associated with a patient. An exam is uniquely characterized by its date and time. Date and time of an exam are shown in the "Exam Date" column of the "Exam List."

A number of images can be associated with an exam. These images are displayed in the "Exam List." If a comment is associated with one image of an exam, an asterisk is displayed in the "C" column of the "Exam List."

In addition, comments of the following types of data can be associated with an image: "3D Rotation Cines," "4D Image Cines," "4D Volume Cine", "Voice Annotations" and "GEMS Kretztechnik volume files." For a description of how the presence of this data is indicated and how this data can be displayed or retrieved see: *"Retrieve Data from SonoView$^{TM}$* (Section 22.3.12).

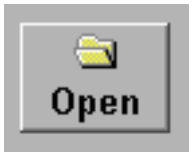
## 22.3 Work with SonoView

### 22.3.1 The Start Screen of SonoView




In the start window of SonoView$^{TM}$ will be a "Display Area," which occupies the largest part of the screen. At the left border of the screen there is a "Menu Area" with some control elements. At the top of the screen is a line containing "Basic Patient Data." At the bottom is a row of thumbnail images used for getting an overview of an exam and for selecting images. At the right border of the screen there are arrows which can be used to select images for display in the "Display Area" and in the "Thumbnail Area."

Click the "Current Exam" button to display the latest images, which have been saved to SonoView$^{TM}$.



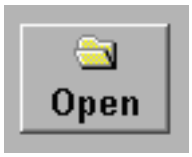

Click the "Open" button to enter the *"Exam List"* (Section 22.3.2) window.

In the *"View Mode"* (Section 22.3.4) dialog choose to view images from one "Exam" or to "Compare" images from different exams. Different *layouts* (Section 22.3.4) can be selected for the display area in the side menu.

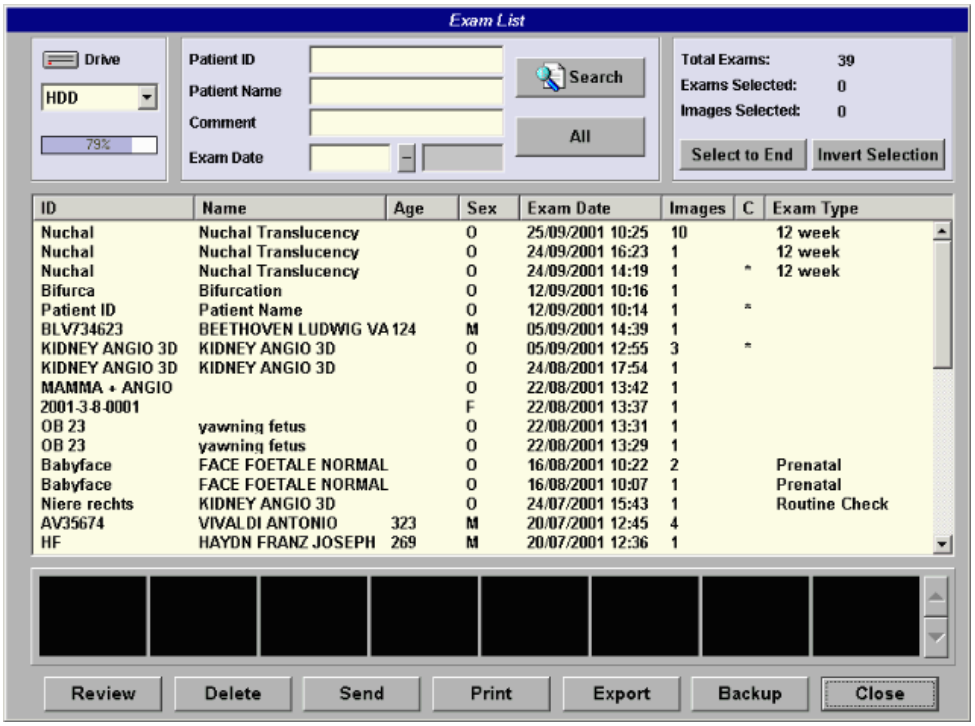
In the *"Tools" menu* (Section 22.4.1) (Tab Menu) of the start screen select among different possibilities of working with data, in addition to displaying and viewing them.

In the *"Exam Navigator"* (Section 22.3.3) window switch between all exams loaded into the memory.

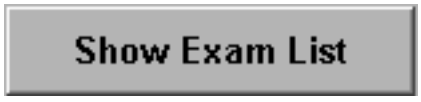
### 22.3.2 Exam List




Click the "Open" button and a list of all exams in the *database* (Section 22.2.2) is displayed.




If in the *"General Settings"* (Section 22.5.1) tab of the "Settings" menu, it is preselected to hide exams on opening the exam list window, the list of exams is not displayed until the "Show Exam List" button is pressed.



### Selecting a Drive

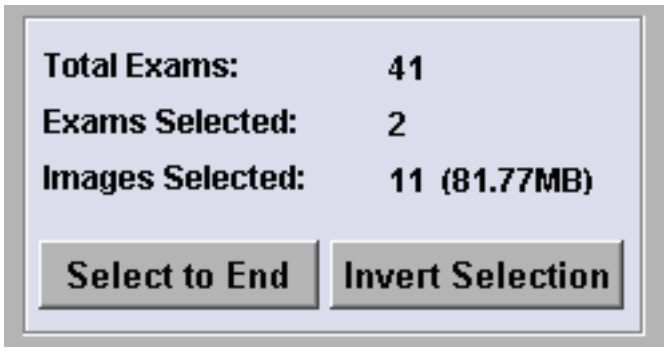
In the upper left corner of the "Exam List" select from which drive (hard disk, MO-drive, CD/DVD-ROM, Network) to read and view the data from a dropdown list. Regarding the network drive please review Section *"Network Drive."* (Section 22.3.11)

When a drive is selected (i.e., the list is closed) the amount of space used from this storage medium is displayed.

### Selecting Exams

Select a single exam with a click of the left mouse button.

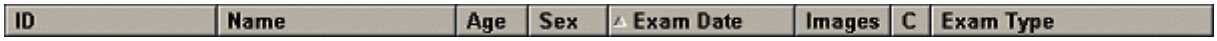
The number of all exams in the "Exam List," the number of currently selected exams, and the number of images that are included in the selected exams are displayed in the upper right corner of the "Exams List:"




With the two buttons "Select to End" and "Invert Selection," groups of exams can be selected.

### Sorting Exams

Click on one of the headers in the "Exam List," the exams are sorted according to the data fields belonging to the selected header. For example, click "ID," the "Exams List" arranges itself in the order of the "Patient IDs" given. Numbers register before letters and capital letters register before lower case letters. A little arrow in the header indicates if the sort order is ascending or descending. Click on the header to switch from ascending to descending order and vice versa.




The default sort order is by "Exam Date and Time" descending, so as to make the newest exams appear on the top of the list.

### Searching for Exams

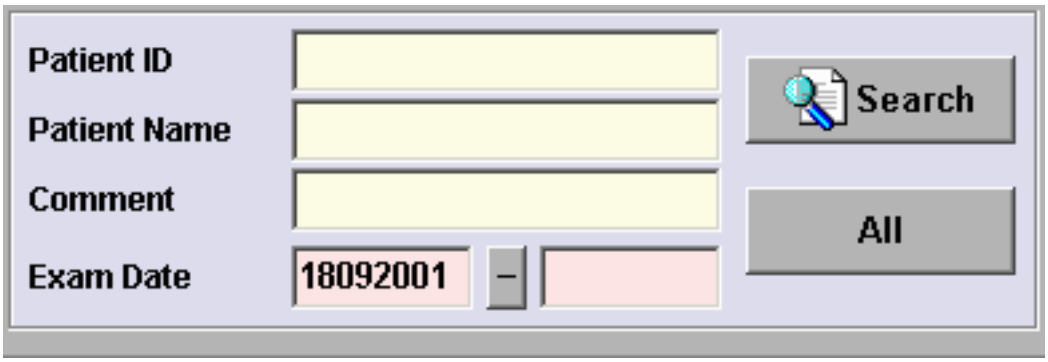
Entry fields for letters and numbers (Patient ID, Patient Name, Comment):
The selection will contain the members of the "Exam List" which contain data fields beginning with the letters entered.

The "Exam Date" fields:
Dates are entered as eight digits without delimiters in the format DDMMYYYY. When searching for an exact date enter it in the "Exam Date" field.

When searching for a range of dates, click the button in the middle between the two date fields.

The second date entry field is activated and the beginning of the range of dates can be entered in the left date field and the end of the range of dates in the right date field. If the left field is left open the selection will begin with the earliest exam on the list. If the right field is left open the selection will extend to the last exam.

If in the *"General Settings"* (Section 22.5.1) tab of the "Settings" menu, it is preselected to display only exams after a specific date, the background of the date fields is highlighted in red:



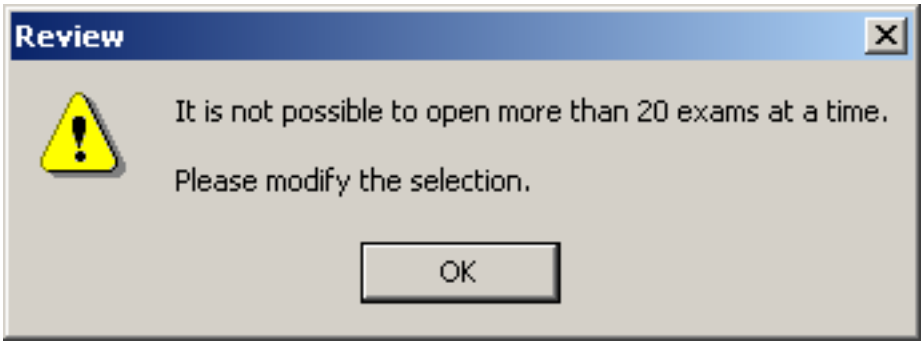

Click the “All” button to switch back to the complete list of exams.

### Reviewing Exams

After selecting some exams in the “Exam List,” click the “Review” button. The entire range of images of the selected exams can be viewed.

View a single exam by double-clicking on it in the “Exam List” with the left mouse button.

Please note that it is not possible to review more than twenty exams at a time. If more than twenty exams are selected in the “Exam List” when the “Review” button is pressed, the following message appears:




In this case please deselect some exams and press the “Review” button again.

If a number of exams are already open and additional exams are opened so that the total number of open exams would exceed twenty, the exams, which have been open for the longest period of time, are closed before opening the new exams.

In the “View” window, select a single image by single clicking on it with the left mouse button. With “Control”(keyboard) + single click of the left mouse button, select more images.

After double-clicking on an image this image will be enlarged to a full-size window or reduced to its original size again if it is already enlarged. A yellow “J” and a yellow number next to it

in the upper left corner of the image indicate that the image was *JPEG compressed* (Glossary). The number represents the quality factor used for compression.

**Attention:** Do not view exams from the internal hard disc (local) and from some other drive in parallel, because "IDs" can get mixed up, i.e., images might be assigned to an erroneous "Patient ID."

Display the patient report belonging to the currently reviewed exam by clicking on the "View Report" button.

**Note:** This displays the measurement report created in 4D View, not the SonoView™ report.

### Deleting Exams

In the "Exam List" dialog box exams can also be deleted.

After selecting the exams to delete by using the mouse, click the "Delete" button.

**Warning:** All images of the selected exams are deleted permanently and cannot be recovered!

### Sending Exams to a DICOM Storage Server

Click on the "Send" button to send the selected images and attached GEMS Kretztechnik volume files to a DICOM storage server. For more details review *"DICOM Send"* (Section 22.3.5).

**Hint:** In SonoView™ there is also an "E-mail Send" function for images which is invoked from the *"Tools" (Tab) menu* (Section 22.4.3).

### Printing the Images of an Exam with a DICOM Printer

Select the images to print, then click on the "Print" button in order to enter the *"DICOM Print"* (Section 22.3.6) dialog box.

SonoView™ also has another print function which is not dependent on a DICOM printer. This print function can be invoked from the *"Tools" (Tab) menu* (Section 22.4.3).

### Exporting the Images of an Exam

Select the images to export, then click on the "Export" button.

For further details please see chapter *"Exporting the Images of an Exam"* (Section 22.3.8).

**Hint:** With this export function an entire series of images can be exported. In SonoView™ there is another export function for single images. With this second export function GEMS Kretztechnik volume files can also be exported. Invoke it from the *"Tools" menu - "Tab 1"* (Section 22.4.1), for more details see *"Retrieving Data from SonoView™"* (Section 22.3.12).

**Note:** Using this function it is also possible to export AVI files of cine loops.

### Backing up Exams

SonoView™ provides a function for backing up images on MO-disk, CD/DVD-R, CD/DVD-RW or a network drive.

For further information review *"Backing up Exams"* (Section 22.3.9).

For backing up data that is stored on a network drive, please review Section *"Network Drive."* (Section 22.3.11)

### Restoring Exams

Once a backup of the data is made, it can also be restored.

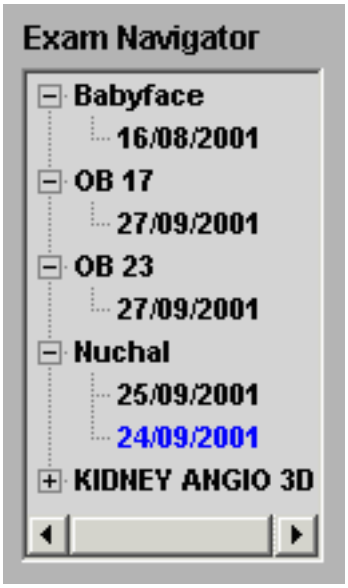
In the "Drive" list box in the upper left corner of the "Exam List" window, select the drive letter of the medium where the backup data is stored.

When a drive is selected for restoring, the "Backup" button at the bottom of the "Exam List" window changes to "Restore." This is a little different when the drive is a network drive. In this case please review Section *"Network Drive."* (Section 22.3.11)

**Attention:** Do not restore exams from a backup made with another 4D View or GEMS Kretztechnik Voluson® ultrasound scanning machine, since "IDs" can get mixed, i.e., images might be assigned to an erroneous "Patient ID."

For more information see *"Restoring Exams."* (Section 22.3.10)

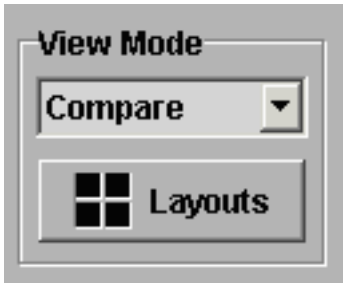
### 22.3.3 Exam Navigator




In the "Exam Navigator" window is a tree diagram of the exams selected in the *"Exam List"* (Section 22.3.2).

Click on a "+" sign, the branch belonging to a "Patient ID" opens, and the exams of this patient designated by "Exam Date" can be viewed. Click on a "-" sign to collapse such a branch of the tree. If the space in the window is too small for displaying all selected exams, a slider will be inserted at the right side of the window to move the displayed section of the "Exam list" tree. When clicking on a date that designates an exam, this date becomes blue and the images of this exam are displayed.

### 22.3.4 View Mode

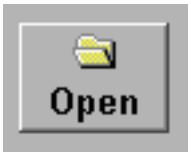



In the "View Mode" dialog choose between the view modes "Exam" and "Compare." In "Layouts," choose the number of images to be displayed at a time.

In View Mode "Exam," only images belonging to a single exam are displayed at any one time.

In View Mode "Compare," compare images from different exams and from different patients.

*How to select images in "Compare" view mode:*

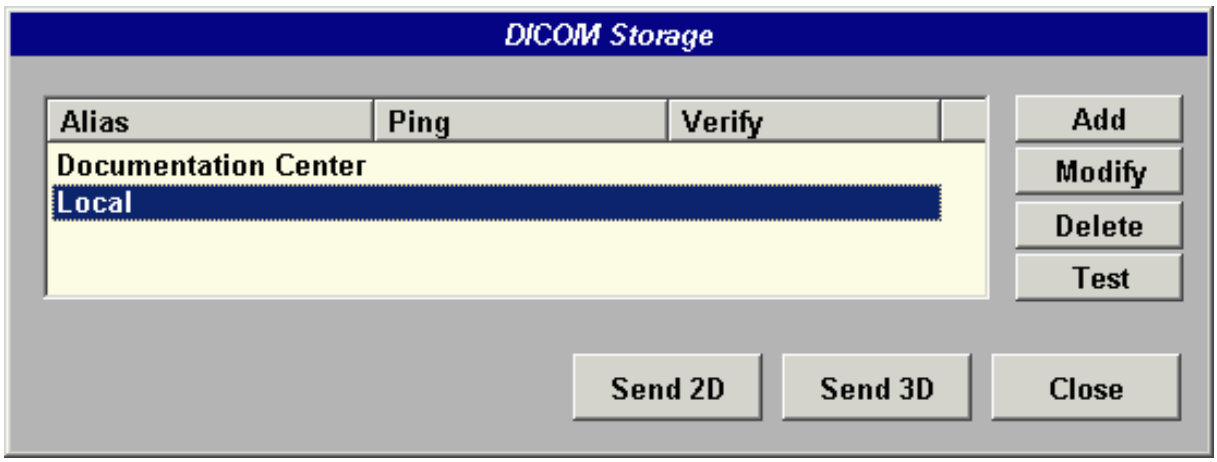
1. Click the "Open" button. 

