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*Meet Your Anatomy™*

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# InVivoDental™ 4.1

## Reference Manual



Invivo.exe

Meet Your Anatomy™



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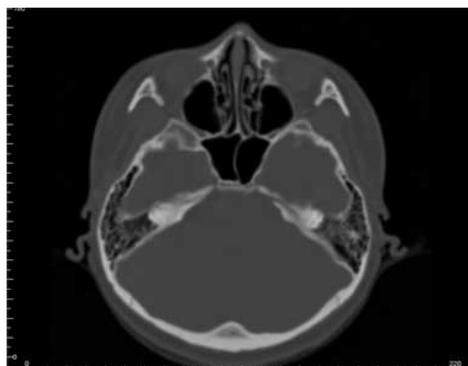
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## Background

### *History of Computed Tomography*

Computed Tomography machines were the first imaging devices for detailed visualization of the internal three-dimensional anatomy of living creatures. Developed in 1972 by Sir Godfrey Newbold Hounsfield, they initially only served as a tomographic reconstructions of slice views or sections. Since the early 1990s, with advances in computer technology and scanners using spiral CT technology, internal three-dimensional anatomy is viewable by three-dimensional software reconstructions, from multiple perspectives, on computer monitors. By comparison, conventional radiology images show only compressed two-dimensional images of complex anatomy, i.e. radiodensity shadowed projections on acetate film. Introduced in the United States in 2000, Cone Beam CT radiograph machines have presented a valuable way to acquire a three-dimensional image with a fraction of the radiation dose of traditional CT machines. The implications and applications of this technology are very exciting.



## Introduction

### *InVivoDental Imaging Software*

Anatomage, Inc. is a medical imaging company composed of a cross functional team consisting of the most elite researchers, mathematicians, engineers, software developers, business analysts, industry leaders, academic faculty, and dental specialists. We believe that InVivoDental software will enable the profession to initiate a revolution of unimaginable scope and magnitude. Ultimately, our mission is dedicated to developing software specially designed for dentists to be simple and refined, yet utilizing the most advanced cutting edge software and technology to better serve their patients. With InVivoDental software, doctors can create 3D volume renderings on their own computers, print, and save various images. The software is designed to reconstruct these 3D volume renderings from DICOM files generated by CBCT, Medical CT MRI radiography machines.

# System Requirements

*Below are the minimal and recommended system configurations.*

Having an adequate computer system is essential to being able to use InVivoDental software efficiently as well as being able to generate the highest quality images possible for enhanced analysis and presentation for your patients and colleagues.

## Minimum Requirements

- Display 1280x1024 display size
- CPU Pentium IV 2.4 MHz
- RAM 1 GB
- HDD 10GB
- Graphics Card nVidia or ATI made within the last years
- OS Windows XP, Vista, Windows 2000

## Recommended Notebook System

- Display 15.4" capable of 1280x1024 display size
- CPU Intel Core Do 2.4 GHz or higher
- RAM 2GB
- HDD 80 GB (7,500 RPM or faster)
- Graphics Card nVidia GeForce Go 9800 with 512MB memory or better
- OS Windows XP

## Recommended Desktop System

- Display 19" or larger capable of 1280x1024 display size
- CPU Intel Core 2 E8500 (3GHz) or faster
- RAM 2 GB
- HDD 100 GB (7,500 RPM SATA or faster)
- Graphics Card nVidia GeForce 8800 with 256MB memory or better
- OS Windows XP

### Notes:

- The most important element is the video card (3D graphics chip or GPU).
- If the system does not have the right video card, you can purchase and install the video card to upgrade your desktop computer.

# Feature List

*An overview of the various features provided by InVivoDental.*

- **Directly opens DICOM data from any CT machine**
- **Section and Multislice View Operations**
- **Volume Rendering of scan data**
- **Linear, Angular, Circomfrontial, Area and Volumetric Measurements**
- **Image Capture and Export**
- **AVI (Movie) Capture and Export**
- **Implant Treatment Planning**
- **Bone Density Evaluation**
- **Panoramic, Cephalometric, TMJ, and other X-Ray Reconstruction**
- **InVivo File Compression**
- **Superimposition and Mirroring**
- **Platform for the AnatoModel service**

# Software Layout

The following is a description of how InVivoDental is organized by Menu Bar, Tool Bar, Specialty Tabs, Dialogue Bar, and Active Window.

## Menu Bar

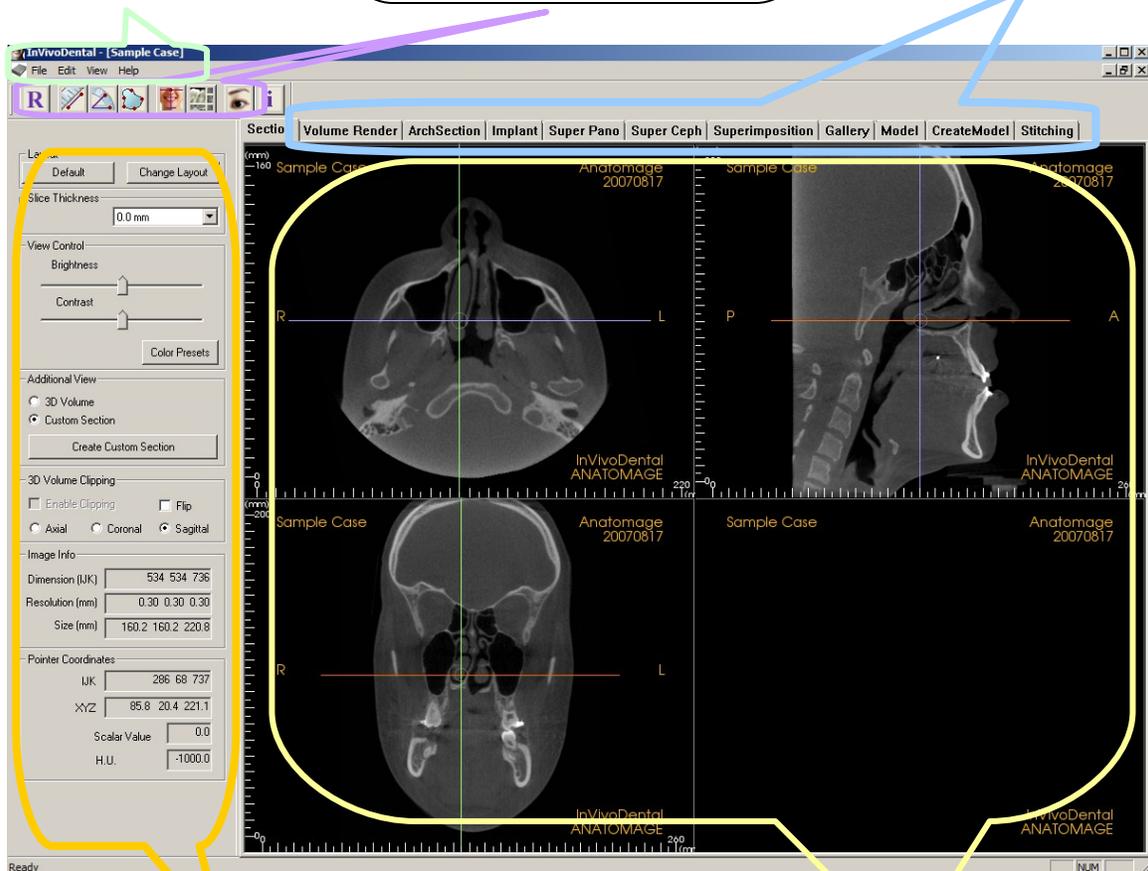
The Menu Bar allows you to perform application operations such as open, save, close, print, capture, etc.

## Toolbar

Tools can be accessed to perform certain functions on patient images. Sets of tools are associated with a specific **View Tab**.

## View Tabs

The view tabs allow you to select different views to perform a specific task or subject of interest.



## View Control

View control is the region where patient images can be manipulated and controlled. A view control is associated with a specific **View Tab**.

## Rendering Window

Rendering Window is the region where patient images are displayed. This window can be customized within many of the **View Tabs** by using the **Toolbar**.

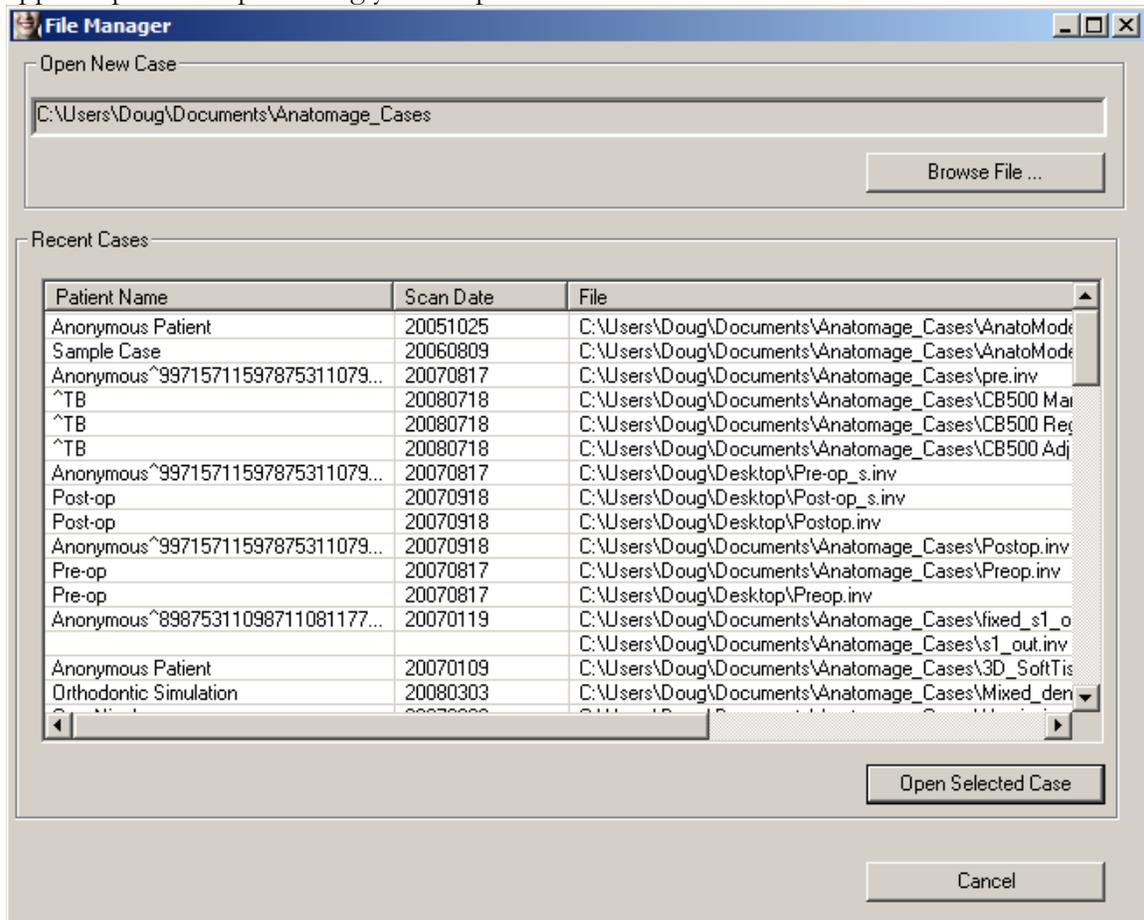
# Basic Features

The following is a detailed explanation of the various features provided by InVivoDental.

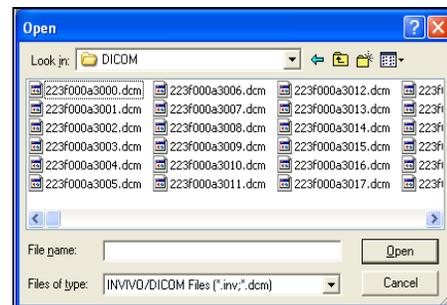
ICON KEY	
	Valuable tool or information
	See glossary for further

## DICOM & InVivo File Loading with the File Manager

To open a DICOM data set, first launch the InVivoDental software. The File Manager will appear upon startup allowing you to open the data.



Click the Browse File box to manually search for the data you would like to open. If you are opening DICOM data, as shown to the right, simply highlight one of the .dcm files and click open. It does not matter which DICOM file you choose, just click one and the software will open all related ones for that data set. If you are opening an InVivo file just click it and press open.