2. In the "Exam List" select some exams.
3. With the "Review" button display the images belonging to the selected exams.

4. In the "View Mode" dialog box switch to "Compare." Now no images are being displayed, but the selection of exams can be seen in the "Exam Navigator" window.
5. If more than one exam has been selected in the *"Exam List"* (Section 22.3.2), select a single exam in the *"Exam Navigator"* (Section 22.3.3).
6. With the left mouse button click on one of the thumbnail images at the bottom of the SonoView™ screen. The border of the selected image blinks yellow, in order to show that this image is selected.
7. Click on one of the places for images in the *"Display Area"* (Section 22.3.1). The selected image is now displayed in this place.
8. Repeat steps 5 to 7 in order to chose more images for comparison.

With a click of the right mouse button images can be removed from the display area again.

### 22.3.5 DICOM Send

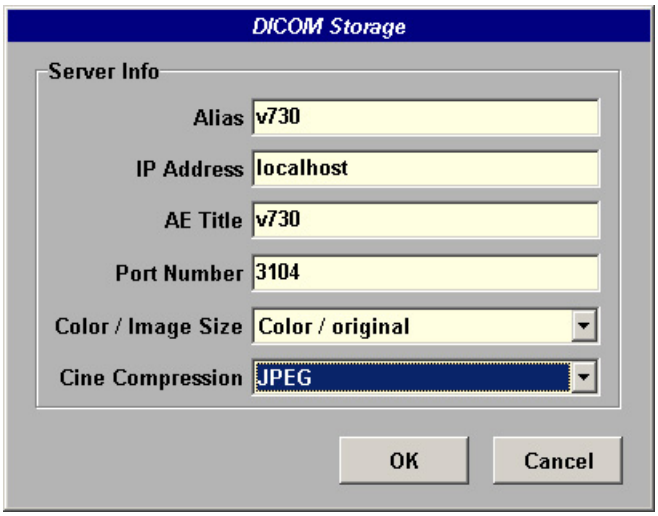



Enter the "DICOM Send" window from the *"Exam List"* (Section 22.3.2) by clicking the "Send" button, or from the *"Tools" menu - "Tab 3"* (Section 22.4.3).

SonoView™ , as a DICOM Sender, can send images and volumes to another PC where 4D View, SonoView™ and Storage SCP (= Storage Service Class Provider) are installed. Storage SCP mus be started on the receiving PC.

Select a destination by clicking on the according name in the list. The background of the row turns blue.

**Change settings:** Change settings for the "DICOM Send" function of SonoView™ by clicking the "Modify" button:




**Alias:** This is a unique nickname for each DICOM station. Use any name, but do not insert space characters.

**IP Address:** This is the IP address or host name of the remote DICOM station.

**AE Title:** This is the "Application Entity Title" of the remote DICOM application.

**Port Number:** This is the number of the port at the remote DICOM station used to establish a DICOM connection (normally 104).

**Color / Size:** Images can be sent in color or in monochrome (grayscale) mode. Additionally, the size of the images sent to the DICOM server can be selected. The two options are "Original" and "640x480". The latter should be selected when sending to a DICOM server that expects an image size of 640x480.

**Cine compression:** Select whether to send cines uncompressed ("None") or in JPEG format ("JPEG").

**Note:** The data is sent in the same format (V730 Format or Multiframe, Secondary Capture) and 2D images are sent with the same compression settings (*JPEG* (Glossary), no compression) as they were stored in SonoView™. For more details see *SonoView Configuration* (Section 23.2).

**Test connection:**

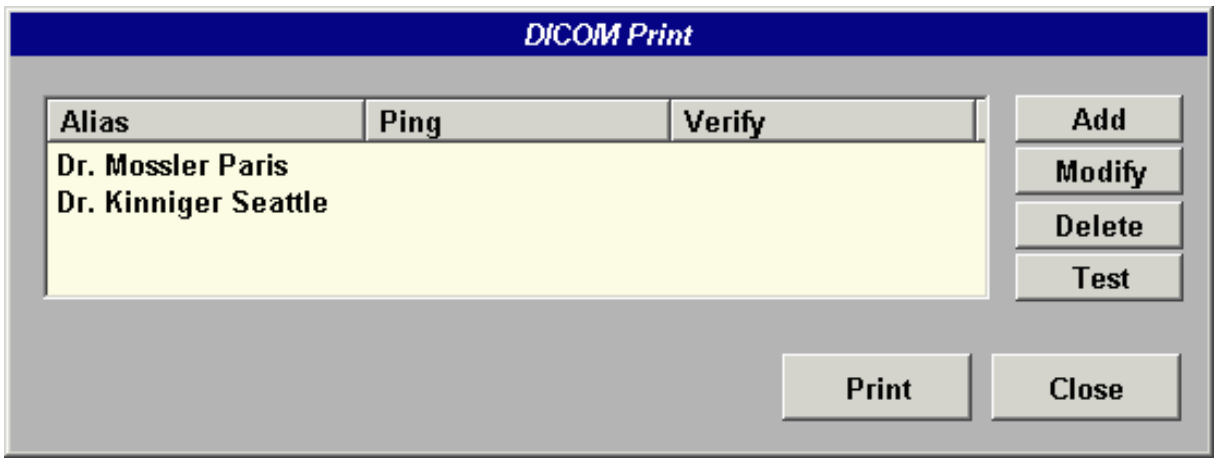
Test the connection to a DICOM station. First click on the station to test with the left mouse key, then click the "Test" button. If the TCP/IP connection to the remote station is active, the entry "Normal" will appear in the "Ping" column. If the DICOM server on the remote station is active, the entry "Normal" will also appear in the "Verify" column.

This connection test may take up to 30 seconds.

**Send:**

Send the data by pressing the "Send 2D" or "Send 3D" button. Send to multiple destinations by selecting more than one destination. This can be done, by selecting the first destination, holding down the [Ctrl] key and selecting additional destinations. All selected destinations are marked with a blue background. Then press "Send 2D" or "Send 3D" to send the data to all selected destinations.

### 22.3.6 DICOM Print




The "DICOM Print" window from the *"Exams List"* (Section 22.3.2) can be entered by clicking the "Print" button or from the *"Tools" menu - "Tab 3"* (Section 22.4.3). The printer must be a special DICOM printer, with DICOM software installed on it. Settings for the "DICOM Print" function of SonoView$^{TM}$ can be changed by clicking the "Modify" button.

**Note:** SonoView$^{TM}$ has another print function, which does not depend on DICOM software. This print function can be invoked in the *"Tools" menu, "Tab 1"* (Section 22.4.1).

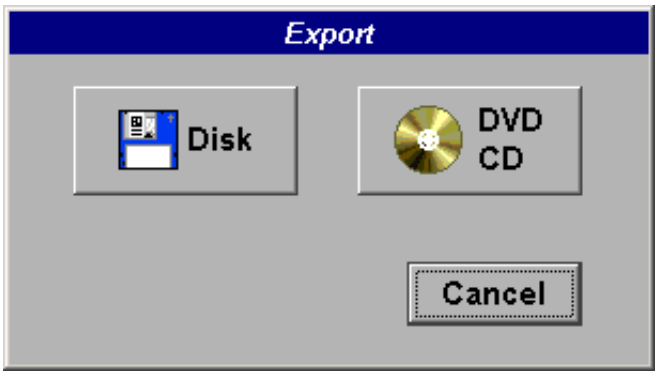
### 22.3.7 Deleting Images from an Exam

To delete a single image from an exam, click on the desired image. The border will turn yellow. Hold down [Ctrl] while clicking on the desired image for selecting additionally or deselecting images. Press the [Del] key on the keyboard.

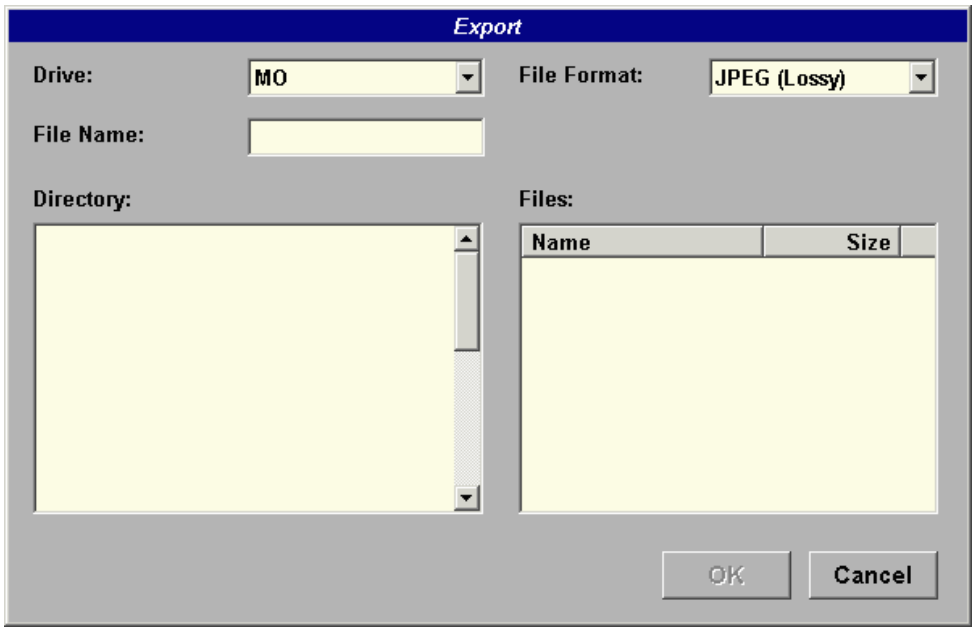
### 22.3.8 Exporting the Images of an Exam

**Note:** Using this function it is also possible to export AVI files of cine loops.

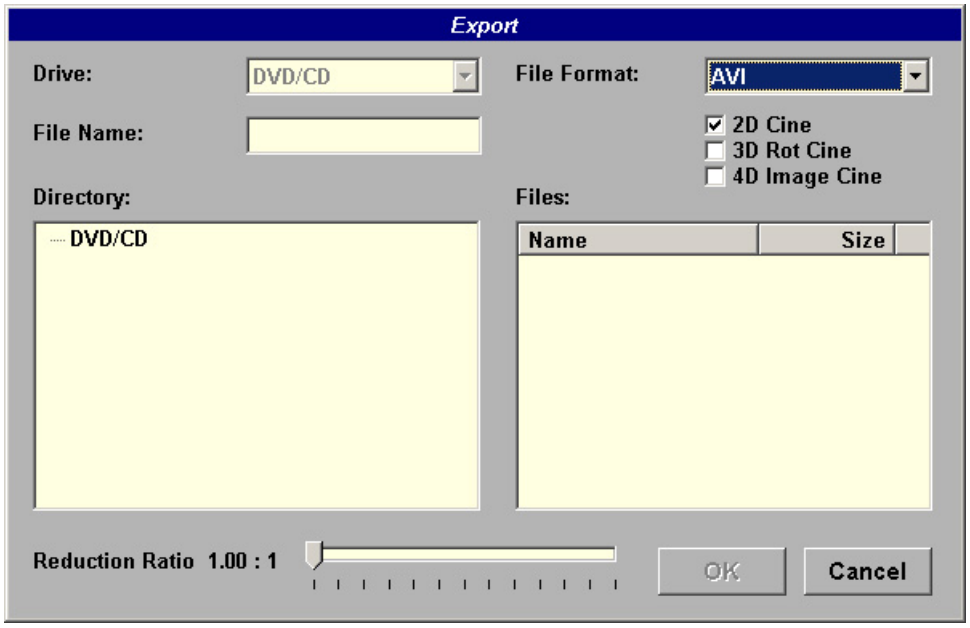
Choose whether images will be exported to a hard disk or to a transportable medium, e.g., a CD/DVD, a MO (Magneto-Optical) disk or a floppy disk.




When choosing CD/DVD, which is a transportable medium, a dialog window is entered where more options can be chosen. Enter a file name, which will be used for creating the file, then press the OK button and thereby export the images. If more than one image is exported, a counter is added to the file name.



If “AVI” is selected as file type, the dialog changes slightly:




Choose which cine types shall be exported (“2D Cine”, “3D Rot. Cine” or “4D Image Cine”) and set the reduction ratio of the exported AVI files.

**Hint:** With this export function an entire series of images can be exported. In SonoView™ there is another export function for single images. With this second export function GEMS Kretztechnik volume files can also be exported. Invoke this export function from the *“Tools” menu - “Tab 1”* (Section 22.4.1), for more details review *“Retrieving Data from SonoView™”* (Section 22.3.12).

### 22.3.9 Backing up of Exams

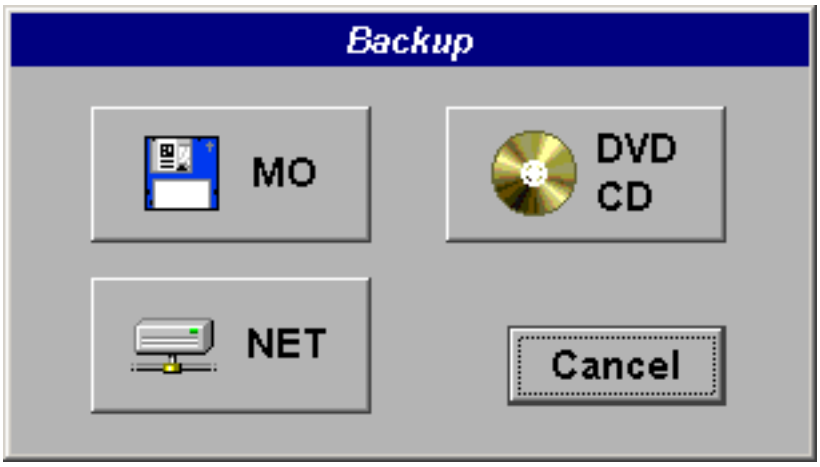
SonoView™ provides a function for backing up exams on a MO disk, a CD/DVD or a network drive.

Select the exams to back up.

If the backup is to be stored on MO or CD/DVD, insert the MO disk or the CD/DVD into the drive and wait till the “Read” LED of the MO or CD/DVD drive gets dark.

Click the “Backup” button at the bottom of the screen.

The “Backup” window appears:




Select where to store the backup. After finishing the backup, select whether the exams should be deleted.

When choosing to delete the exams after finishing the backup, the deletion of the exams from the hard disk is irreversible.

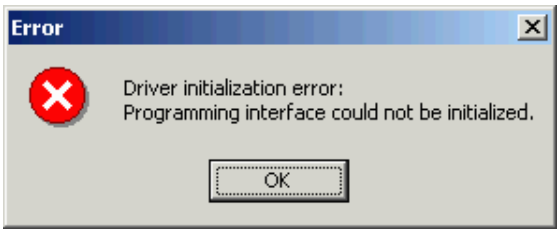
When using “Backup,” all types of data associated with an image, e.g., GEMS Kretztechnik volume files or Cine sequences, are saved to the storage medium, and a *database* (Section 22.2.2) is built on this medium. View this database by selecting the storage medium as “MO”,“CD/DVD” or “Network” in the “Drive” list of the *“Exam List”* (Section 22.3.2) window.

For backing up data that is stored on a network drive, please review Section *“Network Drive.”* (Section 22.3.11)

Once a backup of an exam is made on a CD/DVD, it is impossible to save additional images. In case of a CD/DVD (RW) disk, the medium can be used again after deletion of its content.

The capacity of a blank CD/DVD is 650 MB to 850 MB. However, additional files are saved to enable backup. Therefore, the storage size of the selected images must not exceed 600 MB for a CD/DVD with 650 MB capacity.

If the PC does not have the appropriate driver software for the CD/DVD device installed, the following error message appears, when trying to make a backup on a CD/DVD:



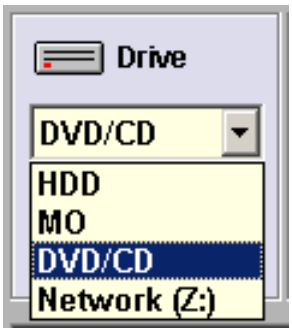

If this message appears, open the directory “ASAPI” on the 4D View CD/DVD and start the setup program “ASAPI.EXE” with a double-click. Follow the instructions on the screen.

### 22.3.10 Restoring Exams

For additional information on restoring data from a network drive, please review Section *“Network Drive.”* (Section 22.3.11)

When restoring data from an MO or CD/DVD insert the MO cartridge or the CD/DVD disc in the drive and wait for the “Busy” LED light to become dark.

Select the MO, CD/DVD or network drive to see the *“Exam List”* (Section 22.3.2) stored on the MO cartridge, CD/DVD disc or network drive:



After selecting the exams, click the “Restore” button at the bottom of the window in order to copy the exams from the MO cartridge or CD/DVD disc to the local hard disk. This is a little different when restoring data from a network drive. Please review Section *“Network Drive.”* (Section 22.3.11)

After restoring an image from an MO disc, select whether this image should be deleted from the MO medium or not.

When choosing to delete the image, it will be deleted completely from the MO drive after the “Restore” function has finished.