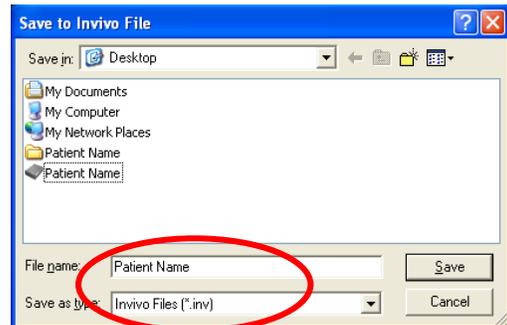
The File Manager allows you to automatically store and reopen recently viewed cases. This allows for quicker access to current cases. The automatic saving of the files is placed in a folder in your “my documents” folder called “Anatamage\_Cases”. This location can be changed or turned off completely in the following location of the software: Menu Bar/File/Preferences/File Manager.

If you close a case and want to reopen another one, click on Menu Bar/File/Open and the File Manager will appear again.

### InVivo File Saving

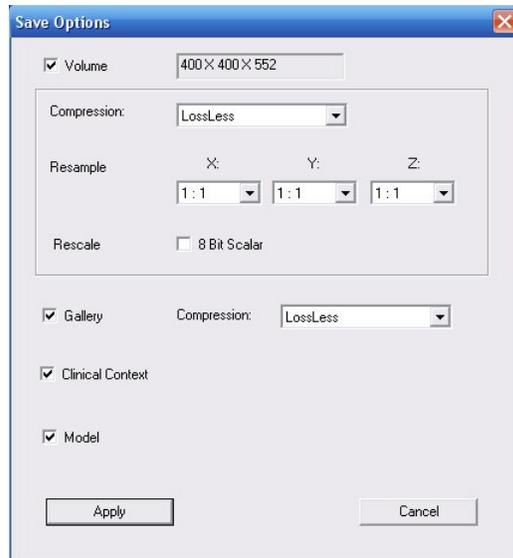
The following work can be saved as an InVivo File .

- Case Information & Patient Orientation
- Traced Nerve Pathways
- Implants & Implant Measurements
- Volume Measurements & Landmarks
- Images captured within the Gallery



Click “File”, “Save as”, browse to the area you would like to save, name the file (default is the patient’s name) then click “Save.”

The following save dialogue box will show up. Select the default “All” option for saving everything without losing any information. Select ”Implant Only” for saving only implants information. This will be used for sending the implant planning to labs for fabricating guides.



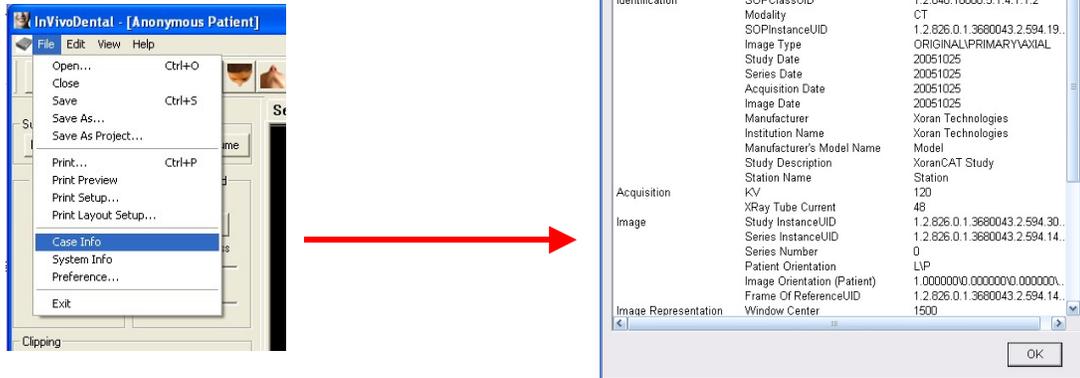
### Custom Saving Dialogue

By selecting “Customize” option, the custom saving dialogue shows up. In the dialogue box, one can selective save difference components of the data or compress the data. For the main volumetric image, one can select to save it lossless compression or lossy compression. With lossless compression, the volume is compressed in about 1/3rd – 1/4th of original size. With the lossy compression option, the file size can be dramatically reduced but the image is altered. Even

though the change is so subtle it is hard to notice in comparison, one should be careful to understand the liability associated with altering the image.

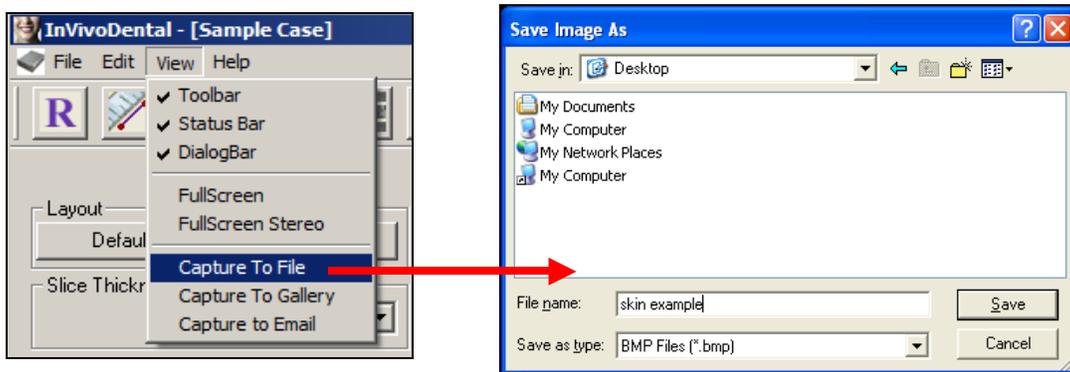
## Case Information Display

To display or hide the Case Information for a specific patient, go to the “File Menu,” click “Case Info.” Click “Anonymize,” to rename information for privacy, Click “OK” to end the edit function.



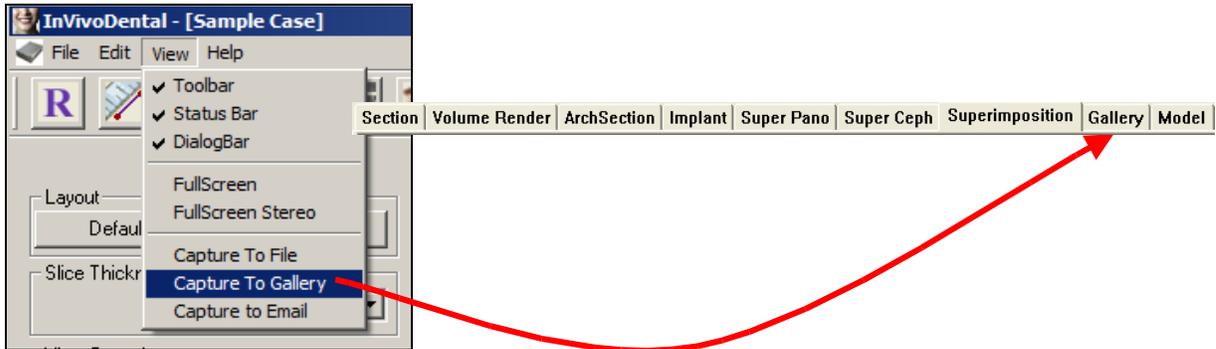
## Image Capture to File

★ To capture an image of the active display click “view,” then “Capture to File.” Browse to the location where you want to save the image, type the name of the file, choose the file “Save as type”, and click “save”. The file can be saved as bmp, jpg, or png format. Jpg is the most popular file format for image but there is a small amount of color degradation. Bmp preserves the image, but the file size is big. .png is effective lossless format that does not degrade the color.



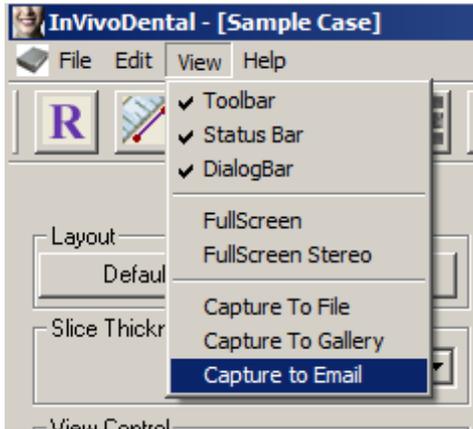
## Image Capture to Gallery

- Selecting “Capture To Gallery” will capture an image of the active display and save it to the Image List (see **Gallery View** Features for additional information).



## Image Capture to an Email

- Selecting “Capture To Email” will capture an image of the active display and attach it to an email ready to send.



# Image Navigation

*Below is an explanation showing how to manipulate images in the Rendering window with the keyboard and mouse.*

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## ICON KEY

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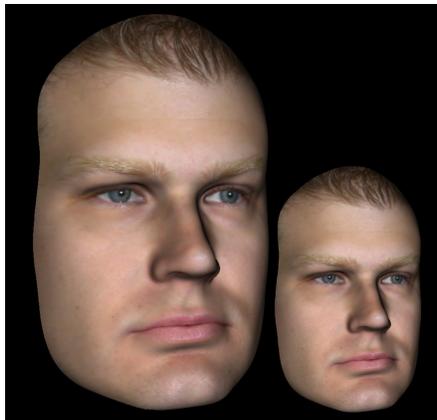
-  Keyboard navigation required
  -  Mouse navigation required
- 

### Slider Bar Scroll



- Click the mouse cursor over any slider bar (e.g. axial slice, brightness, etc.) of the image you want to adjust.
- Keep the mouse cursor over the slider bar, “**scroll the mouse wheel**” forward or backward to achieve the image adjustment you like.

### Zoom In/Out



- Place the mouse cursor in the center of the image you want to zoom.
- Hold down the “**Control + left-button**” on the mouse.
- While holding down the buttons indicated above, move the mouse toward or away from you. This shrinks/enlarges the image: **Down vertically , Zooms Out. Up vertically, Zooms In.**

## Pan (Shift)



- Place the mouse cursor in the center of the image you want to shift.
- Hold down the “**Shift + left-button**” on the mouse.
- While holding down the buttons indicated above, move the mouse **any direction** to achieve the desired image displacement.

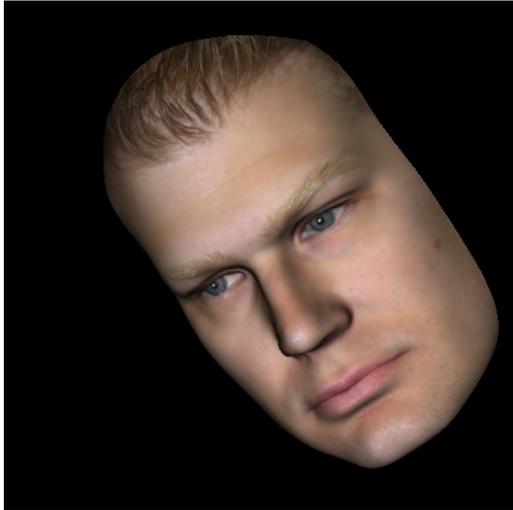
## Free Rotate

*Only applicable for 3D Images.*



- Place the mouse cursor in the center of the image you want to shift. Hold down the “**left-button**” on the mouse.
- While holding down the “**left-button**”, move the mouse in **any direction** to achieve the desired rotational position.

## Free Rolling



- Hold down the “**Space** + **left-button**” on the mouse.
- While holding down the buttons indicated above, move the mouse **up and down** to achieve the desired image orientation.

## Increment Rotate

*Only applicable for 3D Images.*

- Use the keyboard arrows ← ↑ ↓ → to rotate the 3D Model **1 degree** up, down, right, or left, perpendicular the computer screen.

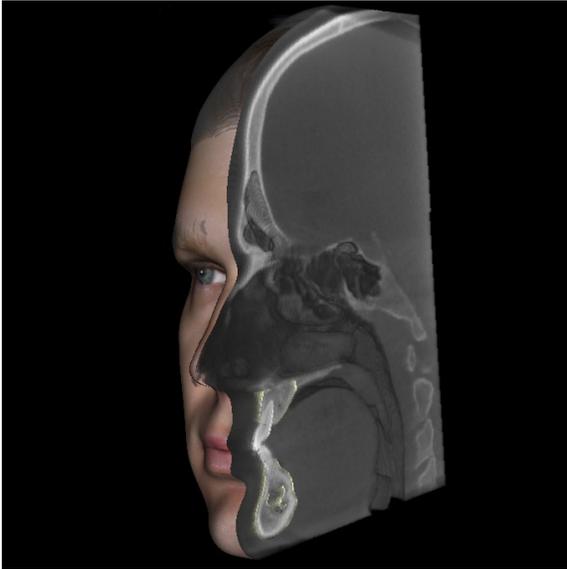
## Increment Roll

*Only applicable for 3D Images.*

- Hold down “**Control**” and use the keyboard arrows ← ↑ ↓ → to rotate the 3D Model **1 degree** rolling up, down, right, or left, perpendicular the computer screen.

## Anatomical Plane Clipping

*Only applicable in for 3D Images.*



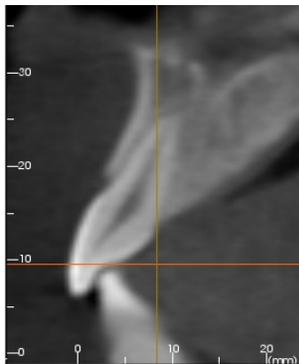
- Place the mouse cursor over the center of the image, then scroll the mouse “**roll the wheel**” forward or backward to clip the anatomic plane as you like.

## Scroll Slice

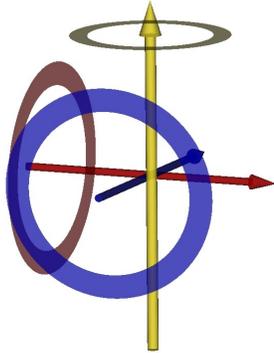
Use when you would like to move through the series of sections when in either the Section, Arch Section, or Pano views.

- Place the mouse cursor in the center of the image then “**scroll the mouse wheel**” forward or backward to move one section at a time as you advance through the data slices.

*Note: In the Arch Section View, you must first create a Arch Spline to activate this feature.*



## Rotation Widget



- **Volume Render View:** Click on either the ring or the arrows circling the patient and move it in the direction you want the patient to be oriented.) See Volume Render View Features for more details)
- **Implant View:** Use to move an implant through a portion of the volume for fine-tuning implant treatment planning. Click on either the ring or the arrows circling the implant and move it in the direction you want the implant to move.

# Full Screen Mode and Keyboard Shortcuts

*Below is an explanation running the software in full screen mode without toolbars and controls.*

## Switching to Full Screen Mode

From the software menu, select “View” -> “Full screen”. “Full screen stereo” is only applicable for the stereo display system. To return back to the normal screen mode, press “esc” key on the keyboard.

Full screen is not applicable to arch section view and implant view.

## Keyboard Shortcuts at Volume Rendering View

The following keyboard short cuts are available in volume rendering view:

View Presets:

“**1- 0**”: switches the view presets

Clipping Keyboard Controls:

“**P**”- toggles clipping on/off

“**A**”- axial clipping

“**S**”- sagittal clipping

“**C**”- coronal clipping

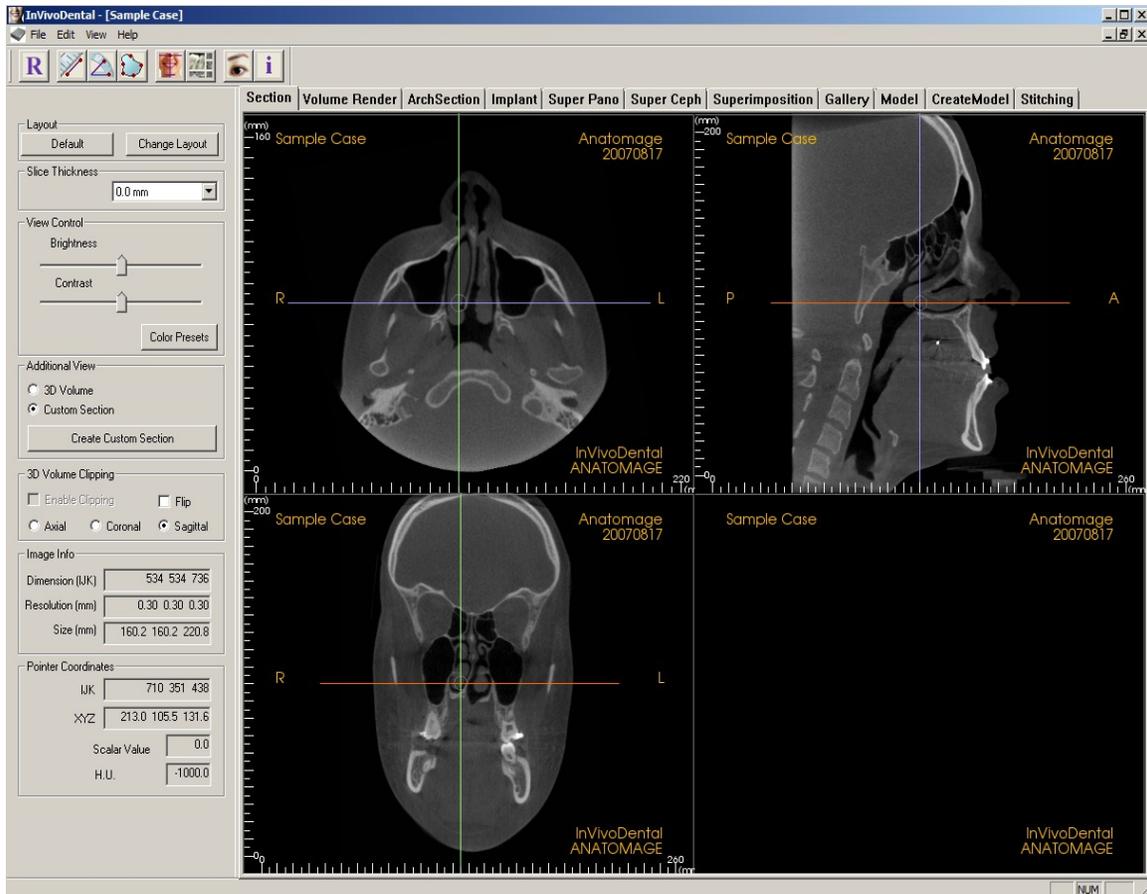
“**F**” to flip the other side of clipping

“**Page Up/Down**”- moves the clipping plane

# The View Tabs:

## Section View Features

The **Section View Tab** gives the ability to view the X, Y, and Z sections (Axial, Coronal, Sagittal, and Custom Sections) simultaneously for 2D visualization, measurements, and to utilize several image enhancement features. Versions 4.1 and higher have 3D functions in the Section View tab as well.



## Section: Toolbar

Shown below is the Tool Bar and tools that are loaded with the Sections View Tab:



**Reset:** Resets the Modeling Window to the original view size.



**Distance:** After selecting this tool, click one point and move the mouse over the end of the other point you would like to measure and click again.



**Angle:** After selecting this tool, “click” your first point, then move the mouse over your second point and click it, and finally click the last point. A number in degrees will automatically display.



**Area:** After Selecting this tool, click multiple points along the boundary of the desired area. Double click or right click to end the measurement. A number in millimeters square will be automatically display.



**Patient Orientation:** Click this button to re-orient image. A circle will show up in each section. Grab the circle and rotate the image to the desired orientation.



**Layout:** Creates a different layout to your preference. After clicking on the layout icon, a list a various layout options will appear. Click on the layout of your preference to apply it.

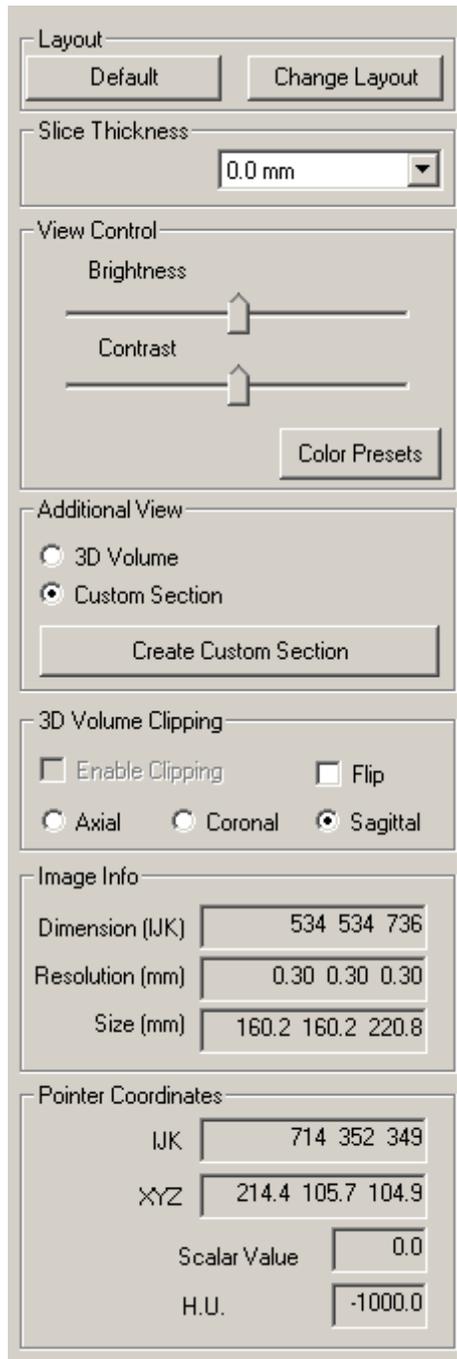


**Hide/Show Cursor**



**Patient Info:** Displays or hides case information embedded in the data.

## Sections: Control Panel



### Layout:

- **Default:** Go back to original layout.
- **Change Layout:** Click to choose custom layout.

**Slice Thickness:** Allows you to select the cumulative thickness of the slices in view.

### View Control:

- **Brightness & Contrast:** Can be adjusted for each of the presets to enhance your image. 📖
- **Color Presets:** Allows better visualization of certain anatomic structures, soft tissue profiles, airway, etc. The color rendering is only for the visualization. **The colors DO NOT represent the density of the bone.** 📖

### Additional View:

- **3D Volume:** This option allows 3D volume rendering in the fourth corner of the window.
- **Custom Section:** By clicking two points, a customized section can be created on any cross section to better visualize anatomy along its long axis.

### 3D Volume Clipping:

- When 3D volume is enabled, this option allows you to clip the volume to see the internal anatomy. The clipping plane will be synchronized with section cursors.

### Image Info:

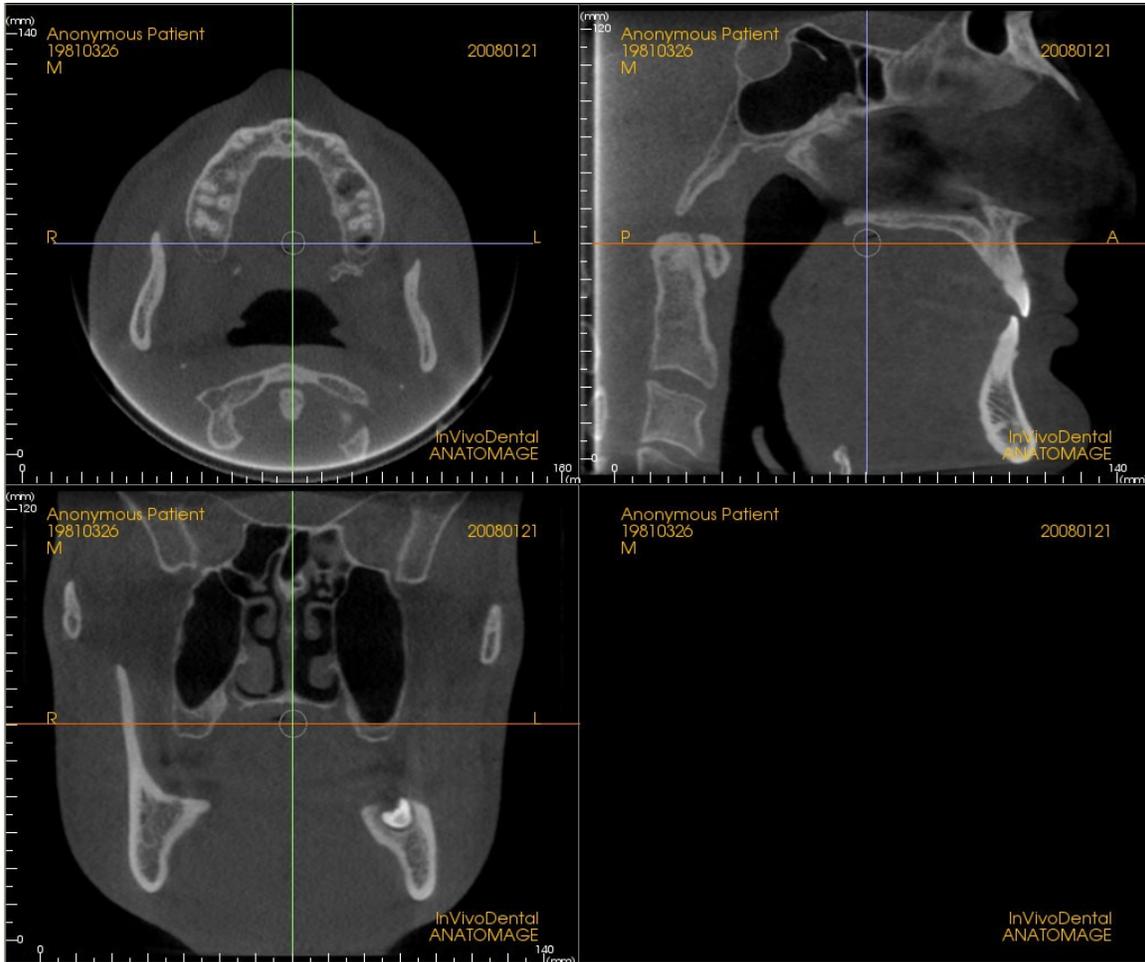
- Dimension, resolution and field of view size is summarized.