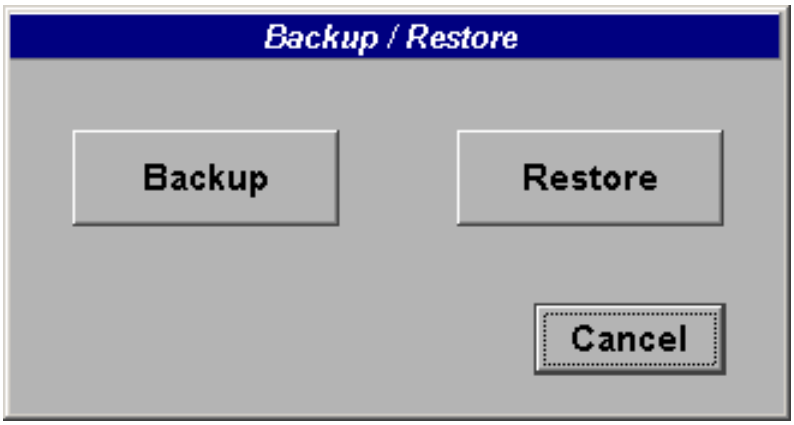
**Attention:** Do not restore exams from a backup made from another 4D View or GEMS Kretztechnik Voluson® ultrasound scanning machine, since "IDs" can get mixed, i.e., images might be assigned to an erroneous "Patient ID."

### 22.3.11 Network Drive

SonoView can also store data on and retrieve data from a network drive. In order to make a network drive available to SonoView, it has to be mapped to the Z: drive of the PC 4D View is installed on. A folder is created on the network drive, which is used to store SonoView data in. The name of the folder is the computername of the PC 4D View is installed on.

When "Network" is selected from the *drive list* (Section 22.3.2), the "Backup" button at the bottom changes to "Backup Restore."

Pressing this button invokes the following dialog:



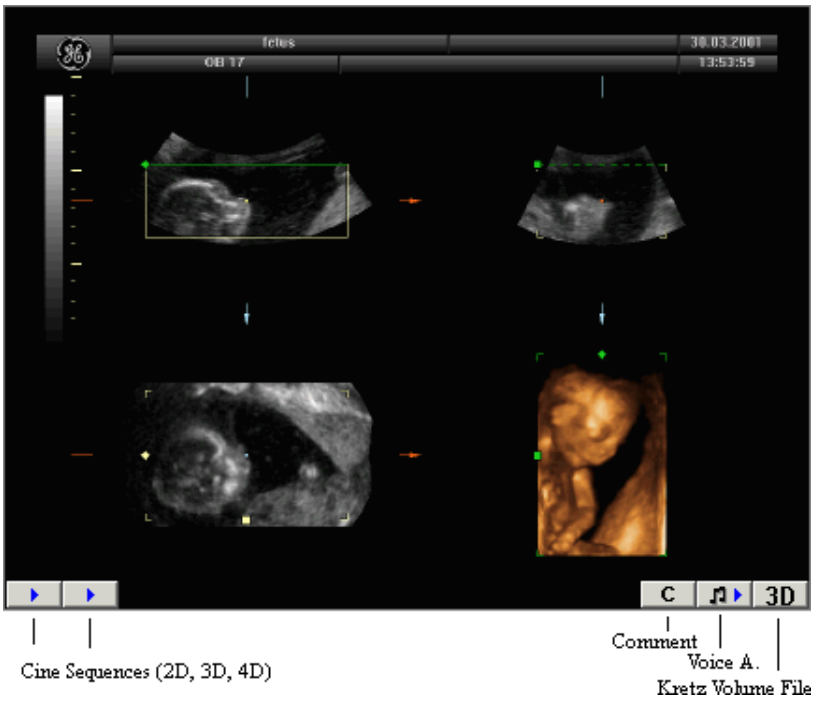

Choose "Backup" to backup data stored on the network drive on a CD/DVD (MO is not possible), or "Restore" to restore data from the network drive to the local hard disk. The "Backup" and "Restore" process is described in more detail in Section *"Backing up of Exams"* (Section 22.3.9) and Section *"Restoring Exams"* (Section 22.3.10).

### 22.3.12 Retrieving Data from SonoView

**Displaying attached items:**

When *selecting an exam* (Section 22.3.2), the images of that exam are displayed. Several items can be attached to the stored SonoView$^{TM}$ image: a 3D Rotation Cine, a 4D Image Cine, a 4D Volume Cine, a *comment* (Section 22.4.2), a *Voice Annotation* (Section 22.3.15) and a GEMS Kretztechnik volume file.

For each of these items there is a button at the lower border of the image:



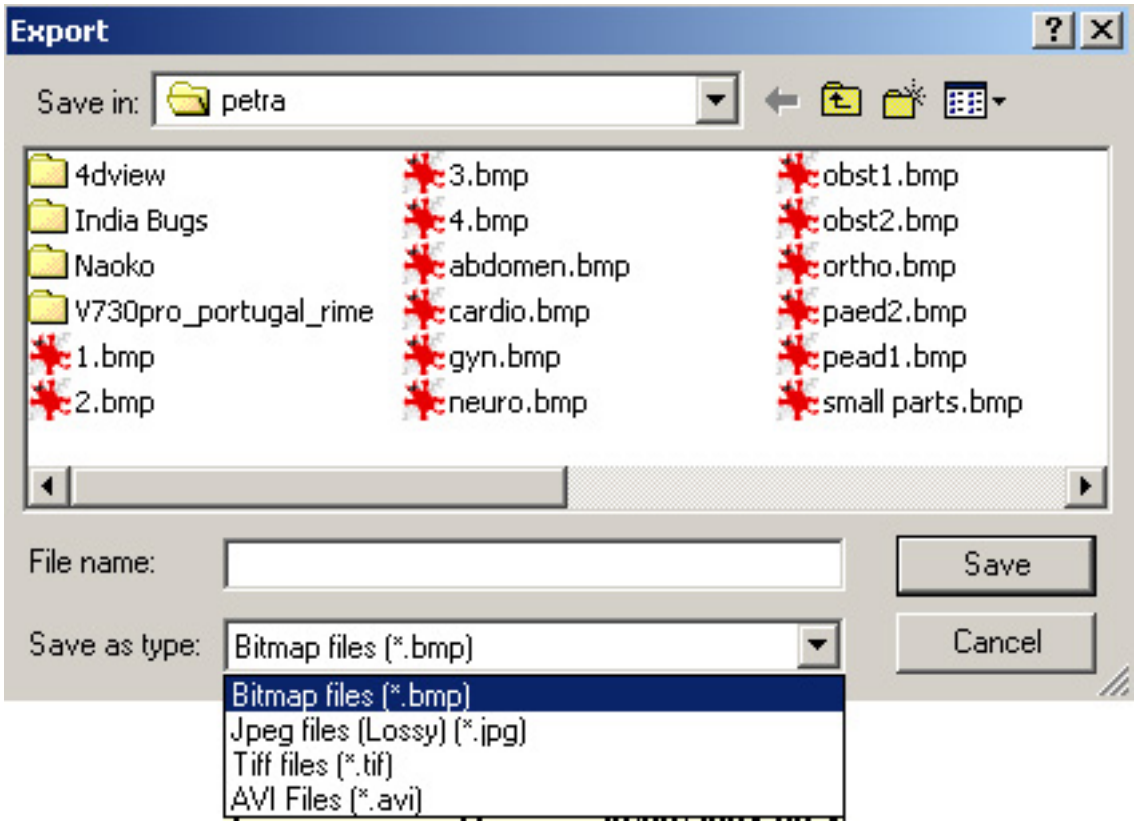

When selecting a “Cine” button, the attached Cine sequence is seen.
When selecting the “Comment” button, a comment is displayed in the image.
When selecting the “Voice Annotation” button, the attached sound can be heard.
When selecting the “3D” button, a GEMS Kretztechnik volume file is displayed with 4D View.

### 22.3.13 Exporting Images and Volume Files

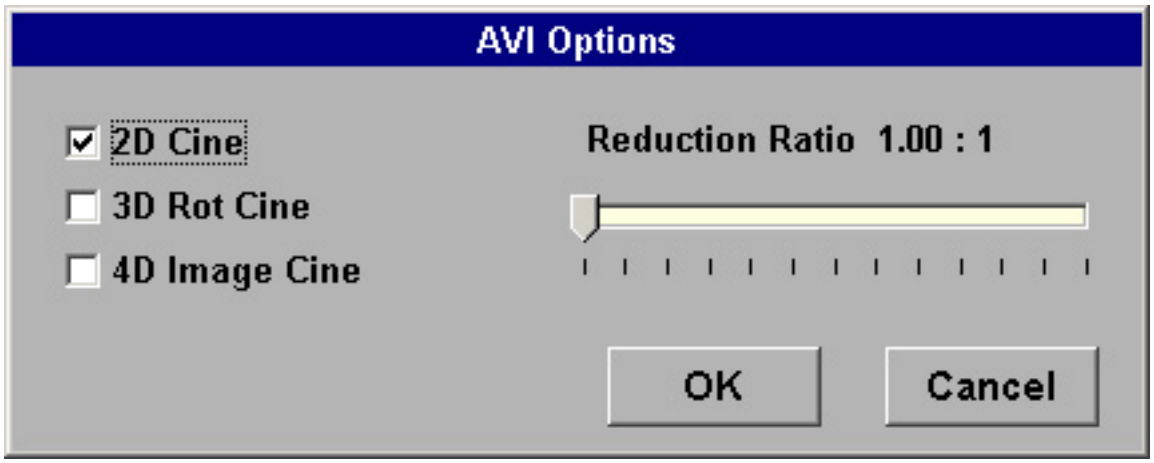
**Note:** Using this function it is also possible to export AVI files of cine loops.

On the left side of the SonoView$^{TM}$ screen there is a small menu with tabs:

Choose the leftmost tab, click the floppy symbol, drag it to the image to be exported, and click the left mouse button. Select whether to save the image to disk or burn it on a CD/DVD. When choosing "Disk," an "Export" dialog box appears, where the data types are selected and a filename is entered:



When “AVI” is selected as file type, a second dialog appears after pressing “Save”:




Choose which cine types shall be exported (“2D Cine”, “3D Rot. Cine” or “4D Image Cine”) and set the reduction ratio of the exported AVI files. Then press “OK”.

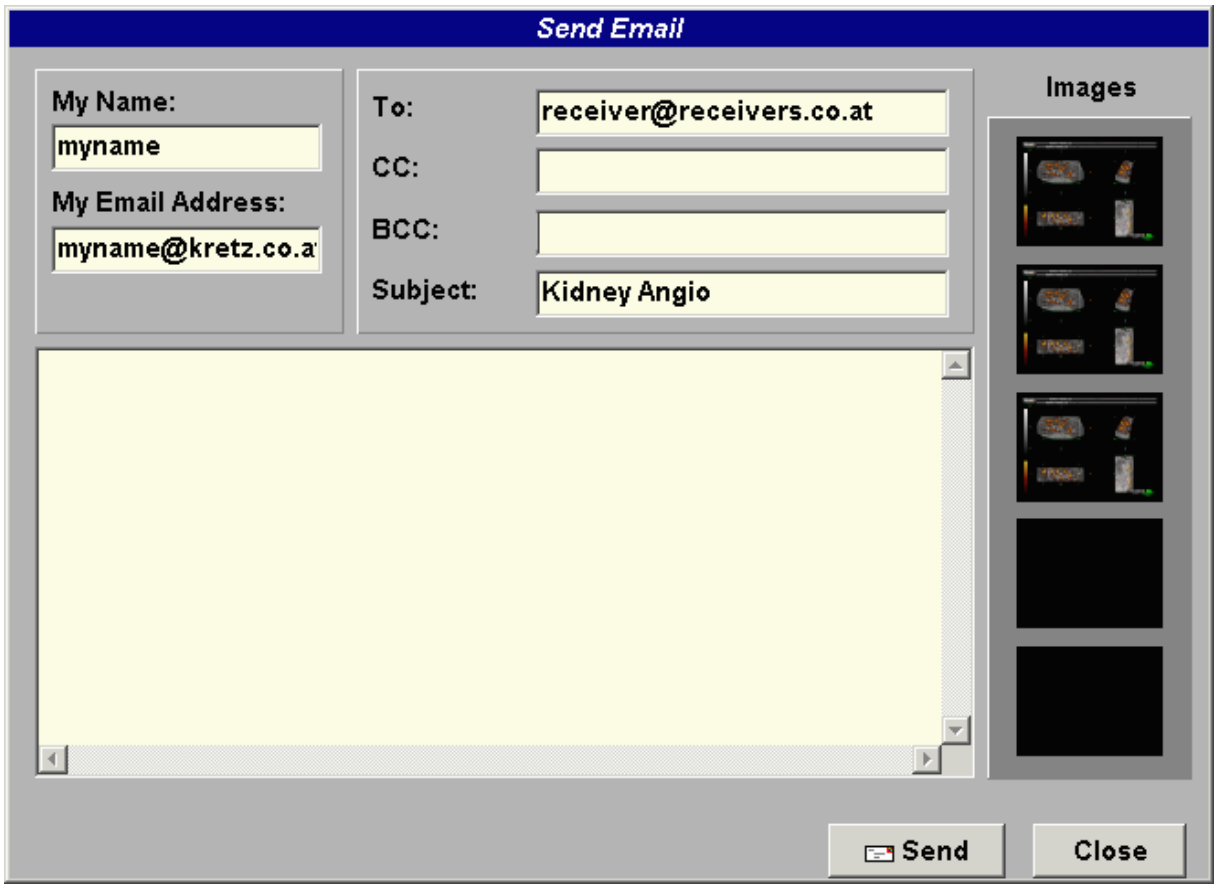
When choosing “CD/DVD” the export dialog box described in *Exporting the Images of an Exam* (Section 22.3.8) is displayed. Enter a file name and select OK in order to burn the image on the CD/DVD.

To save desired images belonging to an exam, select the images (hold down the CTRL key and click on the images) and click on the floppy symbol. Select whether to save the images to disk or burn them on a CD/DVD.

### 22.3.14 Sending Images via Email

With SonoView™ images can be sent directly as an attachment to an e-mail.

Enter this function of SonoView™ through the "Tools" menu, *Tab 3* (Section 22.4.3), by clicking on the letter symbol.




Before using SonoView™ for sending e-mails, enter the name of the mail server in the *"Network Settings"* (Section 22.5.1) dialog. The fields "My Email Address" and "To" are mandatory, the other fields are optional. "CC" means "carbon copy," "BCC" means "blind carbon copy."

**Attaching images to e-mails:**

1. Select desired exams in the *"Exam List"* (Section 22.3.2).
2. If more than one exam is selected in the "Exam List," select single exams in the *"Exam Navigator"* (Section 22.3.3).
3. Click on one of the thumbnail images at the bottom of the SonoView™ screen. The border of the selected image blinks yellow in order to indicate that this image is selected.

4. Click on one of the places for thumbnail images in the right portion of the “Send Email” dialog window. When the selected image is in this window, it will be attached to the e-mail.

### 22.3.15 Voice Annotation

Voice comments can be attached to a SonoView™ image, if the PC is equipped with audio hard- and software. “Windows Media Tools” must be installed. If this is not the case, install it from the 4D View CD/DVD using the program “wmtools.exe” in the directory “MEDIA.”

In order to record a voice annotation proceed as follows:

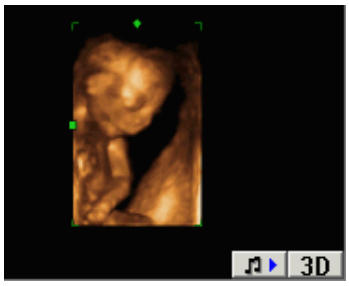
At the left side of the SonoView™ window is a small menu with tabs. Choose the second tab from the left and click on the “Microphone” button.

Place the cursor on the image required comment and click the left mouse button.

The recording is started and a message box displaying the recording time appears:

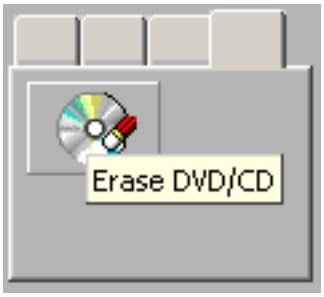
Speaking can begin. When finished, click the “Stop” button in order to end the recording process.

To listen to the voice annotation which is now attached to the image, click the “Note” button in the lower right corner of the image:

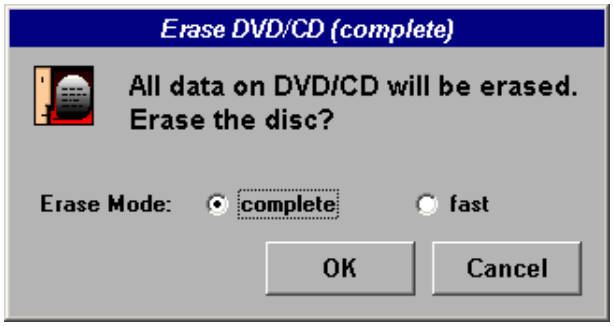


### 22.3.16 Erasing CD/DVD (RW)

On the left side of the SonoView™ screen is a small menu with tabs:



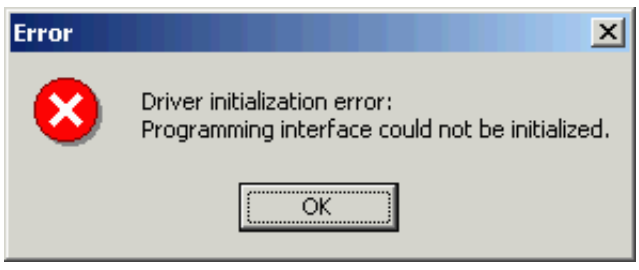

Choose the rightmost tab and click the “disc” button. A dialog appears.