### Pointer Coordinates:

- **IJK or XYZ:** coordinates give the user the ability to examine the coordinate of the cursor upon the absolute coordinate system.
- **Scalar Value** is the gray scale value of the voxel pointed by the cursor pointer. **H. U.** is Hounsfield unit of the voxel calculated by “Rescale Slope” and “Rescale Intercept in DICOM information. **H.U. value may not be accurate if your CT hardware calibration is off. Contact your hardware manufacturer for more about H.U. accuracy.**

## Sections: Rendering Window

This window allows viewing of the X, Y, and Z sections (Axial, Coronal, Sagittal, and Custom Sections or a 3D view) simultaneously. This allows the clinician to have very accurate 2D visualization and 2D measurements.



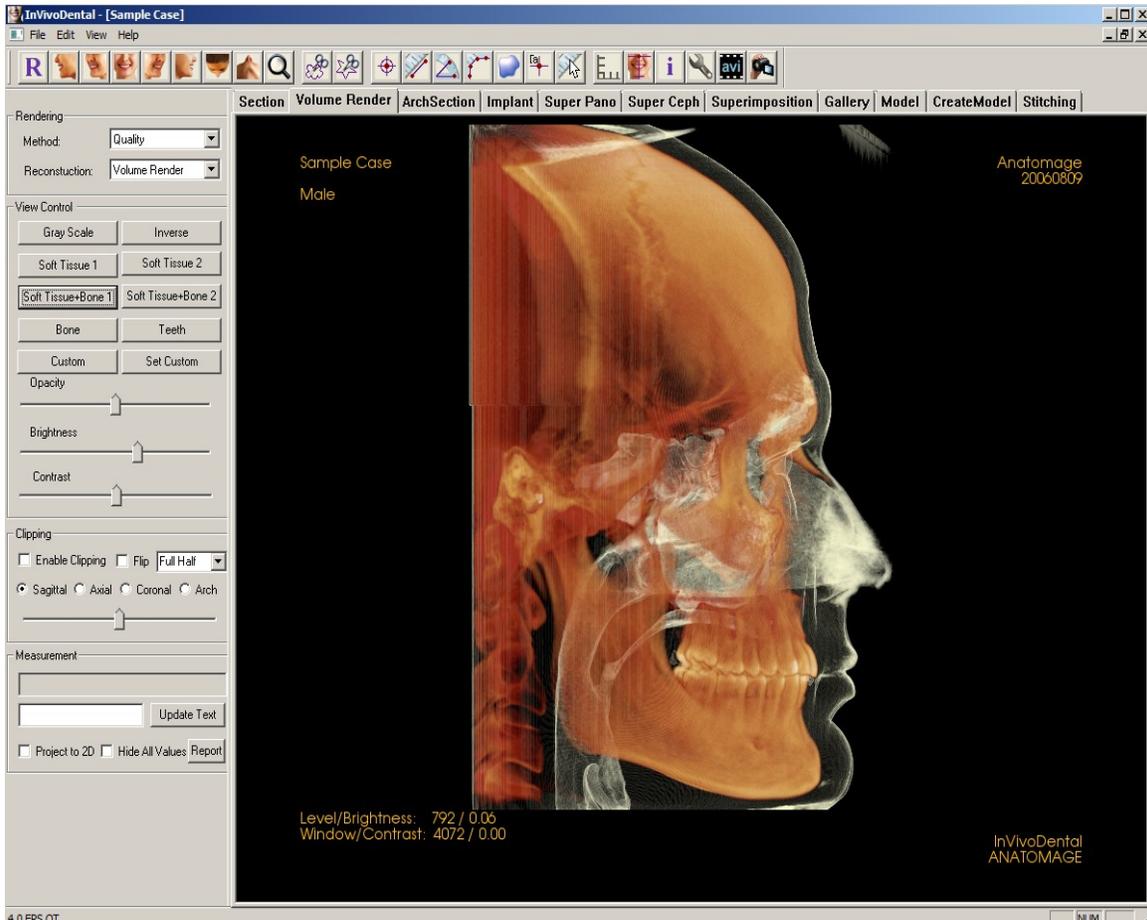
There are three ways to navigate the image.

**Scroll wheel:** Move mouse pointer to the desired cross section. Use scroll wheel to move the slice up and down.

**Cursor:** grab one of the cursors (axial, sagittal or coronal). Move the cursor to the desired direction. The corresponding image will be updated.

**Center Circle:** pick a point inside the center circle. Move the circle in the desired direction. The other 2 images will be updated.

# Volume Render View Features



The Rendering Window shows the patient in three dimensionally reconstructed views and allows you to explore the internal structures and never before seen anatomy of the patient. 

## Volume Render: Toolbar

Shown below is the Tool Bar and tools that are loaded with the Rendering View Tab:



**Reset:** Resets the Rendering Window to the original view size.



**Left Lateral:** Automatically orients the volume so the patient is facing left sagittal.



**3/4 Left:** Automatically orients the volume so the patient is facing 67° left sagittal.



**Frontal:** Automatically orients the volume so the patient is facing the front.



**3/4 Right:** Automatically orients the volume so the patient is facing 67° right sagittal.



**Right Lateral:** Automatically orients the volume so the patient is facing right sagittal.



**Supramaxillary:** Automatically orients the volume so you are oriented above the patient



**Submandibular:** Automatically orients the volume so you are oriented below the patient.



**Quick Zoom:** Click the zoom icon then the point on the volume to zoom in. Use Reset icon to go back to normal size.



**Sculpt (Free Form):** Allows you to freely outline an area that you want to remove from the volume in a “cookie cutter” manner. You may remove areas inside or outside the selection by clicking the scissors inside or outside of the area that has been outlined.



**Sculpt (Point-to-Point):** Allows you to outline an area (by selecting a series of points) for removal from the volume in a “cookie cutter” manner. You may remove areas inside or outside the selection by clicking the scissors inside or outside of the area that has been outlined. *Note: “Right click” your mouse to indicate that you have marked your last point.*



**3D Landmark Point:** When selected you may mark a point on the volume and X,Y,Z coordinates (Transverse, Sagittal, Vertical) will appear. Clicking on the point and moving the cursor can modify points. Clicking on the point and pressing, “delete”, can delete them. View Control features allow the values to be projected to 2D, hidden, or exported to a report.



**Measure 3D Distance:** When selected you may mark 2 points on the volume and distance will appear. Clicking on the point and moving the cursor can modify points. Clicking on the point and pressing, “delete”, can delete them. View Control features allow the values to be projected to 2D, hidden, or exported to a report.



**Measure 3D Angles:** When selected you may mark 3 points on the volume and angle between them will appear. Clicking on their control points and moving the cursor can modify measurements. Clicking on the point or line and pressing, “delete”, will delete them. View Control features allow the values to be projected to 2D, hidden, or exported to a report.



**Measure 3D Distance–Multiple Points:** When selected you may mark unlimited number of points on the volume and the total between the first point and the last point will appear. Clicking on the point and moving the cursor can modify points. Clicking on a point and pressing, “delete”, will delete the measurement. View Control features allow the values to be projected to 2D, hidden, or exported to a report. *Note: “Right click” your mouse to indicate that you have marked your last point.*



**Volumetric Measurement:** This button will open the volumetric measurement window.



**Comments:** You can enter a point in the volume and enter comments. After you pick a point in the volume the default “Comment” text will show up. Select red point and use the edit box in the control panel to enter the text. Press Update Text button to complete the entering.



**Quick Measurement:** click to activate a ruler at the tip of the cursor. Click again to turn off.



**Grid:** Toggles between 4 different grid layouts for simple assessment of size, measurement, and spatial location.



**Patient Orientation:** click to change patient orientation.



**Patient Info:** Displays or hides case information embedded in the data.



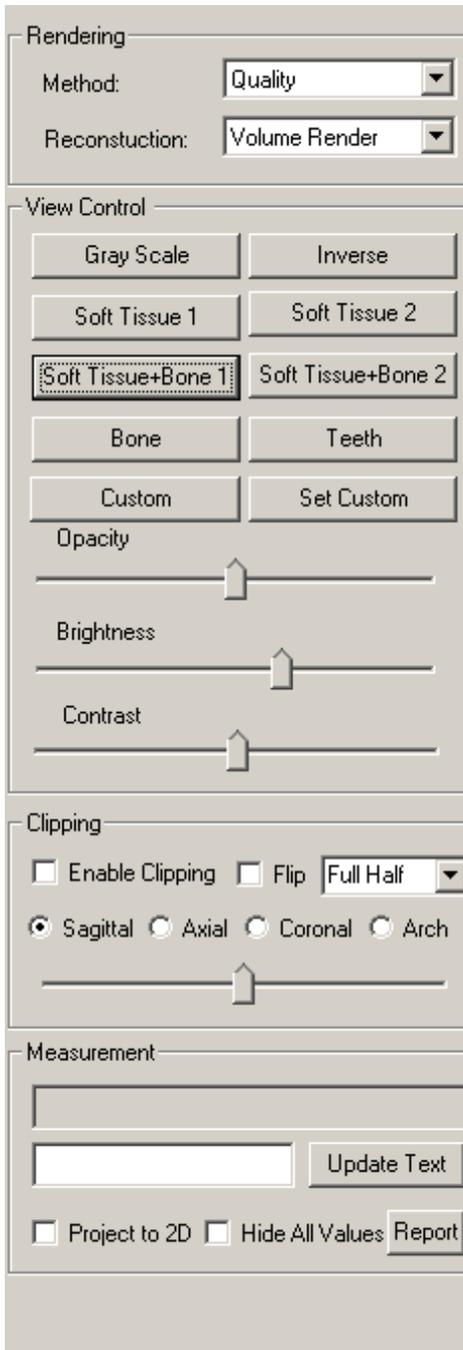
**Select Projection:** Allows option to view either parallel or perspective views in 3D.



**Movie Capture:** Allows the capturing and exportation of an AVI file.



**Camera Sequence:** Allows for the creation of custom camera sequences for movie capturing.



## Volume Render: View Control

**Rendering:** You can select different methods of rendering to suit your needs.

- **Method:** “Performance” is fast but there are some rendering artifacts. “Quality” gives the highest level of detail, but response is slower. “Default” is in between. 📖
- **Reconstruction:** There are three possible reconstruction methods: Volume Rendering, Maximum Intensity Projection, and X-ray. 📖

### Color Display:

- **Color Presets:** Gray Scale, Inverse, Soft Tissue 1, etc. allow better visualizations of certain anatomic structures, soft tissue profiles, airway, etc. This is achieved by displaying specific densities with specific colors.
- **Opacity:** Allows for the translucency and opacity to be adjusted.
- **Brightness & Contrast:** Can be adjusted for each of the presets to enhance your image. 📖

**Clipping:** Click the Enable Clipping box to slice the image along the predefined Anatomical Planes (Sagittal, Axial, Coronal, and Arch). Scrolling the mouse wheel will move the clipping plane. To switch a view to the opposite side, click “Flip.” Control the clipping with the scroll mouse or the slider bar.

**Measurement:** Once landmarks or measurements are defined, they can be projected to 2D values or hidden by clicking the appropriate box. **Report:** exports the values to a .CSV file for viewing and/or computations in Excel or other similar programs. The edit box allows you to enter text associated with the measurements. It is useful for adding annotation or symbol.

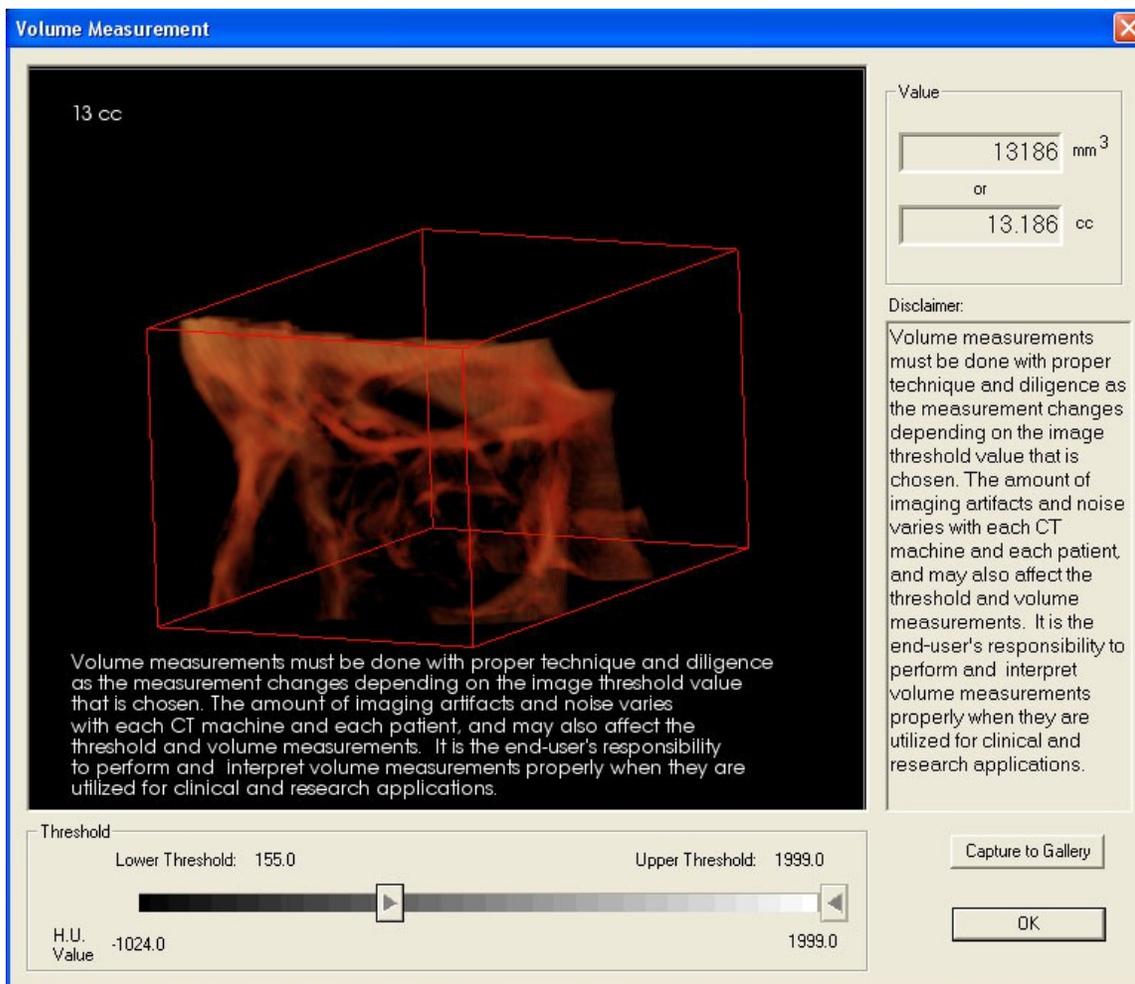
## Volume Render: Render Window

One of the most powerful features of InVivoDental is the remarkable rendering quality and speed at which the software works. The simplicity of this window is that it only displays the volume, Patient Info (if desired), and the brightness and contrast values. As you increase the Contrast, the window value goes down. These adjustments allow improved visualization of the volume image.



Please refer to **Image Navigation** for information about controlling and adjusting these images.

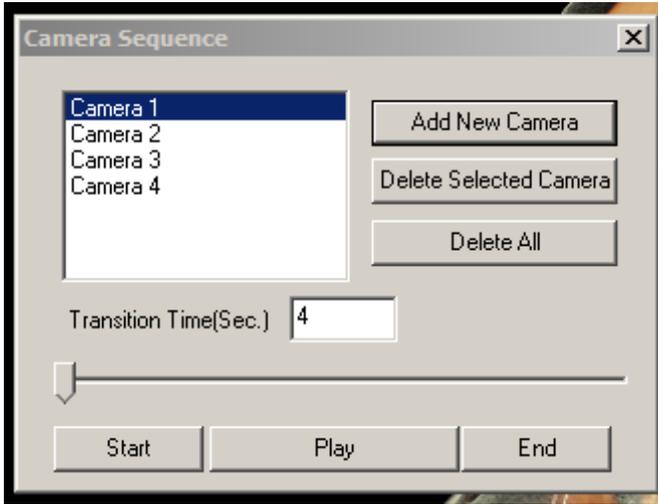
## Volume Render: Volume Measurements



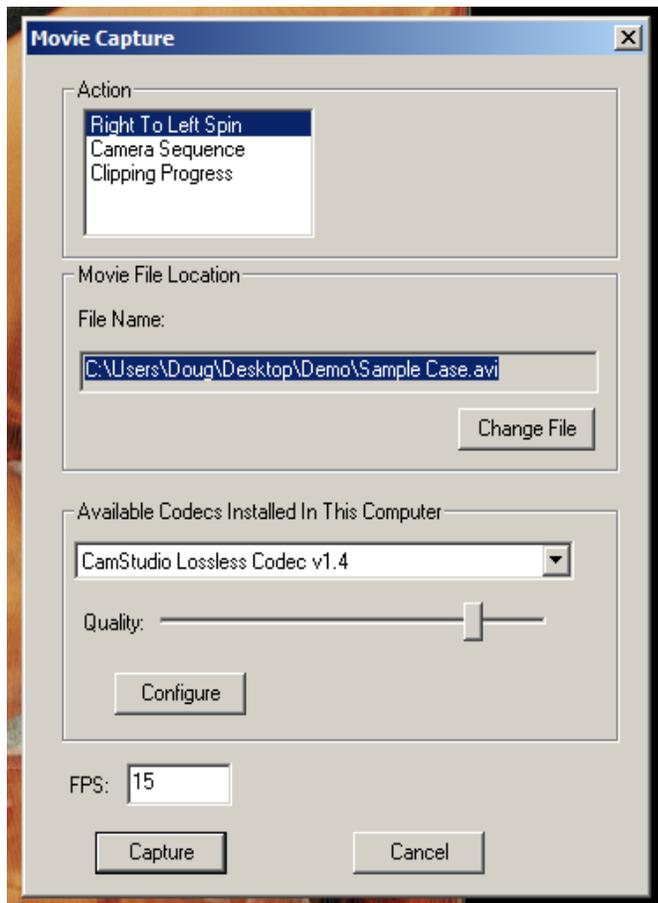
The volume measurement allow you to estimate volumetric measurement ( cc or cubic millimeters ) of a specific anatomical structure. User must do sculpting operations to isolate the desired anatomical structure. Then, press volume measurement button. The new window will open and the volumetric measurement value will be displayed. User must set the right threshold values to obtain the desired measurements.

**It is important that the measurement values may not be true anatomical volumetric measurements. Due to the nature of the imaging, there are imaging artifacts such as white noise, scattering, beam hardening, ring noise or off scale H.U. The software measurement tool cannot distinguish the imaging artifact from the true anatomy. Furthermore, the measurement values depends on threshold values, thus, user must set proper thresholds to get the best estimate of the desired structure. The measurements value must not be used as the sole metric for any treatment.**

## Volume Render: Movie Capturing and Customized Camera Sequences



The Custom Sequence icon  allows you to create your own sequences by adding a new camera sequence to each step you want the volume to move. If you want a movie that spins left to right, and then turns up for a submental view, you would add a new camera for each step and the video capture of it will connect the positions in a seamless movie. The transition time can be set and you can preview it by pressing Play to watch the volume render play out the sequence.



The Movie Capture Icon  allows you to automatically capture and export an AVI (movie) file of the volume rendering.

Different actions can be captured, such as a right to left spin, clipping, or your custom sequence.

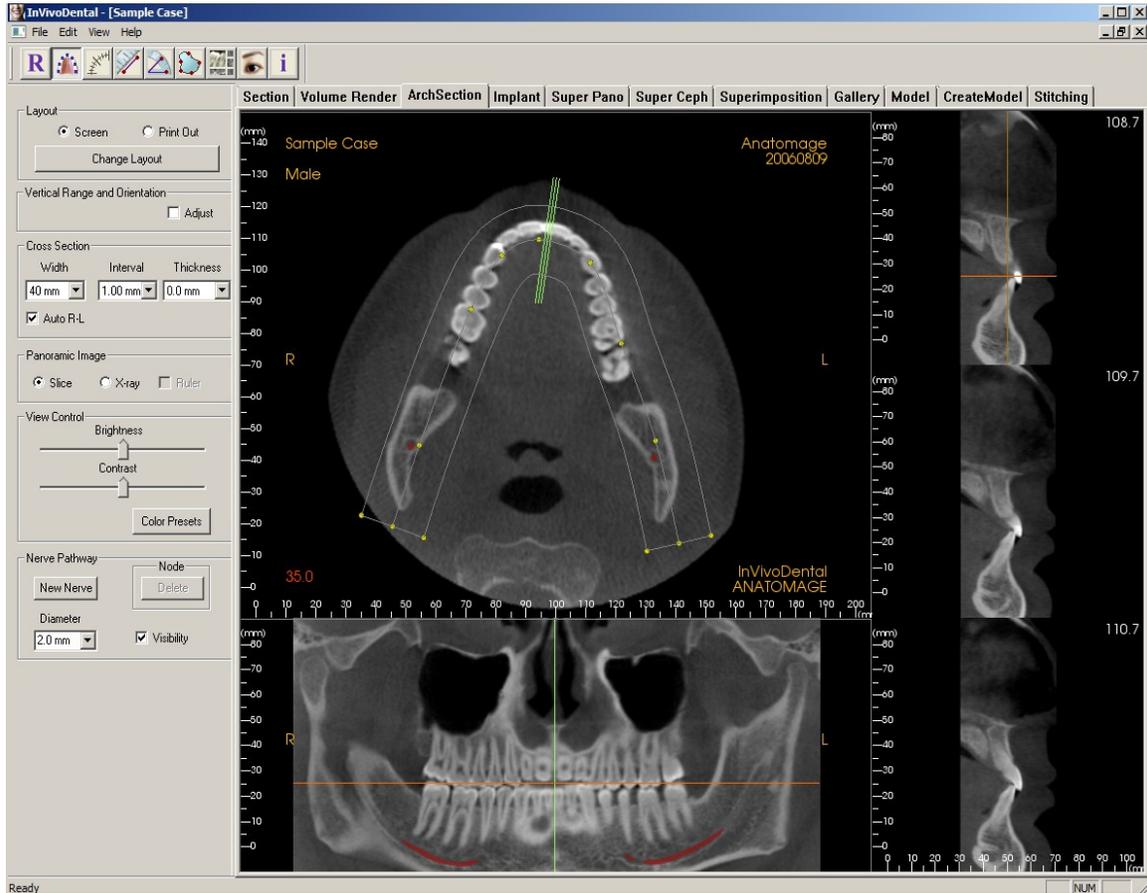
The file name and location to be saved can be determined.

Various codecs that are on your computer can be used to capture the movie at different qualities. If you experience any trouble with the video quality, a different codec may be better. Also make sure to choose how high you want the quality with the Quality slider bar.

Click Capture once everything is set up to automatically export the video to the specified location with the specified name.