Choose erease mode “Complete” or “Fast”. Depending on which type of media is used, different modes are recommanded. For CD, use “Complete” to avoid problems.

Start erasing by pressing the “OK” button.

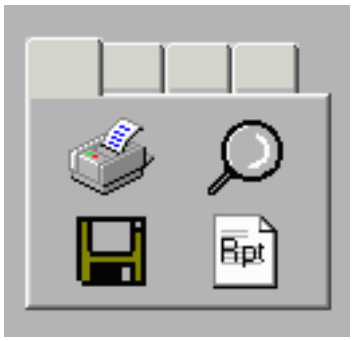
If the appropriate CD/DVD driver software is missing on the PC, the following error message appears:




If this message appears, open the directory “ASAPI” on the 4D View CD and start the setup program “ASAPI.EXE” with a double-click. Follow the instructions on the screen.

## 22.4 Tools Menu

### 22.4.1 Tab 1

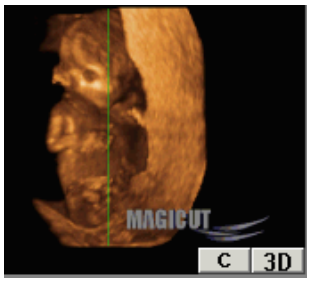



1. From this tab print images including basic patient and exam data, and optionally a report, using a local printer. However, SonoView™ also has a "DICOM Print" function. With this *"DICOM Print"* (Section 22.3.6) function a remote printer can be used.
2. Select a magnifier in order to view details of images.
3. Export images (as bitmap, *JPEG* (Glossary) or TIFF files) and GEMS Kretztechnik volume files, see *"Retrieve Data from SonoView™"* (Section 22.3.12).
4. Create a report. The report can be printed together with the images of the exam.

### 22.4.2 Tab 2

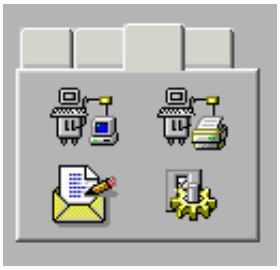
1. Measure distances with the help of lines. This is possible is a single image display area of SonoView™ is selected in *"View Mode - Layouts"* (Section 22.3.4).
2. Circles and ellipses can be used to measure areas and circumferences as described above.
3. If audio hardware is installed on the PC, *voice annotations* (Section 22.3.15) can be attached to an image.

4. Type a comment and attach it to an image, in a way similar to attaching voice annotations. If a comment is attached to an image, a "C" button is displayed in the lower right corner of the image:



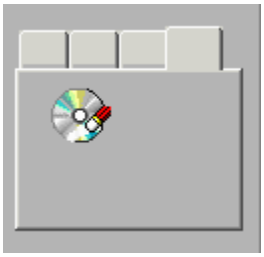

When clicking the "C" button, the comment is displayed and can be edited. A comment can be deleted by entering an empty string instead of a comment.

### 22.4.3 Tab 3



1. Send selected single images or a series of images including GEMS Kretztechnik volume files to a DICOM Storage Service Class Provider, i.e., a DICOM receiver. See *"DICOM Send"* (Section 22.3.5).
2. Print images with a *DICOM printer* (Section 22.3.6).
3. Send images via *e-mail* (Section 22.3.14).
4. Settings: Select an *e-mail server* (Section 22.5.1) and enter necessary information on the *CD/DVD-Recorder* (Section 22.5.4) and the MO-drive.

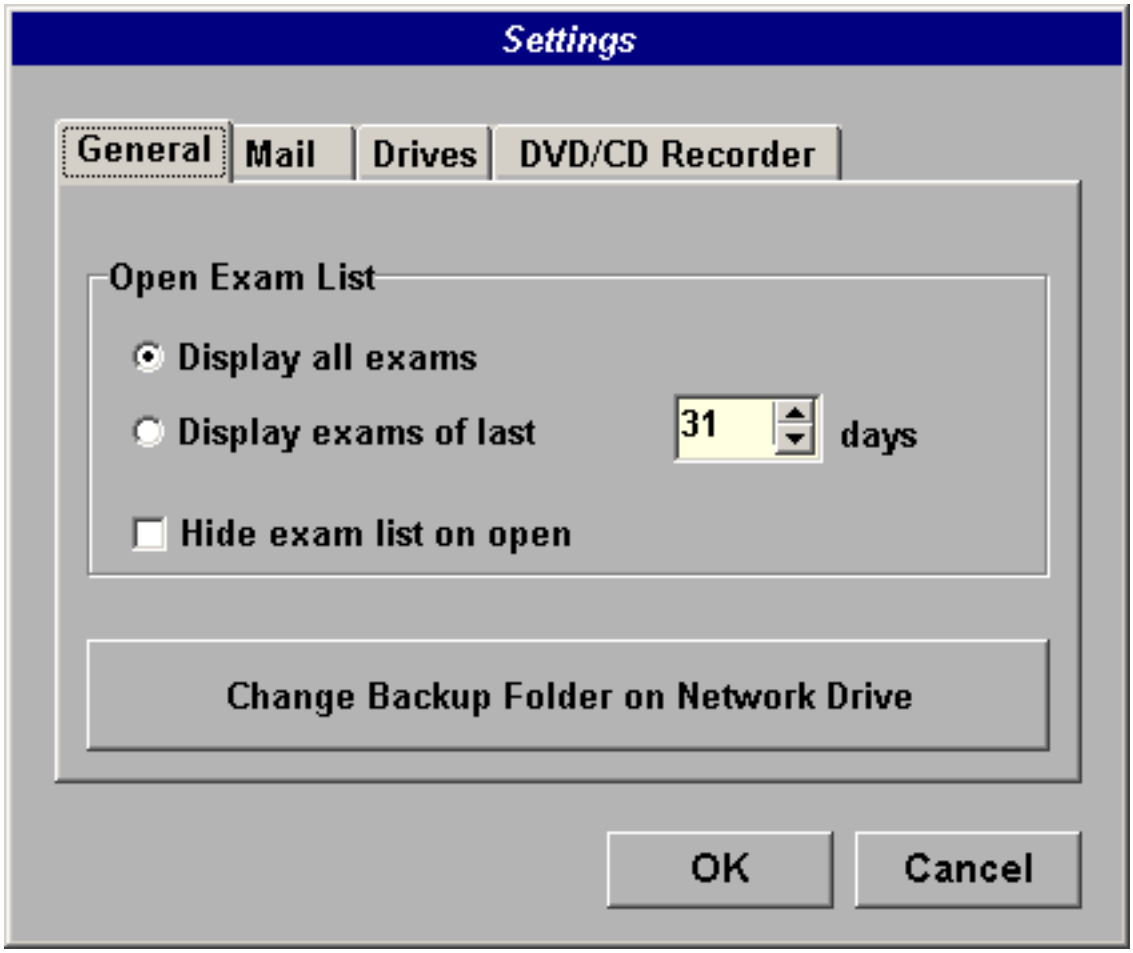
### 22.4.4 Tab 4



Here, *erase a CD/DVD (RW) disc* (Section 22.3.16).

## 22.5 Settings Menu

### 22.5.1 General Settings




**Open Exams List:**

Choose whether to display all exams or only the latest ones in the *"Exam List"* (Section 22.3.2).

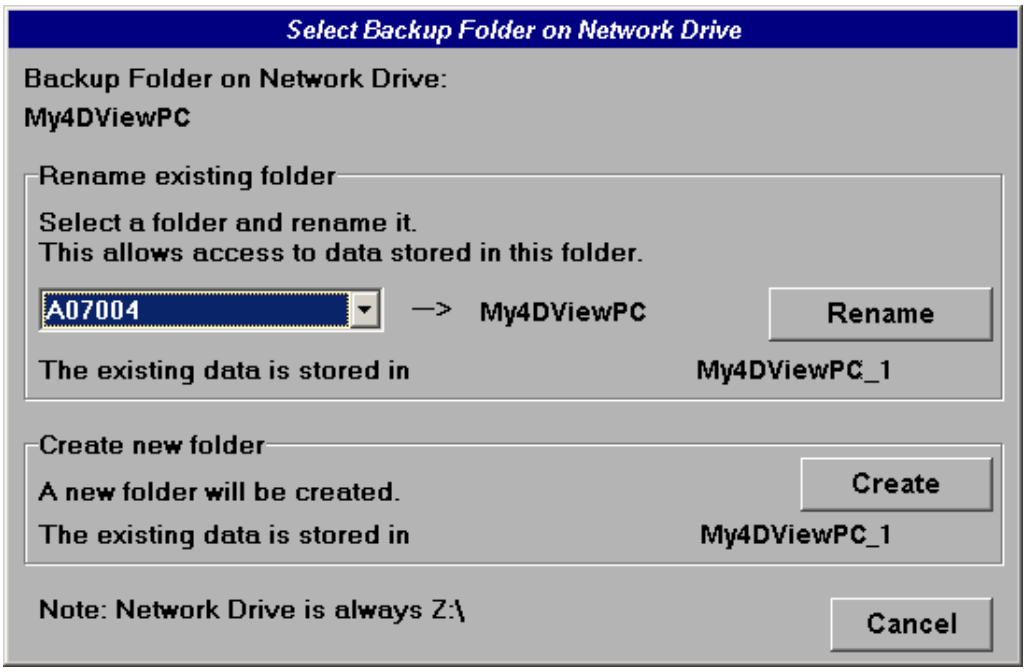
Check "Hide exam list on open" in order to avoid that a list of exams is displayed when opening the *"Exam List"* (Section 22.3.2) window. This setting can be used for protecting patient data.

**Change Backup Folder on Network Drive**

Using the mapped network drive, it is possible to store SonoView Image data to a folder on a server. However, more than one system could be exporting data to a particular server. To avoid data corruption caused by colliding write operations, every system creates its own folder where it stores the data. This folder has the computername of the PC 4D View is installed on or, in case of a V730 series machine, the serial number of the system as a name, e.g. 4DView. Below

this folder lies the backup data. 4D View can only access its own folder that corresponds to the computername of its PC. This folder will be called the working folder in the following text.

If 4D View is connected to a network drive, all export and import operations will be executed on the working folder. For example, 4D View on a PC with a computername of “my4DViewPC” has the working folder “my4DViewPC”, and 4D View on a PC with a computername of “4DViewStation” has the working folder “4DViewStation”.




It is possible to create a new working folder, preserving the existing data. This is done with the [Create] button. The current working folder is renamed such that it has a number at the end of the computername. For example, if a new working folder for 4D View on a PC with computername “my4DViewPC” should be created, the previously existing folder is renamed to “my4DViewPC_1”. This folder now contains all the data. A new, empty working folder is created, having again the name “my4DViewPC”. All operations (e.g. *“Backup”* (Section 22.3.9) or *“Restore”* (Section 22.3.10)) are now performed on the new empty working folder “my4DViewPC”. Subsequent [Create] operations increase the number at the end, e.g. “my4DViewPC_2”, “my4DViewPC_3” and so on).

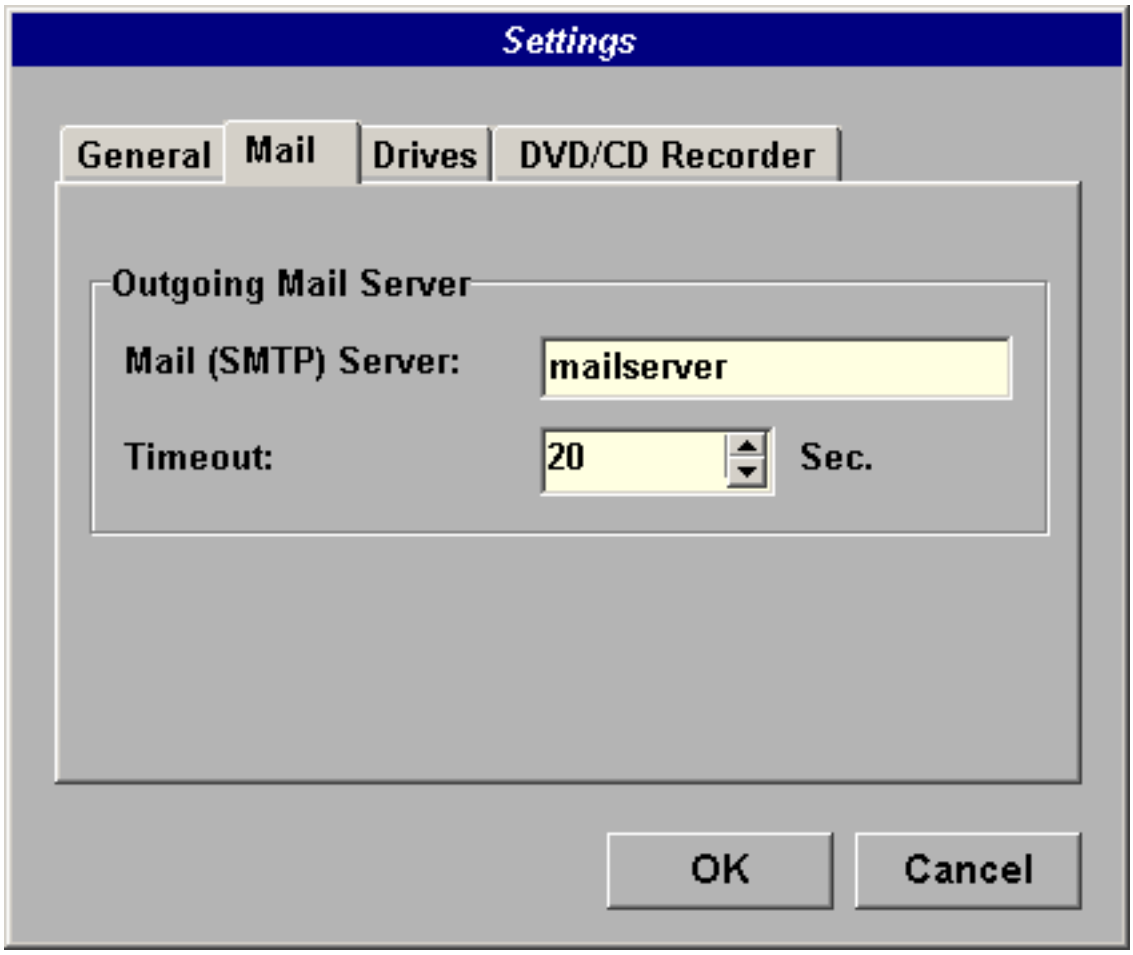
The data stored in the numbered folders (e.g. “my4DViewPC_1” and “my4DViewPC_2”) can be moved back into the place of the working folder. First, the content of the current working folder (e.g. “my4DViewPC”) is stored to a new numbered folder (“my4DViewPC_4”). Then, the selected folder (e.g. “my4DViewPC_1”) is renamed to be the new current working folder (“my4DViewPC”).

This operation is done with the [Rename] button. The drop-down list shows all data folders on the network drive, both numbered ones and ones from other systems (e.g. a V730 series

machine). The folder selected here will be put in the place of the current working folder, as described above. The working folder is not contained in the list.

The drop down list shows all folders on the network drive. If a folder is selected to be renamed, it is not copied, but simply renamed. Thus, the same data can be shared between two machines by renaming the respective working folders to the serial number of the accessing machine.