# Arch Section View Features

*Arch Section View is a sectional image exploration view. Instead of conventional X-Y-Z sections, this view allows to review in dentally meaningful perspectives with multiple cross sections traversing the lengths of the dental arches.*



## Arch Section: Toolbar

Shown below is the Tool Bar and tools that are loaded with the Arch Section Tab:



**Reset:** Resets the window to the original view.



**Arch Spline (Focal Trough) ★:** After selecting this tool, you can create a new Arch Spline or edit an existing **Arch Spline**. First, “**left-click**” on the point you would like to start and continue adding points by “**left-clicking**.” After you have marked your final point, “**right-click**” or **double click** to finalize the **Arch Spline**. When modifying an existing **Arch Spline**, drag the control points to the desired positions.



**Arch Spline (Focal Trough) Ruler:** Places ruler along the Arch Spline for easy reference.



**Distance:** After selecting this tool, click one point and move the mouse over the end of the other point you would like to measure and click again.



**Angle:** After selecting this tool, “click” your first point, then move the mouse over your second point and click it, and finally click the last point. A number in degrees will automatically display.



**Area:** After Selecting this tool, click multiple points along the boundary of the desired area. Double click of right click to end the measurement. A number in millimeters square will be automatically display.



**Layout:** Creates a different layout to your preference. After clicking on the layout icon, a list a various layout options will appear. Click on the layout of your preference to apply it. These options allow for different case workup images. In this window, you can also choose how many millimeters you want the cross section interval to be. If you choose 1.0mm, for example, there will be a space of 1.0mm between each cross section.

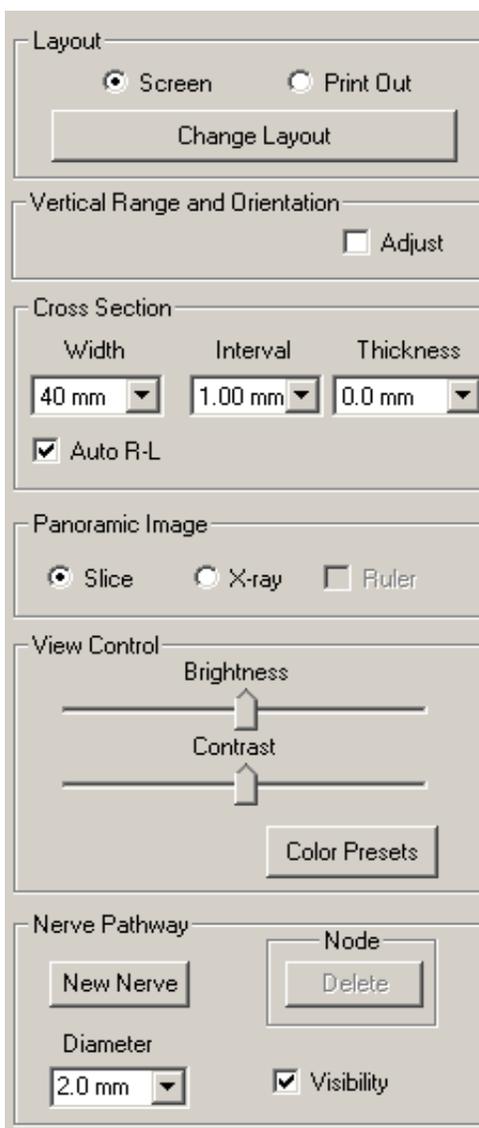


**Hide / Show:** Conceals or displays cursors.



**Patient Info:** Displays or hides case information embedded in the data.

## Arch Section: View Control



### Layout:

- **Screen** layout is optimized for viewing the image on computer screen. **Print Out** layout is optimized for printing the image on paper. With **Print Out** layout, what you see on screen will be what you get on the paper in life size. First capture to Gallery, then print from Gallery to ensure the image is lifesize.

### Vertical Range and Orientation:

- **Adjust** will switch to the view that you can change the upper and lower limit of pano and cross section. Also it allows you to make re-orientation of the image.

### Cross Section:

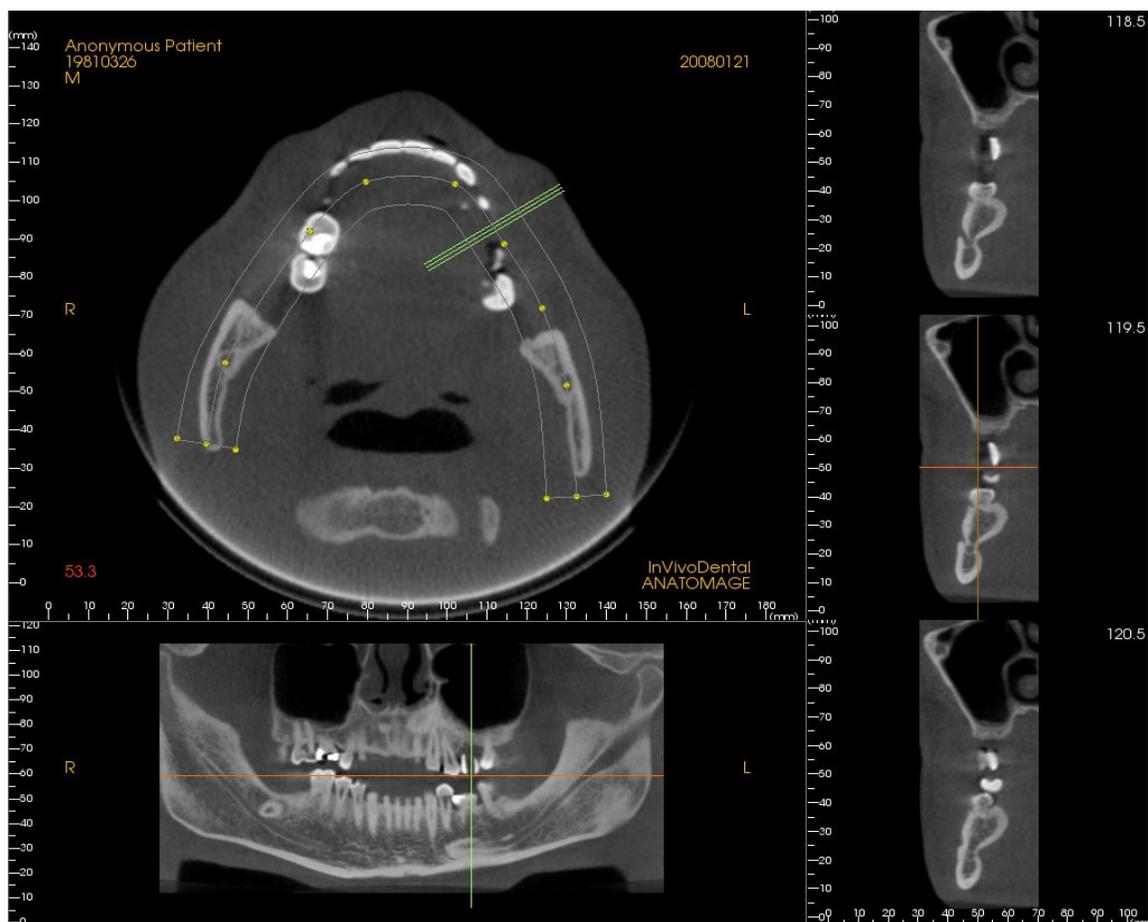
- **Width:** Cross Section Width
- **Interval:** Distance between the subsequent cross sections.
- **Thickness:** Allows for the cumulative thickness of the slices to be viewed in the cross sections.
- **Auto R-L:** This will allow the cross section oriented to consistent R-L orientation on screen. If turned off, the cross section orientation will be consistent to arch spline.

### Panoramic Image:

- **Slice** mode will show you a single cross section along the panoramic curve (yellow). **X-ray** will show you the ray sum(reconstructed xray) in the focal trough. Slice mode is used for drawing the nerve.

- **View Control:**
- **Brightness and Contrast** allows you to adjust the image
- Different **Color Presets** can be used to view the images in color.
- **Nerve Pathway:** Create a pathway for a nerve (e.g. Inferior Alveolar by following the mandibular canal to its exit). Click **New**, then left click the mouse where you want the nerve to start, then move the mouse to the next point along your path and left click again, do this until the length of the nerve is traced, then press **Done** to finish. The **Delete** tab can be used if a point was plotted in the wrong spot; it will delete the last point added. **2.0mm** is the default diameter of the nerve pathway, but you may adjust it for your preference. Picking the nerve and pressing the “delete” key will delete the Nerve that was traced if you want to get rid of it. **Visibility** will turn the nerve on or off from view.

## Arch Section: Rendering Window

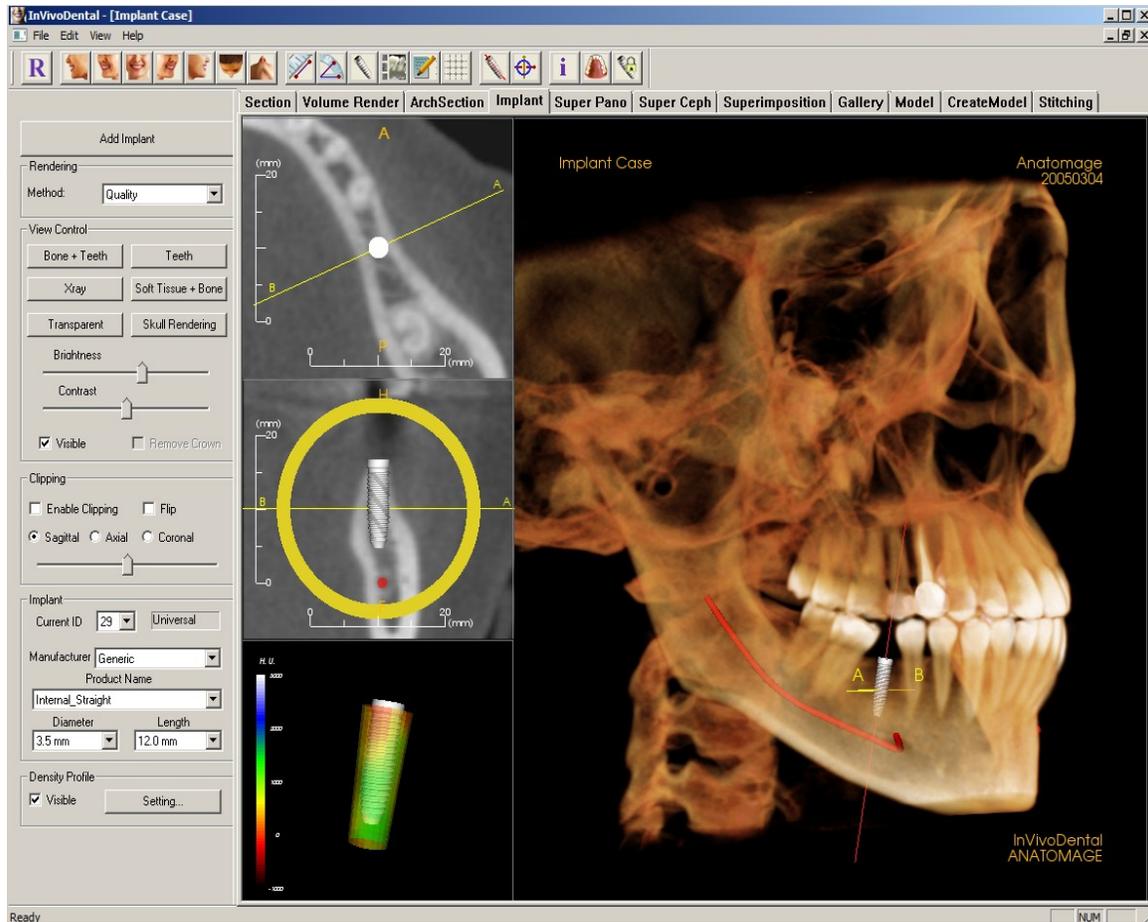


**Arch Cursor:** Notice the Green, Red, and Yellow coordinate indicators. These Arch Section Coordinate Indicators show where you are spatially located within in the Arch Section Modeling Window.