### 22.5.2 Mail Settings

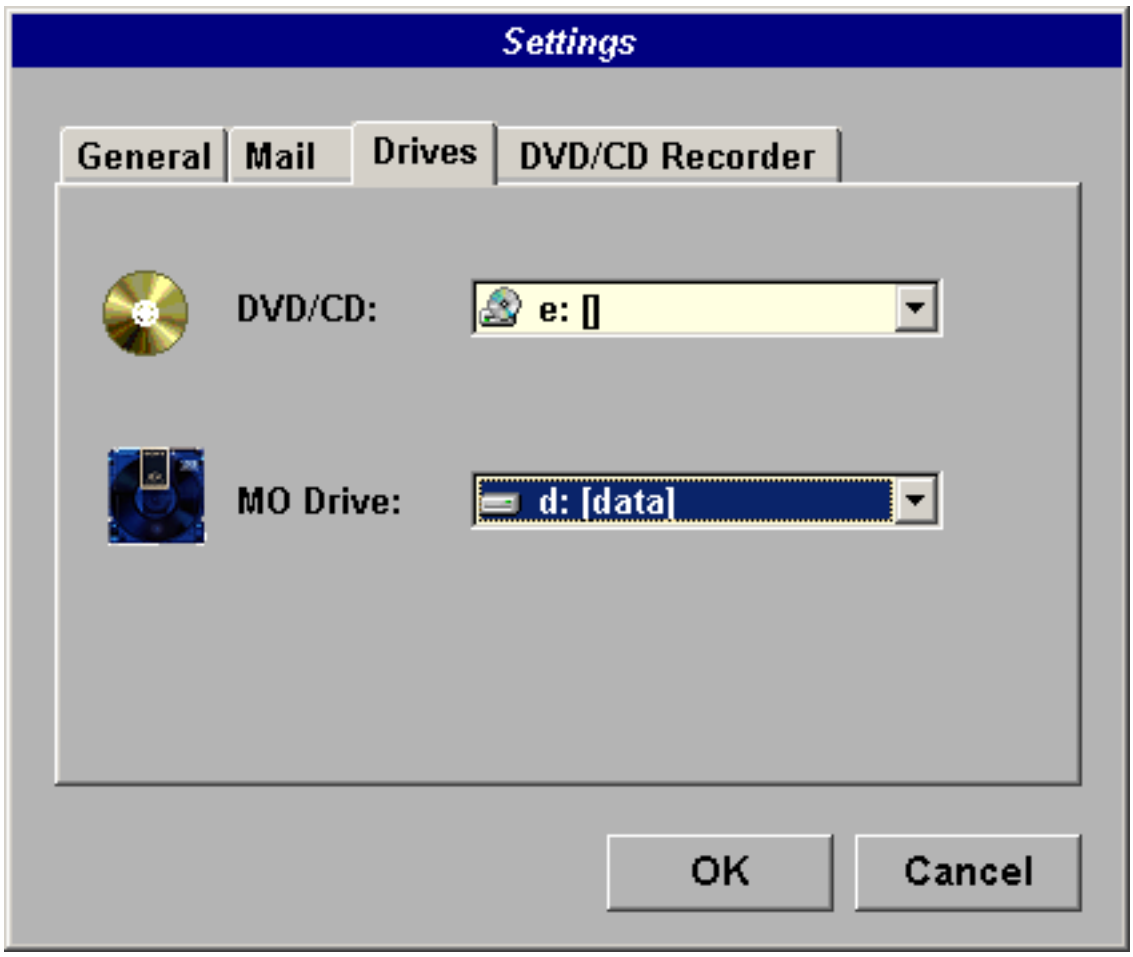



**Outgoing Mail Server:**

Enter the name of the mail server and the timeout value for *sending e-mails* (Section 22.3.14) in this input dialog.

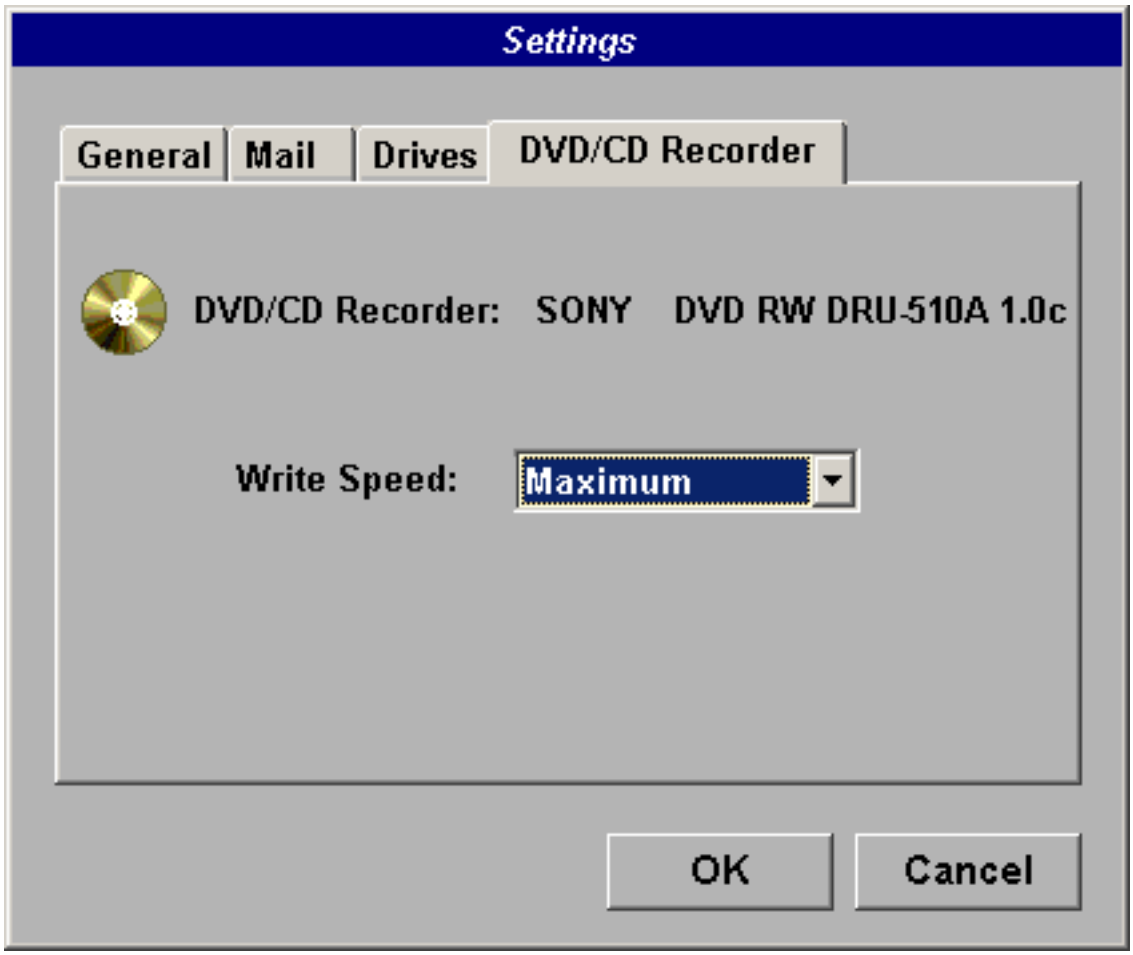
The timeout value sets the time limit on how long SonoView$^{TM}$ will attempt to send the e-mail. Thus SonoView$^{TM}$ will not be paralyzed if the mailserver is not active.

### 22.5.3 Select Drives




In this dialog box choose the drive names of the CD/DVD drive and the MO-Drive, if such drives are installed in the PC.

### 22.5.4 CD/DVD Recorder Options



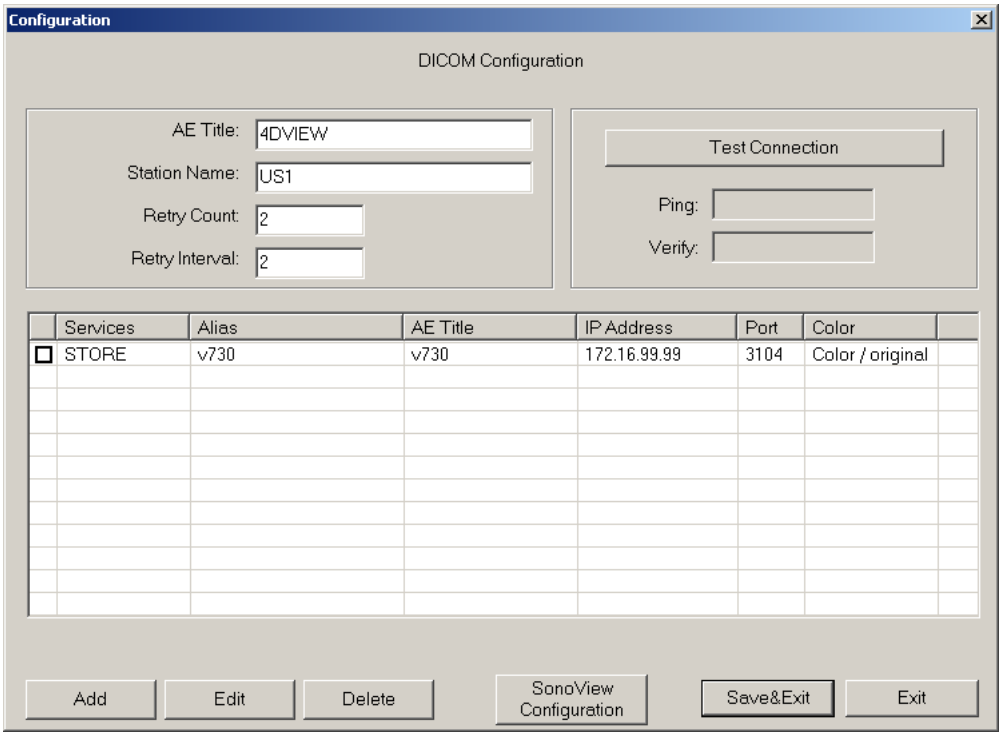

In the "CD/DVD-Recorder Settings" dialog box choose the speed at which data is recorded. The speed values which appear in the list box depend on the CD/DVD-recorder and on the inserted disc. Normally, choose the maximum speed. If, however, the CD/DVD-recorder produces an error at maximum speed, choose a slower speed.

# Chapter 23

# Connectivity

## 23.1 DICOM Configuration

This dialog box is invoked through the *"Settings" menu* (Section 5.4).




The entries in the upper part of the "DICOM Configuration" dialog are the properties of the home station. The single lines in the lower part refer to connected stations. Such a station can be a DICOM viewer, a DICOM printer, another PC with 4D View installed, a worklist server or a server designed to receive measure reports in a special format.

### 23.1.1 Setting the Properties of the Home DICOM Station

**AE (Application Entity) Title:** The name that is used to identify the 4D View DICOM application in other DICOM applications. For setting the AE-Title correctly please contact the designated DICOM network administrator.

**Station Name:** The name of the home institute or organization (optional).

**Retry Count:** The number of times the system should retry to establish a DICOM connection in case an attempt fails.

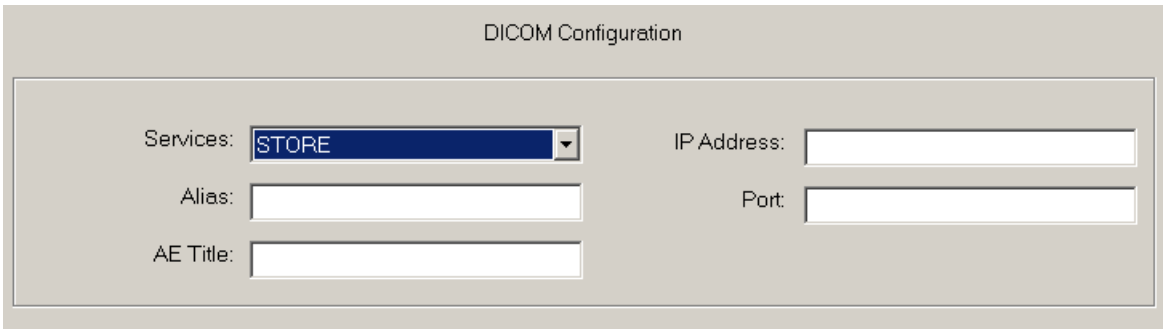
**Retry Interval:** The amount of time in minutes the system pauses between two attempts to establish a DICOM connection.

### 23.1.2 Testing the Connection

Test the connection of the home system to another DICOM station. First choose the station to test from the list by clicking on its line with the left mouse key, then click the “Test Connection” button. If the TCP/IP connection to the remote station is active, the entry “OK” appears in the “Ping” line. If the DICOM server on the remote station is active, the entry “OK” also appears in the “Verify” line.

This connection test may take up to 30 seconds.

### 23.1.3 Setting the Connection Properties of the Remote DICOM Stations for Connection




In order to add a new destination (DICOM device to send data) or source (DICOM device from where data is retrieved) click the “Add” button and enter all available information.

In order to edit the configuration of an existing DICOM device, mark the line containing this device and click the “Edit” button.

To delete an entry, select the appropriate line by clicking on it with the left mouse key and click on the “Delete” button.

**Types of services:**

**STORE** The service provided by DICOM servers or other PCs with 4D View.

**STORE3D** The service provided by DICOM servers or other PCs with 4D View. Used to set up a server which shall only receive 3D data.

**PRINT** The service provided by DICOM Printers.

**WORKLIST** The service provided by a DICOM worklist server.

**REPORT** The service provided by a server designed to receive measure reports in a special format.

"Report" is limited to one entry, i.e., this service can only be provided by one device. On the other hand, there can be several "Storage," "Storage 3D" and "Worklist" entries in the list. However, only one of each type can be activated at a time by selecting it with a checkmark in the first column at a time. Something similar applies for "Print" entries. Several printers can be in the list, but only one can be selected at a time.

**Properties for all types of services:**(Ask the designated DICOM administrator for the information.)

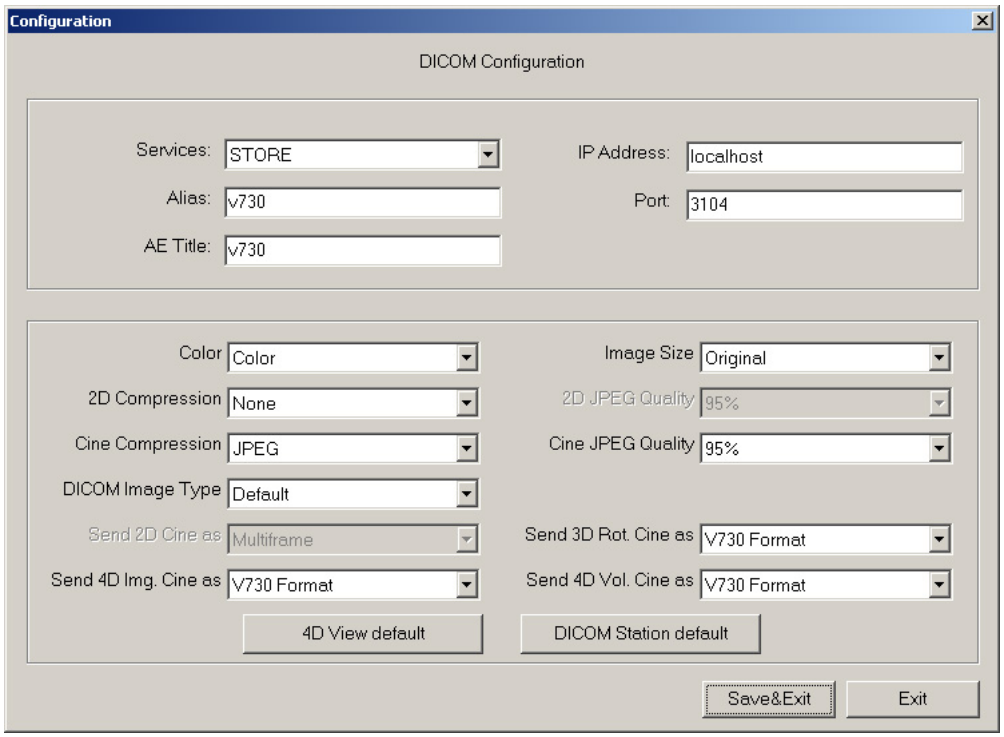
**Alias:** A unique nickname for each DICOM station. Use any name, but do not insert space characters.

**AE Title:** "Application Entity Title" of the remote DICOM application.

**IP Address:** The IP address or host name of the remote DICOM station.

**Port:** The number of the port at the remote DICOM station used to establish a DICOM connection (normally 104).

### 23.1.4 Adding or Editing a DICOM Store Server




When configuring a "STORE" or a "STORE3D" server following settings are possible:

**Color:** Images can be sent in "Color" (RGB) or in "Grayscale" (Monochrome) or in "Automatic" mode (Color or Grayscale depending on image mode).

**Image Size:** Select the size of the images sent to this DICOM server. The two options are "Original" and "640x480". The latter should be selected when sending to a DICOM server that expects an image size of 640x480.

**2D Compression:** Select the type of compression used when sending images to this DICOM server. If *"JPEG"* (Glossary) is selected, the images are sent *JPEG compressed* (Glossary). If "None" is selected, the images are sent uncompressed.

**2D JPEG Quality:** This selection is only available if "2D Compression" is set to *"JPEG"* (Glossary). It sets the compression quality for images sent to this DICOM server. If "100%" is selected, lossless compression is used, i.e. the files become smaller, but no quality is lost. If less than 100% is selected, a warning appears. The reason for this is that now lossy compression is used, which means that the image quality is reduced. The use of lossy *JPEG compression* (Glossary) is also indicated in the sent image. A small, yellow indicator appears at the top left corner of the sent image (only ultrasound images, not patient dialog or report). It displays a J for *JPEG compression* (Glossary) and a number (95,90,85 or 80) indicating the compression quality.

**Cine Compression:** Choose which type of compression is used for sending cines (2D Cine, *3D Rot. Cine* (Glossary) as Multiframe and *4D Img. Cine* (Glossary) as Multiframe).

**Cine JPEG Quality:** This selection is only available if "Cine Compression" is set to *"JPEG"* (Glossary). Set the compression quality for cines sent to this DICOM server. If "100%" is selected, lossless compression is used, i.e. the files become smaller, but no quality is lost. If less than 100% is selected, a warning appears. The reason for this is that now lossy compression is used, which means that the image quality is reduced. The use of lossy *JPEG compression* (Glossary) is also indicated in the sent image. A small, yellow indicator appears at the top left corner of the cine sent. It displays a J for *JPEG compression* (Glossary) and a number (95,90,85 or 80) indicating the compression quality.

**DICOM Image Type:** Select "secondary capture" in order to send all 2D images as DICOM secondary capture.

**Send 2D Cine as:** 2D Cines are not available in 4D View.

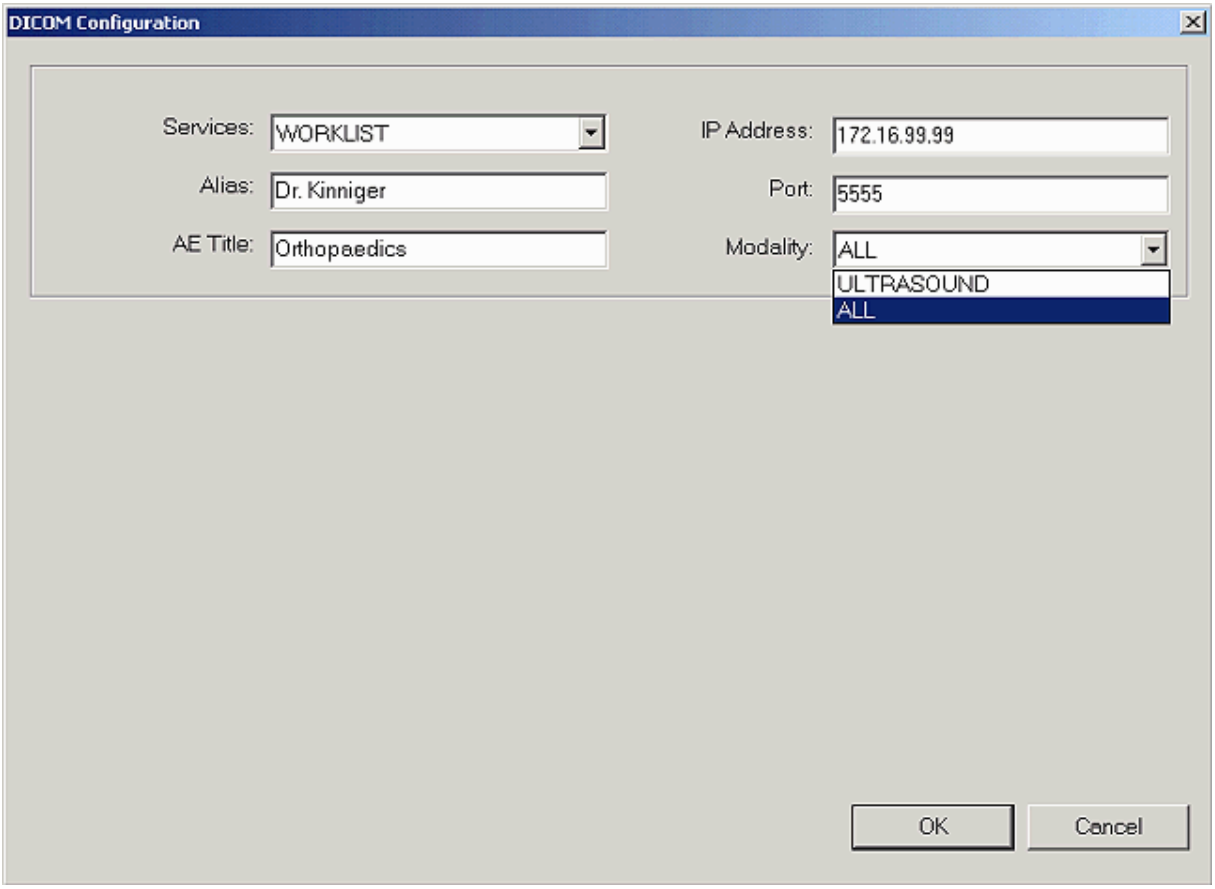
**Send 3D Rot. Cine as:** Choose between "V730 Format" and "Multiframe". "V730 Format" can be reloaded into 4D View or a Voluson 730 series machine, but cannot be read by a DICOM server. "Multiframe" means that a "movie" of the cine is sent, similar to a 2D cine. It cannot be reloaded into 4D View or a Voluson 730 series machine. However, it can be displayed in SonoView as well as most DICOM servers. There this setting should be used if sending to a DICOM server.

**Send 4D Img. Cine as:** Choose between "V730 Format" and "Multiframe". "V730 Format" can be reloaded into 4D View or a Voluson 730 series machine, but cannot be read by a DICOM server. "Multiframe" means that a "movie" of the cine is sent, similar to a 2D cine. It cannot be reloaded into 4D View or a Voluson 730 series machine. However, it can be displayed in SonoView as well as most DICOM servers. There this setting should be used if sending to a DICOM server.

**Send 4D Vol. Cine as:** *4D Volume Cines* (Glossary) are always sent as "V730 Format".

There are also two buttons available. "4D View default" adjusts all settings to the values recommended when sending to a different 4D View. "DICOM Station default" adjust all settings to the values recommended for sending to a DICOM Server.

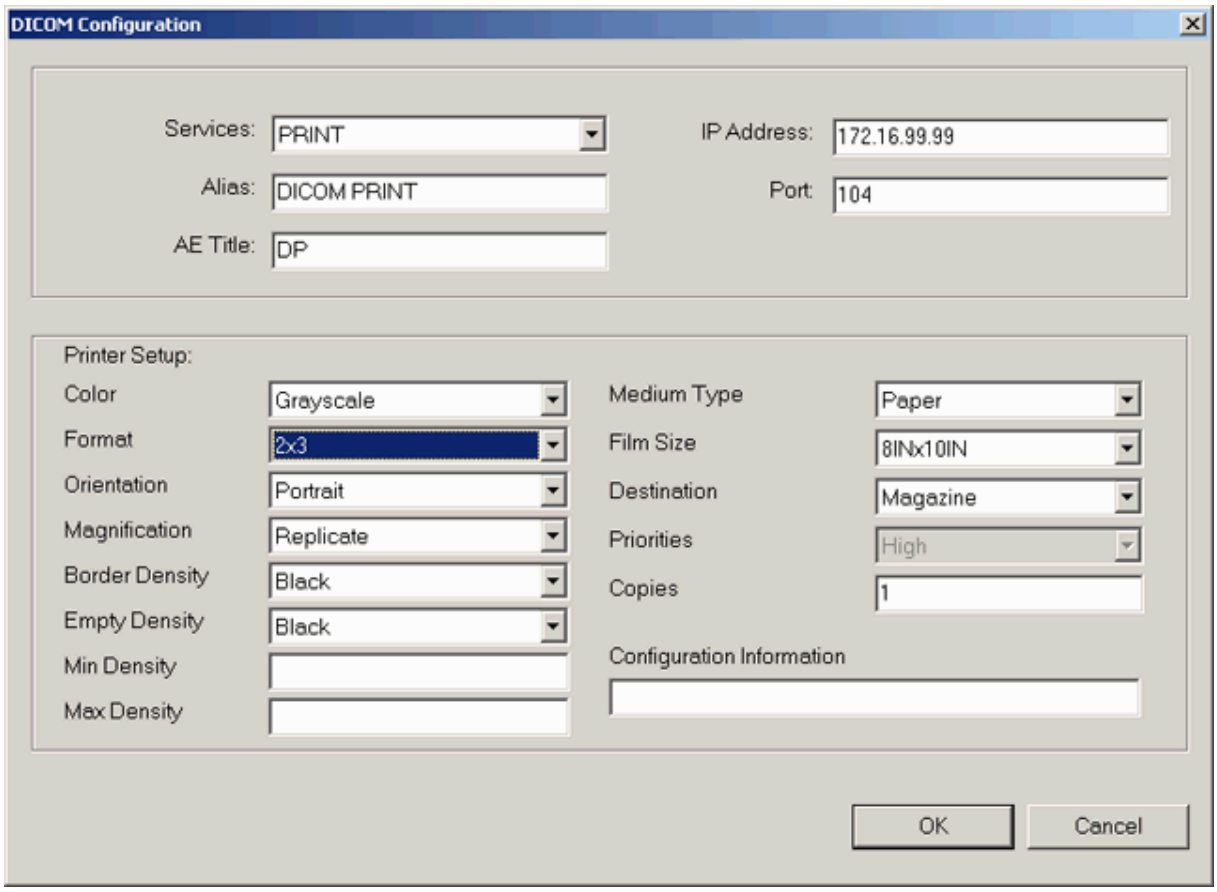
### 23.1.5 Adding or Editing a DICOM Worklist Server




When configuring a DICOM Worklist Server an additional parameter can be set.

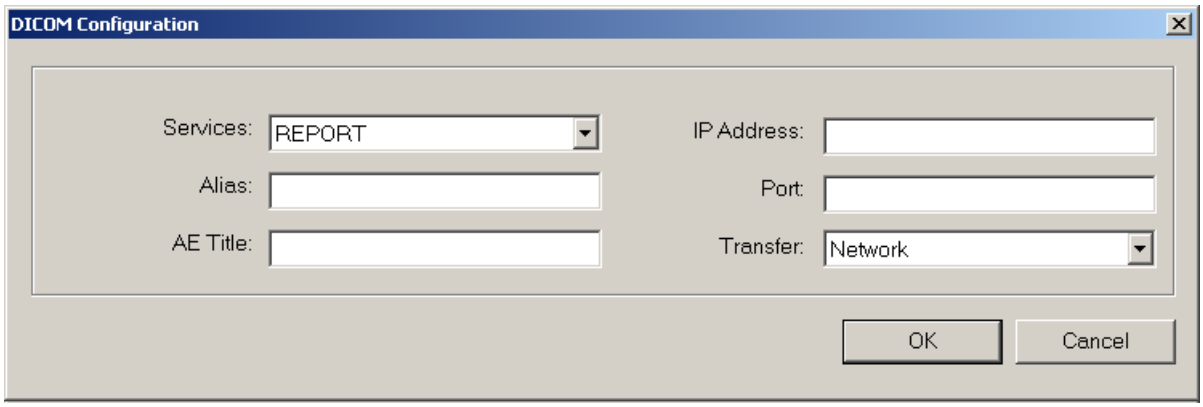
**Modality:** A filter (mask) can be selected, that chooses only patient data marked with "ULTRASOUND."

### 23.1.6 Adding or Editing a DICOM Printer



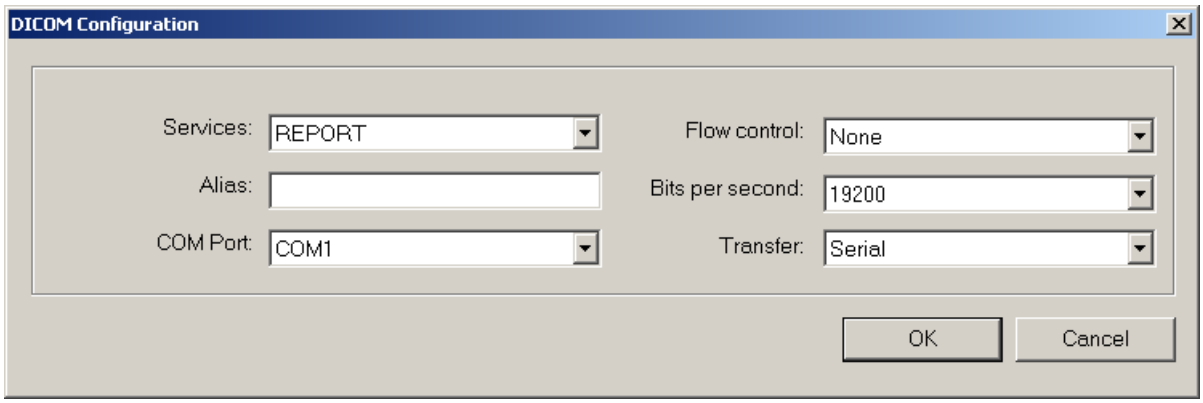

When configuring a DICOM Printer there are several additional choices to be made. The most important field in this dialog is the one named “Copies.” Here set the number of times the data should be printed. Another important item is “Print Format” which determines how many images are printed on a page. Here set how many images are printed in each row, i.e., how many columns there are, and how many rows shall be printed on one page. In the above example, “2x3” means that 2 images will be printed in each of the 3 rows per page, i.e., that 6 images fit on one page. Most of the time all other fields can be left unchanged.

### 23.1.7 Adding or Editing a Report Server




When configuring a report server, the first choice to be made is whether to use a network or the serial port. Use the "Transfer" pull-down menu for this selection.

If "Serial" is selected the dialog is changed to look like in the image below:

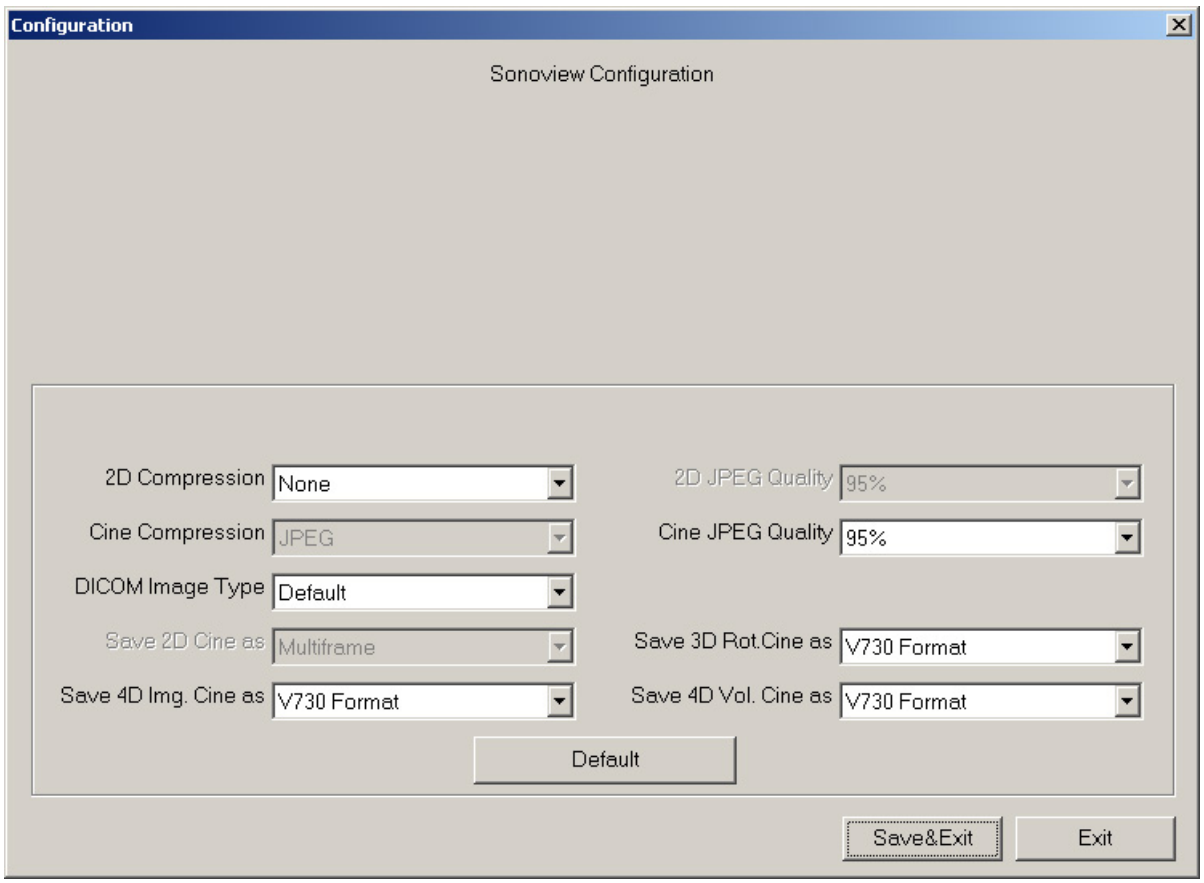



**COM port:** Select the number of the COM port the data will be sent to.

**Flow control:** Select between "None"(default) and "Hardware".

**Bits per second:** Select the appropriate number of bits per seconds to be sent (baud rate).

## 23.2 SonoView Configuration




Open this dialog by going to "Settings" - "DICOM/SonoView Configuration". Here press the "SonoView Configuration" button at the bottom.

The settings here influence the way images, cines and volumes are stored in SonoView.

**2D Compression:** Select the type of compression used when storing images in SonoView. If *"JPEG"* (Glossary) is selected, the images are sent *JPEG compressed* (Glossary). If "None" is selected, the images are sent uncompressed.

**2D JPEG Quality:** This selection is only available if "2D Compression" is set to *"JPEG"* (Glossary). It sets the compression quality for images sent to this DICOM server. If "100%" is selected, lossless compression is used, i.e. the files become smaller, but no quality is lost. If less than 100% is selected, a warning appears. The reason for this is that now lossy compression is used, which means that the image quality is reduced. The use of lossy *JPEG compression* (Glossary) is also indicated in the sent image. A small, yellow indicator appears at the top left corner of the sent image (only ultrasound images, not patient dialog or report). It displays a J for *JPEG compression* (Glossary) and a number (95,90,85 or 80) indicating the compression quality.

**Cine Compression:** Choose which type of compression is used for storing cines (2D Cine, *3D Rot. Cine* (Glossary) as Multiframe and *4D Img. Cine* (Glossary) as Multiframe). Currently, *"JPEG"* (Glossary) is the only available option.

**Cine JPEG Quality:** Set the compression quality for cines sent to this DICOM server. If "100%" is selected, lossless compression is used, i.e. the files become smaller, but no quality is lost. If less than 100% is selected, a warning appears. The reason for this is that now lossy compression is used, which means that the image quality is reduced. The use of lossy *JPEG compression* (Glossary) is also indicated in the sent image. A small, yellow indicator appears at the top left corner of the cine sent. It displays a J for *JPEG compression* (Glossary) and a number (95,90,85 or 80) indicating the compression quality.