- **Cross Section Indicator:** The Green lines gives the location of the cross section along the **Arch Curve**.
- **Axial Slice Indicator:** The **Red line** shows the axial coordinate position within the section.
- **Arch Spline:** The **Bright Yellow** spline gives the original **Arch Spline** you created, and the Dark Yellow spline represents the current position where the **Arch Section** has moved.
- **Cross Section:** Mouse scrolling within any one of the three Sagittal frames advances the slices sagittally to the patient's right or left and causes the Green Coordinate Indicator to move anteriorly or posteriorly in the Axial and Pano Section simultaneously.
- **Axial Section:** Mouse scrolling within the Axial section advances the sections superiorly or inferiorly and causes the Red Coordinate Indicator to move superiorly or inferiorly in the Cross or Pano sections simultaneously
- **Pano Section:** Mouse scrolling within the Coronal frame advances the slices buccal or lingual and causes the Yellow Coordinate Indicator to move buccal and lingual in the Axial and Cross section simultaneously.

# Implant View Features

The **Implant View** allows you to access a detailed portion of implant planning. Note: this view is only active after an implant has been placed in the Arch Section View.



## Implant: Toolbar

Shown below is the Tool Bar and tools that are loaded with the Implant View Tab:



**Reset:** Resets the Modeling Window to the original view.



**Left Lateral:** Automatically orients the volume so the patient is facing left sagittal.



**3/4 Left:** Automatically orients the volume so the patient is facing 67° left sagittal.



**Frontal:** Automatically orients the volume so the patient is facing the front.



**3/4 Right:** Automatically orients the volume so the patient is facing 67° right sagittal.



**Right Lateral:** Automatically orients the volume so the patient is facing right sagittal.



**Supramaxillary:** Automatically orients the volume so you are oriented above the patient



**Submandibular:** Automatically orients the volume so you are oriented below the patient.



**Measure 3D Distance:** When selected you may mark 2 points on the volume and distance will appear. Clicking on the point and moving the cursor can modify points. Clicking on the point and pressing, “delete”, can delete them. View Control features allow the values to be projected to 2D, hidden, or exported to a report.



**Measure 3D Angles:** When selected you may mark 3 points on the volume and angle between them will appear. Clicking on their control points and moving the cursor can modify measurements. Clicking on the point or line and pressing, “delete”, will delete them. View Control features allow the values to be projected to 2D, hidden, or exported to a report.



**Add Implant:** To place an implant, first click the **Add Implant** icon, then “**left-click**” the mouse on the spot that you want the implant to be placed in.



**Change Layout:** To toggle the layout click on this icon.



**Create Summary:** Creates an Implant summary of images.



**Grid:** Toggles between two different grid layouts for use in the upper two section frames allowing quick assessment of measurements and spatial location.



**Implant Long Axis toggle:** Shows a red line that goes through the long axis of the implant to check for orientation, click it again to toggle it off.



**Orientation Widget Toggle:** Toggles the implant orientation widget on and off.



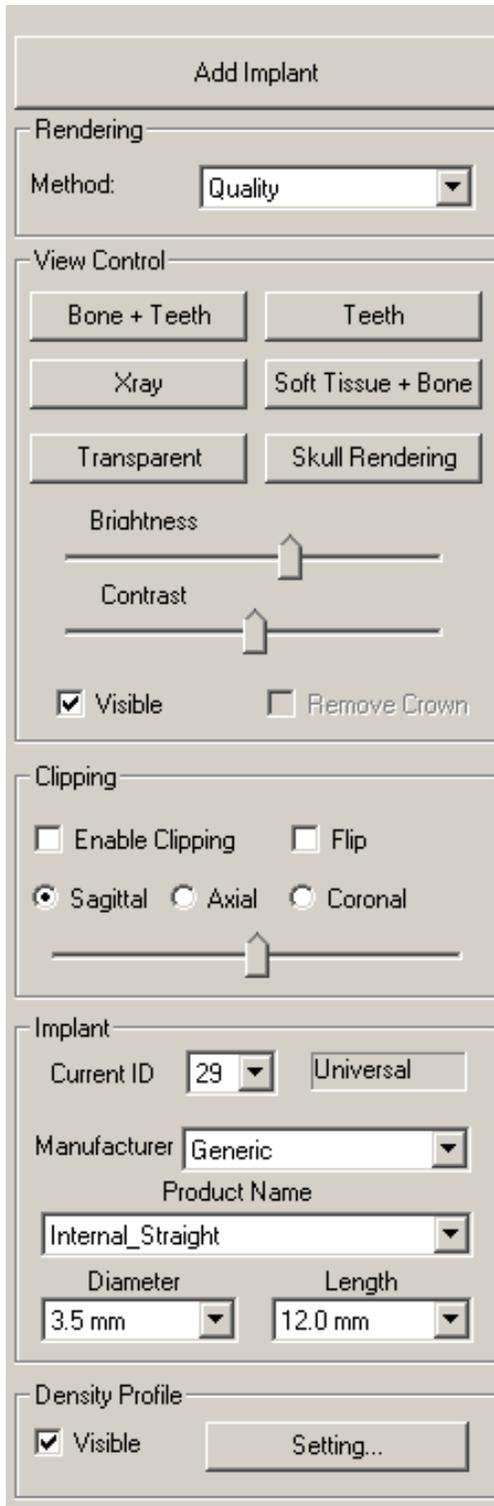
**Patient Info:** Displays or hides case information embedded in the data.



**Change Model Visibility:** Allows various models to be turned on or off from view.



**Treatment Lock:** Locks the implants in place so that they are not accidentally moved when viewing the 3D images.



## Implant: View Control

**Add Implant:** Click to add implant into the 3D volume.

**Rendering:** You can select different methods of rendering to suit your needs.

- Method: “Performance” is fast but there are some rendering artifacts. “Quality” gives the highest level of detail, but response is slower. “Default” is in between. 📖

### View Control:

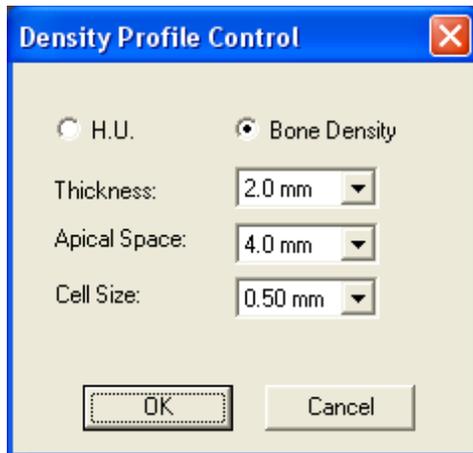
- **View Presets:** Different settings allow for better visualization of certain anatomic structures, soft tissue profiles, hard tissue, etc. This is achieved by displaying specific densities with specific colors.
- **Brightness & Contrast:** Can be adjusted for each of the presets to enhance your image.
- **Visible:** allows the 3D Volume Rendering to be turned on or off from view.
- **Remove Crown:** Only applicable with modeling service options.

**Clipping:** Click the Enable Clipping box to slice the image along the predefined Anatomical Planes (Sagittal, Axial, Coronal, and Arch). Scrolling the mouse wheel will move the clipping plane. To switch a view to the opposite side, click “Flip.” Control the clipping with the scroll mouse or the slider bar.

### Implant:

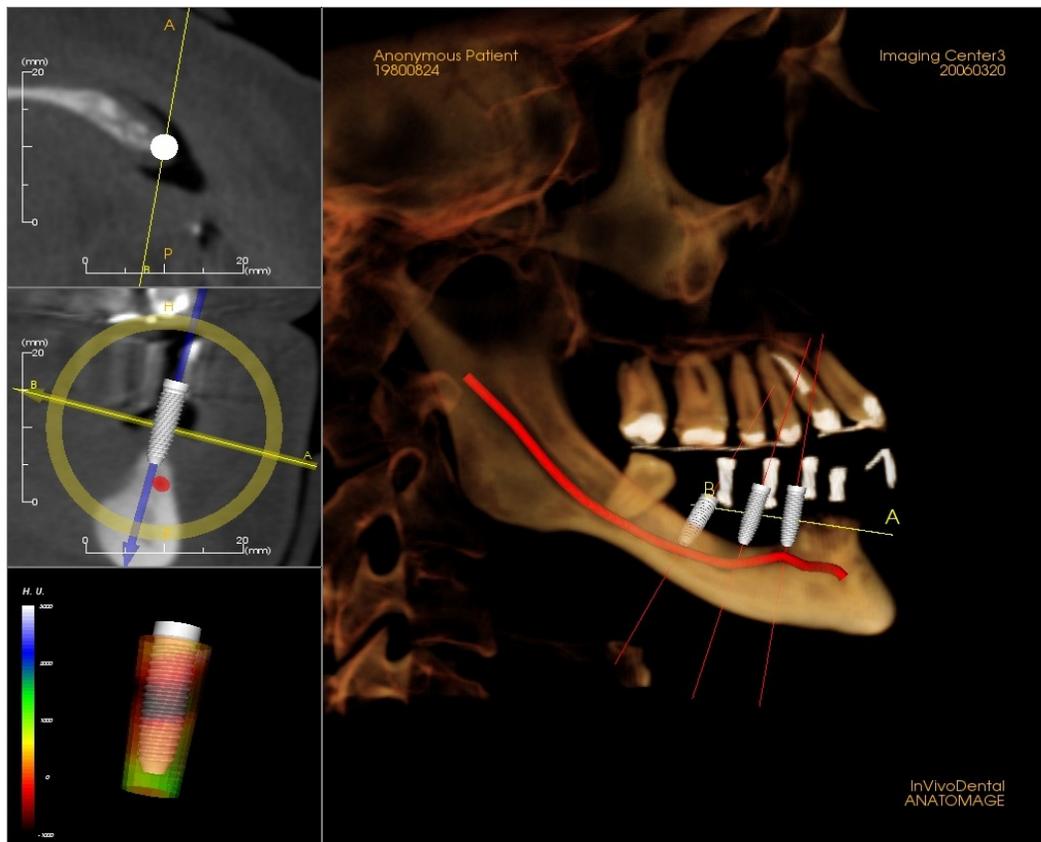
- **ID:** Use the drop-down menu to select an implant to manipulate. The active implant will appear lighter in color than the others.
- **Manufacturer, Product Name, Diameter, and length:** The default is generic, but you may select a specific implant manufacture, diameter and length.

**Density Profile:** To see a bone density assessment immediately surrounding the surface of the implant, check the visible box. The Setting tab allows you to customize how much bone around the implant you want to assess. This is explained in more detail below:



- **H.U.** shows the bone density in Hounsfield unit
- **Bone Density** shows the density in Misch's bone density units.
- **Thickness** Changes the sampled volume located around the implant.
- **Apical Space:** Changes the sampled volume located at the apex of the implant.
- **Cell Size:** Changes how fine the voxel will be sampled and displayed volume around the implant.

## Implant: Rendering Window



Used for more precise control and final detailed touches to implant treatment planning. By navigation discussed below, one visualizes all aspects of the implant in the 3D volume patient data. **★Once an implant is added, it will also appear in the Volume Render View.**

**Axial Section:** Top left window. This section is the view from the top of the implant. The yellow line passing through the axis creates the view seen in the Sagittal view. Scrolling the mouse wheel after clicking inside the Axial window, or clicking and dragging the line will change the cross-section seen in the Sagittal view as the line rotates about the axis of the implant.

**Sagittal Section:** Middle left window. This section is the view from the side of the implant. The yellow line passing through the implant creates the cross-section view that appears in the Axial view. Scrolling the mouse wheel after clicking inside the Sagittal window, or clicking and dragging the line will change the cross-section seen in the Axial view.

**Density Profile:** Lower left window. Displays a real-time visualization of the volume density immediately surrounding the implant

**Volume Rendering:** Right window. This frame allows user to change the implant position and orientation with the orientation widget within the 3D volume rendering.