**DICOM Image Type:** Select "secondary capture" in order to store all 2D images as DICOM secondary capture.

**Save 2D Cine as:** 2D Cines are not available in 4D View.

**Save 3D Rot. Cine as:** Choose between "V730 Format" and "Multiframe". "V730 Format" can be reloaded into 4D View or a Voluson 730 series machine, but cannot be read by a DICOM server. "Multiframe" means that a "movie" of the cine is saved, similar to a 2D cine. It cannot be reloaded into 4D View or a Voluson 730 series machine. However, it can be displayed in SonoView as well as most DICOM servers. This setting should be used if wanting to send to a DICOM server from SonoView after saving.

**Save 4D Img. Cine as:** Choose between "V730 Format" and "Multiframe". "V730 Format" can be reloaded into 4D View or a Voluson 730 series machine, but cannot be read by a DICOM server. "Multiframe" means that a "movie" of the cine is saved, similar to a 2D cine. It cannot be reloaded into 4D View or a Voluson 730 series machine. However, it can be displayed in SonoView as well as most DICOM servers. This setting should be used when wanting to send to a DICOM server from SonoView after saving.

**Save 4D Vol. Cine as:** *4D Volume Cines* (Glossary) are always saved as "V730 Format".

There is also the "Default" button available. It adjusts all settings to the recommended values.

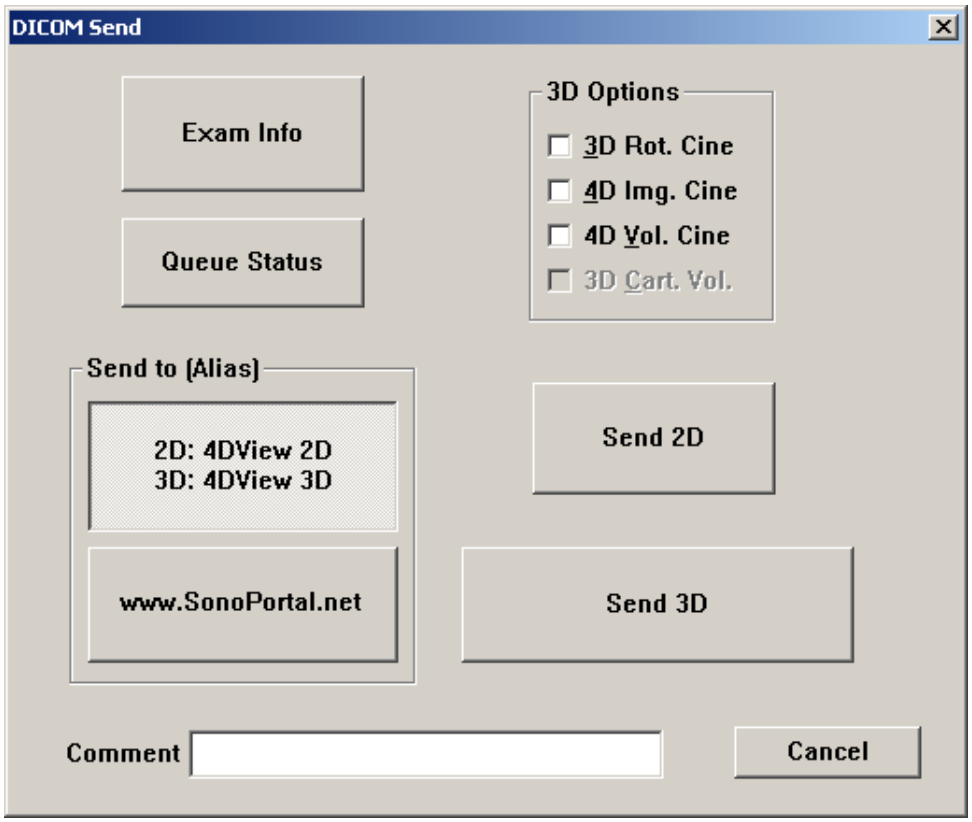
## 23.3 DICOM Send

With a click on this button in the toolbar begin sending volumes and images over a *DICOM* (Section 3.7) connection.

Choose the destination where to send the volumes and images to in the *"DICOM Configuration"* (Section 23.1) dialog box, which is invoked through the *"Settings" menu* (Section 5.4), or by clicking on the "Alias" button, which displays the alias name of the currently selected remote DICOM device (e.g., labeled "2D: 4DView 2D; 3D: 4DView 3D" in the dialog shown below). The designated device to send data to must provide a "STORE" or a "STORE3D" service, e.g. *the Storage SCP* (Section 23.7) of the 4D View. Therefore, only destinations in the "DICOM

Configuration" dialog can be selected that display "STORE" or "STORE3D" in the "Services" column.

In order to select a destination, place a checkmark on the corresponding line in the "DICOM Configuration" dialog.




### 23.3.1 Exam Info

Click the "Exam Info" button to edit the given *patient and exam data* (Section 22.1.3). The "Patient and Exam Info" dialog appears.

### 23.3.2 Queue Status

Click the "Queue Status" button and the status of the *DICOM transfer queue* (Section 23.5) is displayed. See *"DICOM Transfer Status"* (Section 23.5).

### 23.3.3 3D Options

Select one of the three "3D Option" for sending volumes over a DICOM connection. In the volume file a *"3D Rotation Cine,"* (Glossary) *"4D Image Cine"* (Glossary) or *"4D Volume Cine"* (Glossary) sequence can be included, if these are available. Also, the volume can be sent in "Cartesian" format.

**Note:** How many files are generated depends on the settings of the "Store" and "Store3D" server. (See *"DICOM Configuration"* (Section 23.1)). If "V730" format is used, *"3D Rotation Cine,"* (Glossary) *"4D Image Cine"* (Glossary) and *"4D Volume Cine"* (Glossary) will be included in one file. However, if "Multiframe" is used, a seperate file has to be generated for each Multiframe object. So if for example, *"3D Rotation Cine,"* (Glossary) and *"4D Image Cine"* (Glossary) are sent as multiframe together with a *"4D Volume Cine"* (Glossary). Three files are generated, one for each of the two multiframe objects and one for the *"4D Volume Cine"* (Glossary).

### 23.3.4 Select a DICOM Destination

**Send to (Alias)** (general case):

Here the alias name of the 2D and 3D DICOM destination is displayed, if one has been specified in the *"DICOM Configuration"* (Section 23.1) dialog box. If no DICOM destination is specified, the "Send 2D" and "Send 3D" buttons are disabled and the "Send to [Alias]" button displays: "2D: not defined; 3D: not defined." In order to select a DICOM destination in the *"DICOM Configuration"* (Section 23.1) dialog, click on the first (Alias) button and the "DICOM Configuration" dialog opens. Select one of the devices marked with "STORE" or "STORE3D" by placing a checkmark in the appropriate line. If no device fitting this description is available add one by pressing the "Add" button and entering the appropriate information.

If only a "STORE" server is selected in the DICOM configuration dialog, both "Send 2D" and "Send 3D" are enabled and the "Send to [Alias]" button reads: "2D: [Alias]; 3D: not defined." Both 2D and 3D data are sent to the specified "STORE" server.

If only a "STORE3D" server is selected in the DICOM configuration dialog, "Send 2D" is disabled, "Send3D" is enabled and the "Send to [Alias]" button reads: "2D: not defined; 3D: [Alias]." 3D data is sent to the specified "STORE3D" server.

If both, a "STORE" and a "STORE3D" server are selected in the DICOM configuration dialog, both "Send 2D" and "Send 3D" are enabled and the "Send to [Alias]" button reads: "2D: [Alias]; 3D: [Alias]." 2D data is sent to the specified "STORE" server and 3D data is sent to the specified "STORE3D" server.

For more information on sending the image/volume to the DICOM destination chosen, see *"Send 2D / Send 3D"* (Section 23.3.5).

**www.SonoPortal.net**:

If registered as a 3DSono Senior Member at http://www.sonoportal.net, personal volumes or images can be sent directly to this website.

When using this service the first time, enter the "AE-Title" aquired during membership registration. For entering the "AE-Title" please click the "www.SonoPortal.net" button again and enter the registered AE-Title.

For more information on sending the image/volume to this specific homepage see *"Send 2D / Send 3D"* (Section 23.3.5).

The volume/image is stored automatically in one's personal homepage and in the volume/image library at http://www.sonoportal.net.

**Attention**

*In order to ensure the privacy of patient data, patient names are removed in the transfer process. By sending volumes/images to http://www.sonoportal.net , the data will be compressed (volumes up to 1:40, images with JPEG) automatically in order to speed up the internet transfer!*

*It is not allowed to use these datasets for diagnostic purposes - this is prohibited by law.*

### 23.3.5 Send 2D / Send 3D

Choose whether to send only an image by choosing "Send 2D," or an additional GEMS Kretztechnik volume file, by using "Send 3D."

If the "Send 2D" and "Send 3D" buttons appear disabled, a DICOM destination must be selected in the *"DICOM Configuration"* (Section 23.1) dialog box first.

### 23.3.6 Adding a Comment

A comment can be added by simply typing a message in the "Comment" field of the dialog box.

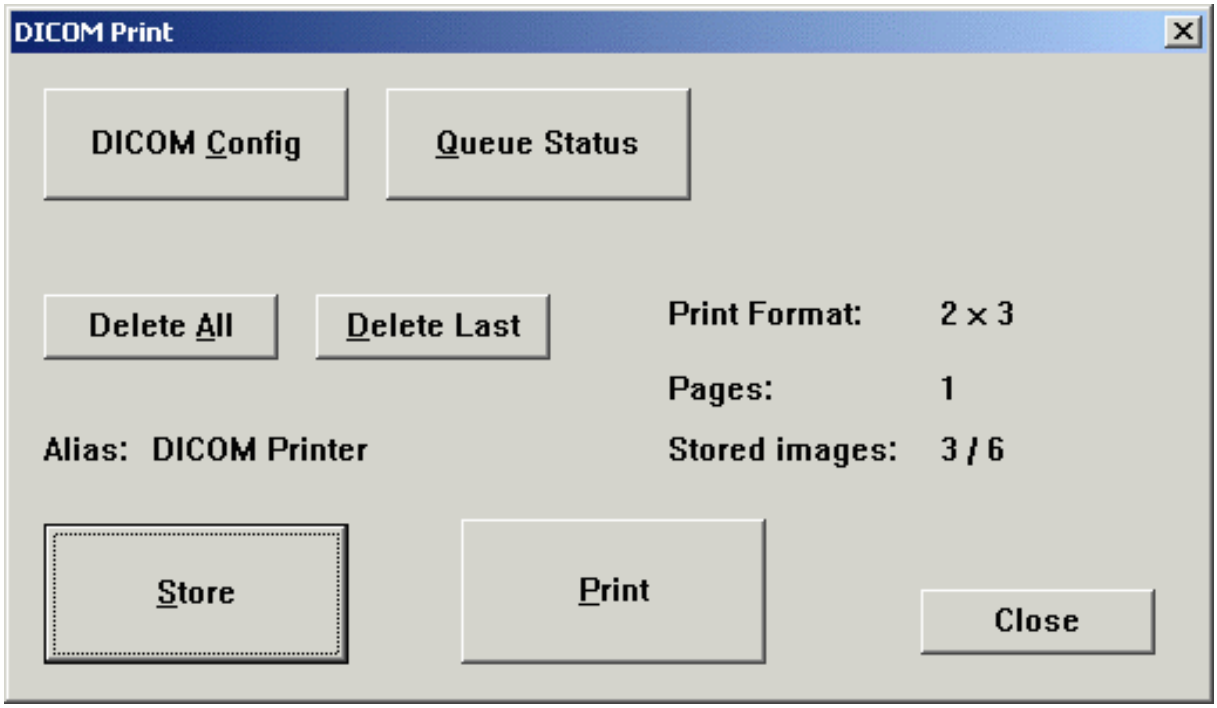
## 23.4 DICOM Print

Click on this button in the toolbar to print images on a *DICOM* (Section 3.7) printer.

Choose the destination where to print the images in the *"DICOM Configuration"* (Section 23.1) dialog box, which is invoked through the *"Settings" menu* (Section 5.4), or by clicking on the "DICOM Config" button (in the "DICOM Print" dialog shown below). The designated device must provide a "PRINT" service. Therefore, only devices in the "DICOM Configuration" dialog which display "PRINT" in the "Services" column can be selected.

In order to select a printer, place a checkmark on the corresponding line in the "DICOM Con-

figuration" dialog. If no device providing a "PRINT" service is available, add one by pressing the "Add" button and entering the appropriate information.




By clicking the "Store" button, store as many images as desired.

The following information will be provided:

**Print Format:** 2x3 (depending on "Printer Setup")

**Stored Images:** 3/6 (3 images are currently stored, and 6 per page are possible with the selected "Print Format")

**Pages:** 1 (Number of pages which will be printed. E.g., to print 12 images, and 6 are placed on one page, 2 pages will be printed.)

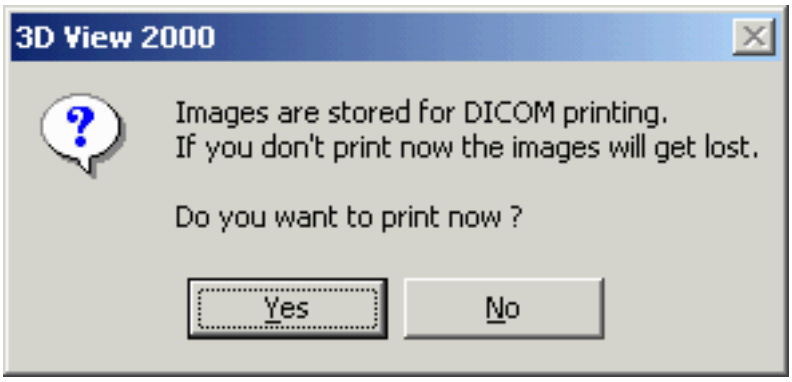
For information on changing the "Print Format" please review: *"DICOM Configuration"* (Section 23.1).

If desired, delete either "All" or just the "Last" stored image.

When storing images is completed, print them to the DICOM printer by clicking on the “Print” button.

**Remark:**

If the current exam is ended before printing all the stored images on the DICOM printer, the following message appears:




Choose either to print the remaining stored images or to discard the remaining stored images.

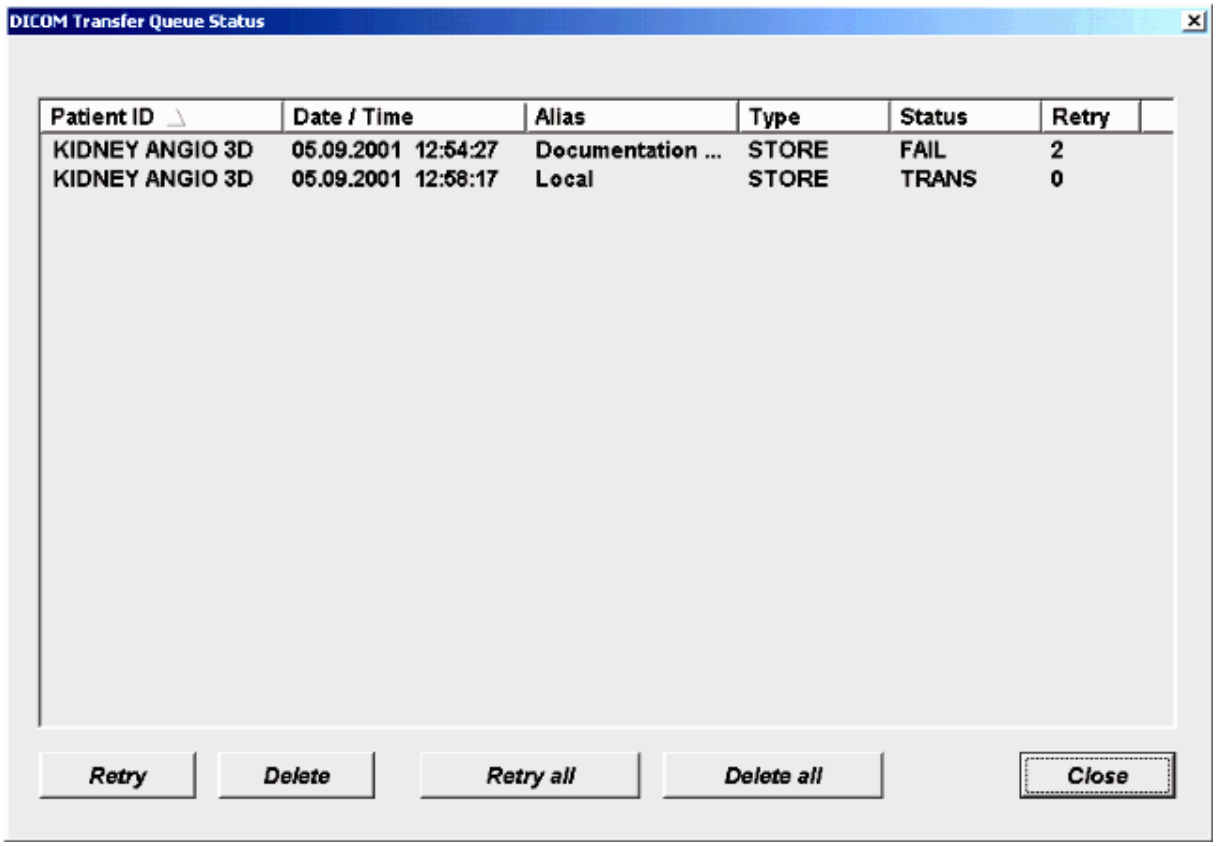
**Queue status**

Click the “Queue Status” button to display the status of the *DICOM transfer queue* (Section 23.5).

## 23.5 DICOM Transfer Status

Enter the “DICOM Transfer Status” window by clicking the “Queue Status” button in the *“DICOM Send”* (Section 23.3) or the *“DICOM Print”* (Section 23.4) dialog box.

In this window the status of all DICOM messages can be viewed that have not yet been successfully transferred yet.




When a DICOM transfer is in progress its status is "TRANS."
When a DICOM transfer has been successfully finished, the entry for this transfer disappears from the window.
A reminder occurs only for the transfers which have not yet been completed. They have the indication "FAIL."

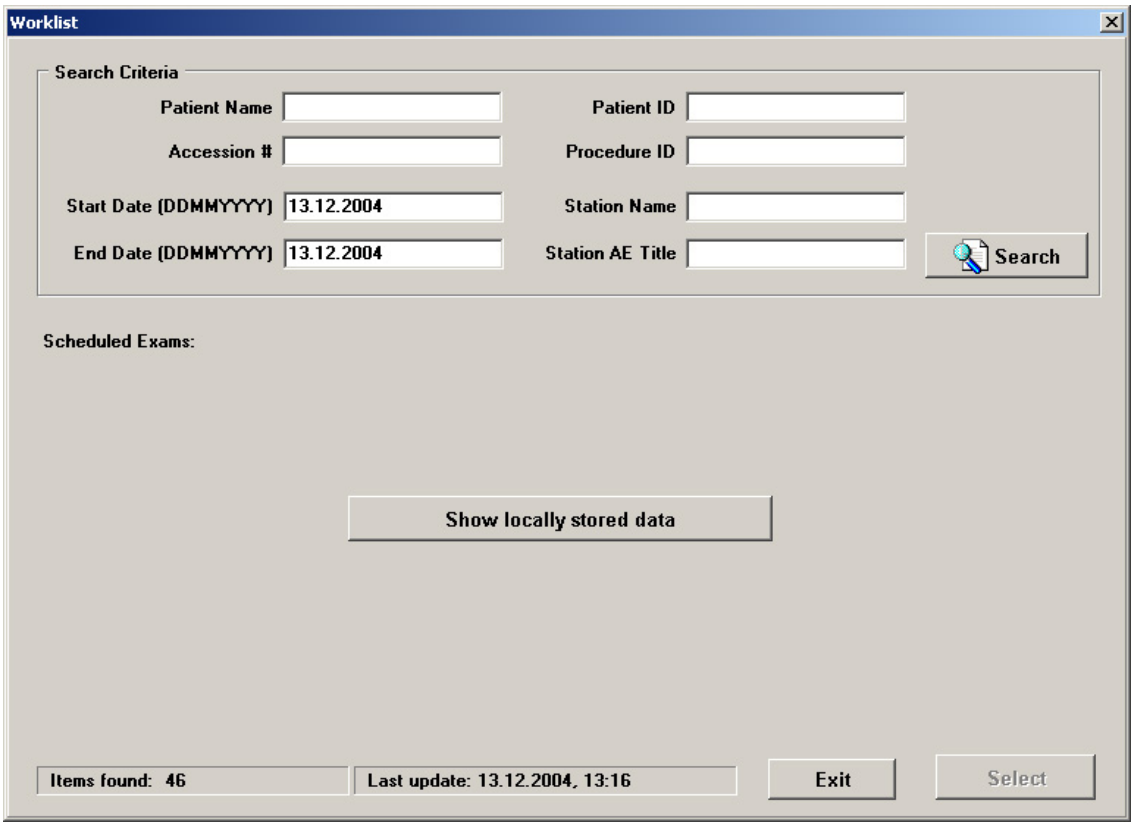
## 23.6 DICOM Worklist

With the "DICOM Worklist" function of 4D View, data of patients can be retireved from a DICOM worklist server.

Enter the "DICOM Worklist" window via the *"Patient and Exam"* (Section 22.1.3) dialog box by clicking the "Worklist" button situated in the upper third of the dialog box.

The device from which data is retrieved must provide a "WORKLIST" service. Therefore, only select devices in the *"DICOM Configuration"* (Section 23.1) dialog that display "WORKLIST" in the "Services" column. If no DICOM worklist server is selected in the *"DICOM Configuration"* (Section 23.1) dialog, the "Worklist" button is disabled. If this is the case, select an appropriate device first. In order to select a source, place a checkmark on the corresponding line in the *"DICOM Configuration"* (Section 23.1) dialog. If no device providing a "WORKLIST" service

is available, add one by pressing the "Add" button and entering the appropriate information. The settings for the DICOM worklist server can also be edited in the *"DICOM Configuration"* (Section 23.1) dialog box.




Using the entry fields in the upper part of the dialog box, the search can be narrowed. For example, enter a "Patient Name," a "Start Date," and an "End Date." When this information is entered, only data of patients with that particular name between the two given dates will be displayed in the list below. If a "Modality" of "ULTRASOUND" is selected in the *"DICOM Configuration"* (Section 23.1) dialog, only data marked with "ULTRASOUND" will be retrieved from the server.

The button "Show locally stored data" is available if old worklist data from a previous request exists. The date and time in the "Last updated:" field gives the date and time the currently used worklist data was retrieved.

To retrieve new worklist data press the "Search" key, to use the old worklist data from the hard disk press "Show locally stored data."

The data to retrieve can be selected in two ways. Either select an exam from the list with the left mouse key and then click the "Select" button, or, select the exam by double-clicking.

After selecting an exam, the data of this exam will be copied into the corresponding fields of the *"Patient and Exam"* (Section 22.1.3) dialog box.

## 23.7 DICOM Storage Service Class Provider

With the "DICOM Storage Service Class Provider" (Storage SCP), the PC can receive DICOM volumes from another PC with 4D View or from a GEMS Kretztechnik Voluson® 730 series ultrasound scanner.

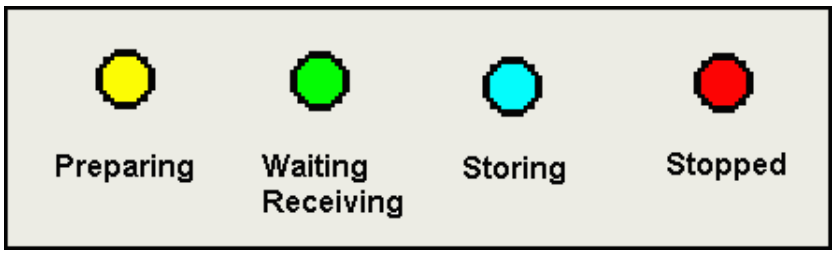
**Hint:** If the "Storage SCP" is running and shows its activity by displaying a green circle in the status area of the task bar of Windows 2000® but obviously does not store data, i.e., the sent images do not appear in the *"Exam List"* (Section 22.3.2) of SonoView™, check if there is enough free disc space available. In order to work properly with the Storage SCP, about 200 MB of free disc space is required.

### 23.7.1 Starting the DICOM Storage SCP

The Storage SCP is an application which can be used independently from 4D View, therefore it is initialized from the Windows 2000® Start Menu. Click the "Start" button at the lower left corner of the Windows 2000® screen. In the lower part of the "Start" menu is the menu item "Programs." Move the mouse cursor over this menu item and look for the program group "4D View." From this program group start the Storage SCP.

The Storage SCP shows its activity by a colored circle in the status area of the task bar, which is normally situated at the lower right corner of the Windows 2000® screen.

### 23.7.2 The Colors and Status of the Storage SCP




### 23.7.3 Controlling of the Storage SCP

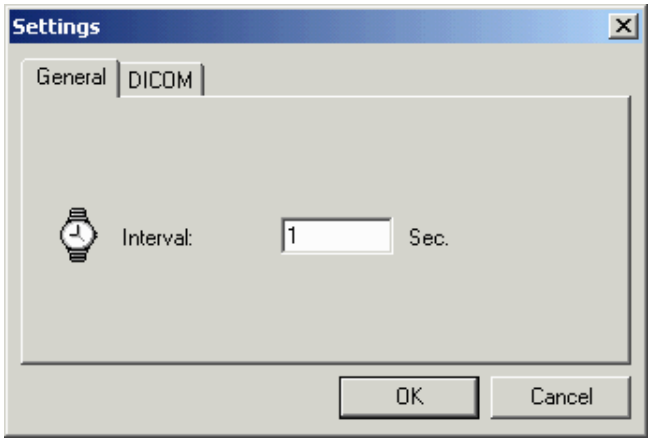
When the Storage SCP is running control it by clicking on its icon with the right mouse button. A small menu appears to choose to stop or to exit the program.

### 23.7.4 Settings of the Storage SCP

Only when the program is stopped and the circle is red, can the "Settings" menu of the Storage SCP be entered. (This has nothing to do with the "Settings" menu of 4D View.)

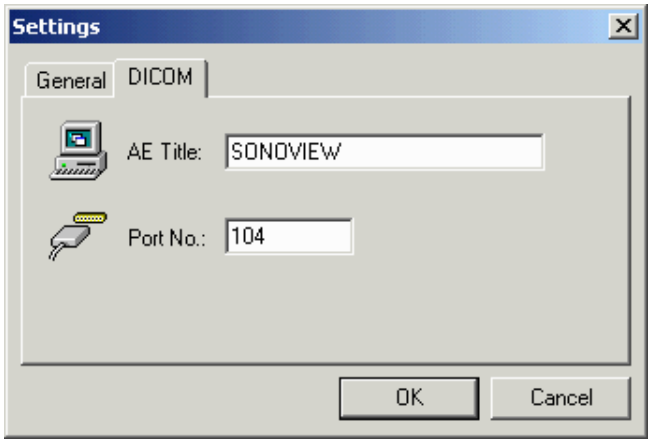
In the "Settings" part of the Storage SCP there is one page for "General Settings" and one page for "DICOM Settings."

#### General Settings




Here, the time interval can be changed for the Storage SCP searching of whether a DICOM sender is waiting for processing. This time interval must be matched with the timeout interval of the DICOM sender. The time interval of the Storage SCP must be shorter than the timeout interval of the DICOM sender.

#### DICOM Settings



Here, the DICOM specific settings of the Storage SCP can be changed.

**AE-Title** is the "Application Entity Title" of the Storage SCP.
The **Port Number** is the number of the PC's communication port at which the Storage SCP communicates with the DICOM sender.

## 23.8 Report Transfer

Worksheet data can be sent from 4D View to a server designed to receive measure reports in a special format. The data can be sent over the network or via the computer's serial port.

*Technical detail: Using a network the data is sent using low-level DICOM.*

### 23.8.1 Preparing Worksheet Data

- Enter the patient's data in the *"Patient and Exam"* (Section 22.1.3) dialog. Invoke this dialog through the *"Edit" menu* (Section 5.2), or with the "Person" button in the *toolbar* (Section 5.3.4).

- An exam must be started with at least one calculation measurement completed, or a previously saved worksheet must be restored.
- A connection for a report transfer must be registered in the *"DICOM Configuration"* (Section 23.1) dialog. The designated device must provide a "REPORT" service. Therefore, only devices in the *"DICOM Configuration"* (Section 23.1) dialog can be selected that display "REPORT" in the "Services" column.

### 23.8.2 Sending Worksheet Data

When there is worksheet data available, the button "Transfer Data" is visible at the bottom of the *worksheet* (Section 15.1) menu.

The status and result of the transfer can be seen in the *"DICOM Transfer Status"* (Section 23.5) window, entered through the *"DICOM Send"* (Section 23.3) dialog box.

### 23.8.3 Receiving Report Data

An example for software that can receive and store reports from 4D View is the PIA documentation system for medical diagnostics and digital image archiving from ViewPoint (http://www.viewpoint-online.com).

## 23.9 www.SonoPortal.net

http://www.sonoportal.net provides a platform for physicians, ultrasound specialists and any other interested person in medical ultrasound. Its objective is to support the communication and knowledge exchange of ultrasound experts world-wide.

Benefits for members are:

- Access to all data including:
  - PubMed database
  - Teaching course
  - All images/volumes/movies/case reports provided by our members
  - Member forum
  - Download section
- A free personal homepage including: (for Senior Members only)
  - Image gallery
  - Volume gallery
  - Movie gallery
  - Case reports
  - Pages to add additional information

The 4D View software version enables sending of V730 series volumes/images directly from a PC to http://www.sonoportal.net(Senior Membership is required), where any member of the portal can view and discuss your uploaded demo cases.

For further information about this website, please visit http://www.sonoportal.net and register for a **free membership**!

# Chapter 24

# Glossary

**3D Rotation Cine** A 3D Rotation Cine is an animated rotation of the rendering of a static 3D volume. The rendering can be rotated around the x or y axis, and an angle for the rotation can be chosen as well as a start and end image. A 3D Rotation Cine can be calculated using a Voluson 730, 730 Pro, 730 Expert and 4D View.

**4D Image Cine** A 4D Image Cine consists of a number of images and one volume. The images document a 4D aquisition process and the volume is the last volume aquired during this process. The volume can be edited just as any other static 3D volume. The images can not be edited after aquisition. 4D Image Cines can be generated in Realtime 4D mode using a Voluson 730, 730 Pro and V730 Expert.

**4D Volume Cine** A 4D Volume Cine consists of up to 128 volumes aquired with a Voluson 730 Expert in Realtime 4D, Fetal Cardio, VCI A or C, or 4D Biospy mode. Each volume can be edited as any static 3D Volume. A 4D Volume Cine contains all the data aquired during aquisition.

**JPEG** JPEG is an acronym for the Joint Photographic Experts Group. It is referred to as a "joint" group because this committee is sanctioned by the CCITT and the ISO, two prominent international standards groups. JPEG refers both to the committee and their work in progress - a compression standard that will define a method for compressing photographic images. Images compressed with the JPEG algorithm undergo a "lossy" compression. The amount of compression can be varied, with a resulting loss or gain in resolution. JPEG compression can achieve impressive compression ratios, reducing the memory required by images to less than 10 % of the size of the original with only very slight loss of resolution. By sacrificing more resolution images can be compressed by 95 % or more using JPEG.

**Region of Interest (ROI)** ROI designates Region Of Interest. A synonym for ROI is "render box."

**SonoPortal** http://www.sonoportal.net provides a platform for physicians, ultrasound specialists and any other interested person in medical ultrasound. Its objective is to support the communication and knowledge exchange of ultrasound experts world-wide.

Benefits for members are:

- Access to all data including:
  - PubMed database
  - Teaching course
  - All images/volumes/movies/case reports provided by our members
  - Member forum
  - Download section
- A free personal homepage including: (for Senior Members only)
  - Image gallery
  - Volume gallery
  - Movie gallery
  - Case reports
  - Pages to add additional information

The 4D View software version enables sending of V730 series volumes/images directly from a PC to http://www.sonoportal.net(Senior Membership is required), where any member of the portal can view and discuss your uploaded demo cases.

For further information about this website, please visit http://www.sonoportal.net and register for a **free membership**!

**Ultrasound Units** Units calculated with a velocity of sound of 1540 m/s in beam direction.

**VOCAL II** ™ is an acronym for Virtual Organ Computer-aided AnaLysis

The diagnosis and therapy of cancer is one of the most important issues in medical care. The new VOCAL™ - Imaging program is an extension of the 4D View software, integrated in GEMS Kretztechnik's Voluson® 730 series sonography system and also available for the PC. It opens up completely new possibilities in cancer diagnosis, therapy planning and follow-up therapy control. VOCAL™ offers different functions:

- Construction of a virtual shell around the contour of the lesion. The thickness of the shell can be defined. The shell can be imagined as a layer of tissue around the lesion, where the tumor-vascularization takes place.
- Automatic calculation of the vascularization within the shell by 3D color-histogram, comparing the number of color voxels to the number of gray-scale voxels.

The follow-up control of tumor volume and vascularization delivers information on the proper dose of medication or radiation and therefore a measure for the success of treatment.

After definition of a contour in 3D space a wide range of functionality is given:

- Definition of a shell contour.
- Visualization of a (shell) contour as a surface or wire mesh.
- Volume calculation of a (shell) contour.
- Histogram calculation of ultrasound tissue inside a (shell) contour.

- Visualization of ultrasound tissue inside a (shell) contour as a rendered image.
- Niche presentation of contour and slices.
- Shell map presentation of ultrasound tissue inside a (shell) contour.

**Voxel** A voxel is the smallest unit of a given 3D dataset. In comparison, the smallest unit of an image is a pixel.

# Chapter 25

# Appendix

## 25.1 Trademarks

Voluson® is a registered trademark of GE Medical Systems Kretztechnik, GmbH & Co., OHG, Austria.

VOCAL™ is a trademark of GE Medical Systems Kretztechnik, GmbH & Co., OHG, Austria.

SonoView™ is a trademark of Medison Co., Ltd., Korea.

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Pentium™ is a trademark of the Intel Corporation.

GEMS Kretztechnik is the short form of GE Medical Systems Kretztechnik GmbH & Co OHG.

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