## How to add a new implant?

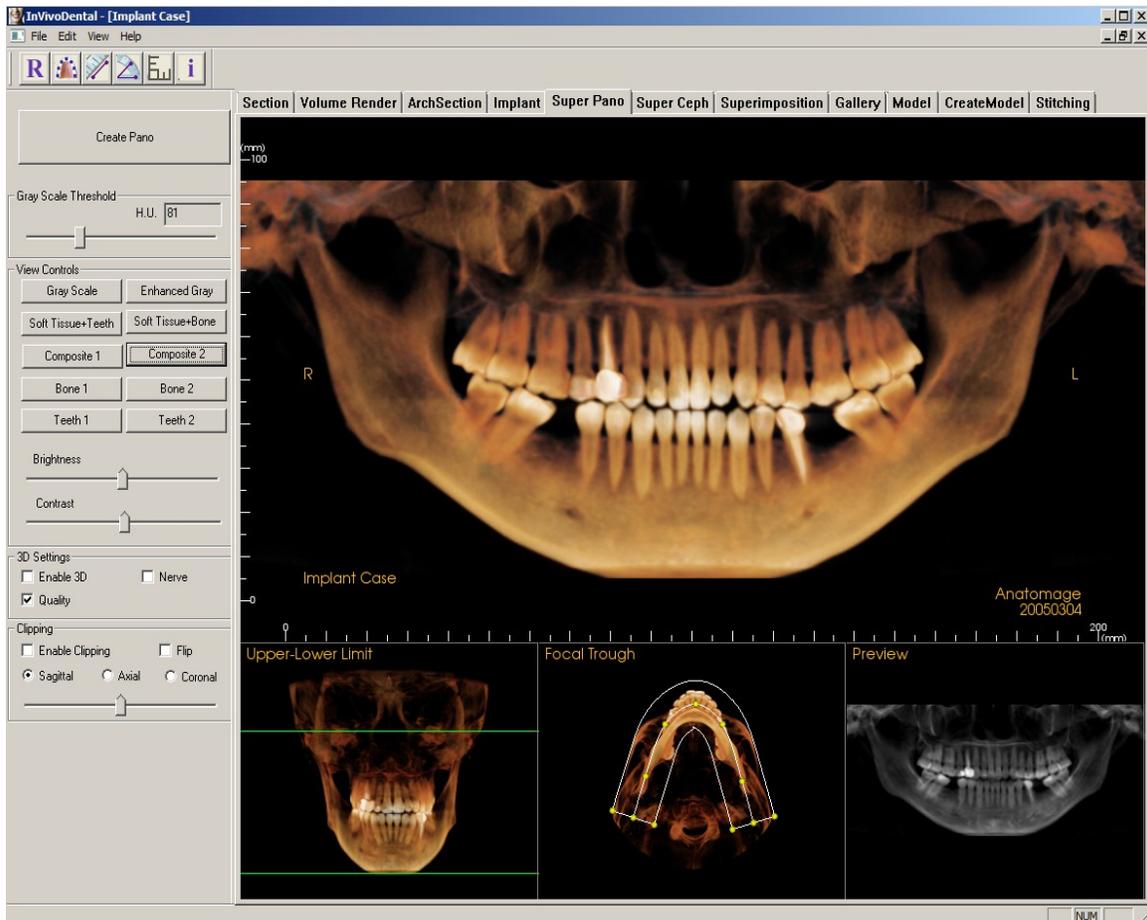
- Click the implant tab in the tool bar on the Add Implant button in the view controls.
- The implant ID dialogue will show up.
- Select implant ID to be inserted. Press OK, and a new implant will appear on the mouse pointer.
- Drag and drop the implant in 3D view .
- In Axial view, align the yellow line such that the below Cross Section view becomes the view along mesial-distal direction.
- In Cross Section view, re-orient and position implant.
- In Axial view, align the yellow line such that the below Cross Section view becomes the view along buccal and lingual direction
- In Cross Section view, re-orient and position implant.
- Review the final implant position in 3D view.

## How to Delete an implant?

- Select the desired implant in 3D view.
- Confirm the right implant shows up in axial and cross sections.
- Press “Delete” key on the keyboard.
- The implant will disappear.

# Super Pano Features

The **Super Pano View Tab** gives you the ability to construct and view an enhanced version of a panoramic radiograph, take measurements, and utilize several image enhancement features. It also has the ability to render a pano into a volumetric 3D image that can be rotated for greater visual advantages.



## Super Pano: Toolbar

Shown below is the Tool Bar and tools that are loaded with the Super Pano View Tab:



**Reset:** Resets the Modeling Window to the original view.



**Focal Trough:** Sets the boundaries of the Super Pano. A focal trough is automatically set but can be adjusted or recreated entirely. Use the yellow dots to stretch, widen, or reshape the focal trough. The focal trough selects only the objects you want to appear in the Super Pano and excludes others such as the spine, which traditionally appears in panoramic radiographs as background noise.



**Distance:** After selecting this tool, click one point and move the mouse over the end of the other point you would like to measure and click again.



**Angle:** After selecting this tool, “click” your first point, then move the mouse over your second point and click it, and finally click the last point. A number in degrees will automatically display.

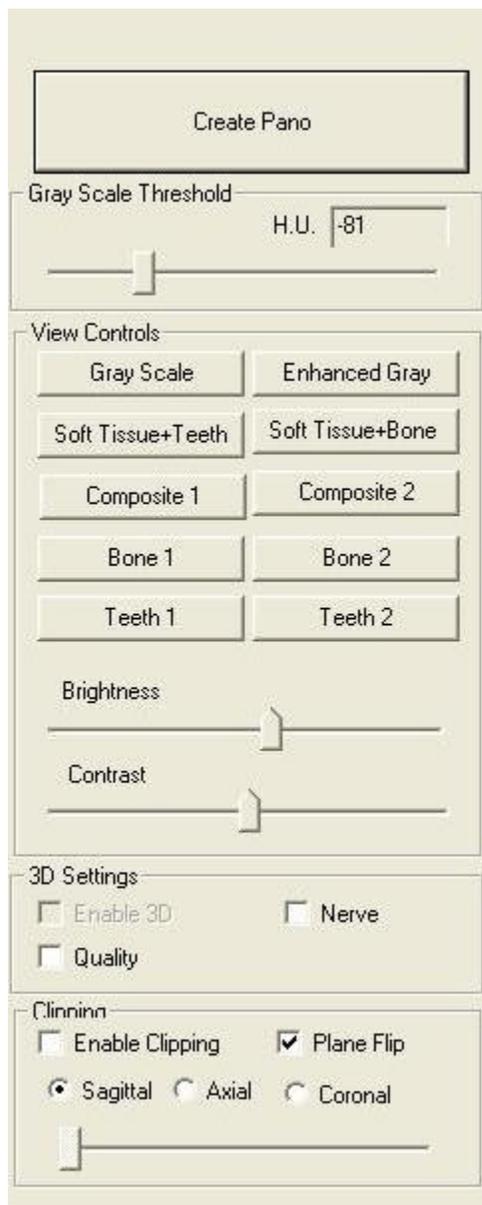


**Grid:** Toggles between two different grid layouts for use in the all of the section frames allowing quick assessment of measurements and spatial location.



**Patient Info:** Displays or hides case information embedded in the data.

## Super Pano: View Control



### Create Pano

- The Create Pano button should be pressed after the Lower-Upper Limit and Focal Trough are adjusted in the rendering window, a preview is shown in the window to the lower right.
- The Lower-Upper Limit is adjusted by left-clicking on a green line and dragging with the mouse. It specifies the vertical dimension of the Pano that is being created. The red line indicates the Focal Trough plane and can be moved with the mouse as well.
- The Focal Trough is adjusted by left-clicking on the yellow points and dragging with the mouse. The length, width, and shape of the Focal Trough are adjusted to specify what will appear in the Pano.
- A preview is also shown in the rendering window. When it looks acceptable, left-click with the mouse on the Create Pano button to produce a customized panoramic x-ray.

### Gray Scale Threshold

- This threshold sets the limit of the density that will be included in the pano. For noisy image, it is important to adjust the threshold so that the noise does not contribute to the pano. Usually it is desired to set to value slightly below bone density

### View Controls

- Allows the Pano that was created to be viewed in multiple ways, such as in “**Gray Scale**”, “**Soft Tissue+Teeth**,” etc. Each view has different visual advantages.

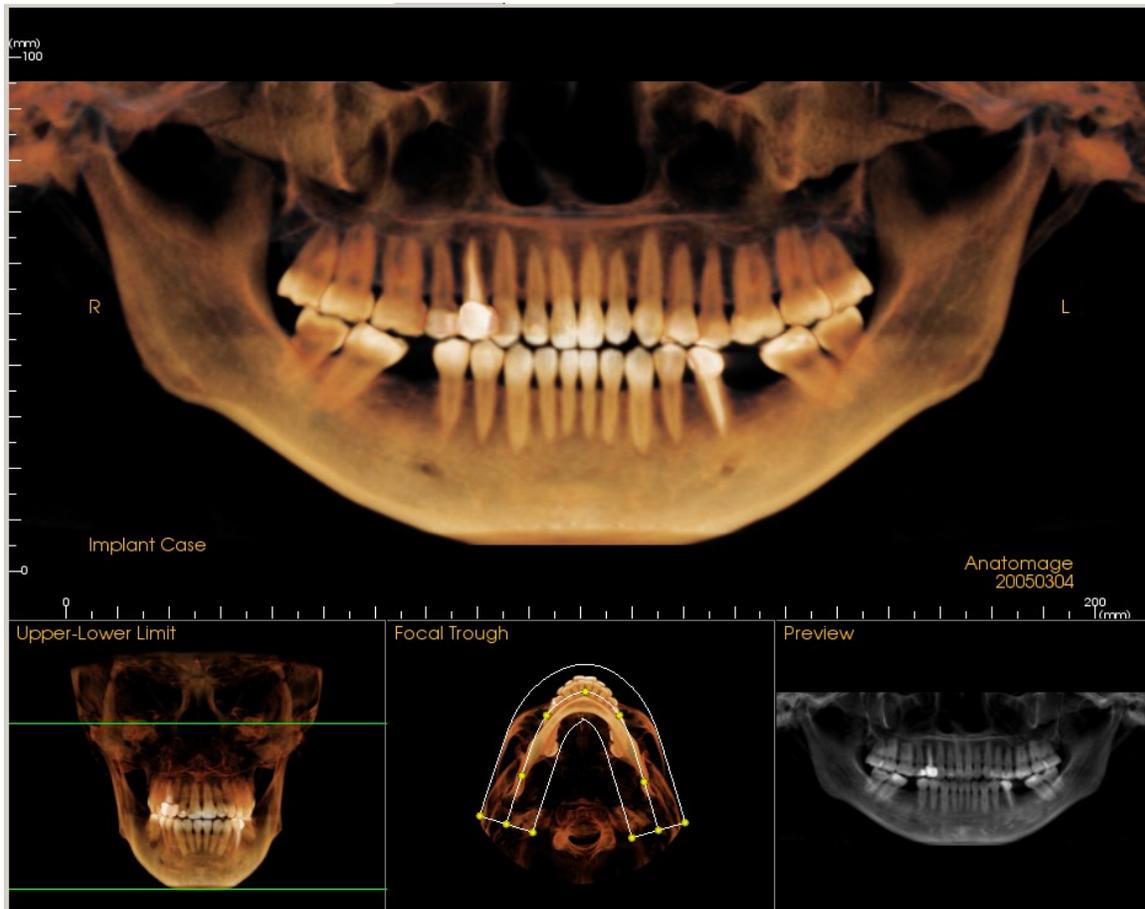
- **Brightness & Contrast:** Can be adjusted to enhance your image. 📖
- **Quality:** Left-click with mouse on box to turn on or off. Gives the highest level of detail but response is slower.
- **Enable 3D:** Left-click with mouse on box to turn on or off. This feature renders the Pano into a volumetric 3D image. The image can then be rotated like other volume renderings (see Image Navigation on page 8 for more details). This tool offers visual advantages never before possible in a traditional 2D panoramic x-ray. For example, the degree of divergence of a tooth’s roots can be assessed when one rotates the pano.
- **Clipping:** This option is only applicable when 3D pano is available. Clipping hides some part of the image so that the internal structure can be visible.

## Super Pano: Rendering Window

This window is where the Super Pano is viewed and adjusted.

**Upper-Lower Limit:** The lower left box where the vertical parameter of the Super Pano is set. There is an upper and lower green line indicating the vertical limits. They can be left-clicked and dragged to set the desired Upper and Lower limit of the Super Pano. For example, if the orbits are desired to show up on the Super Pano, the Upper green line should be dragged above the orbits. The red line indicates where the focal trough plane is. It can also be adjusted.

**Focal Trough:** The focal trough is adjusted in the lower middle box. Whatever is contained within it will appear in the Super Pano. This allows the construction of a panoramic x-ray without the background noise of the spine. The yellow dots can be left-clicked on and dragged to adjust the length, width and shape of the focal trough. The focal trough can be adjusted by dragging the focal trough control points, or a new trough can be created by clicking the trough icon on the toolbar (see page 25 for more information).



**Preview:** A preview of the Super Pano will be displayed in the lower right box before actually creating it. This feature allows a Super Pano to be made more efficiently and with fewer or no adjustments needed afterwards.

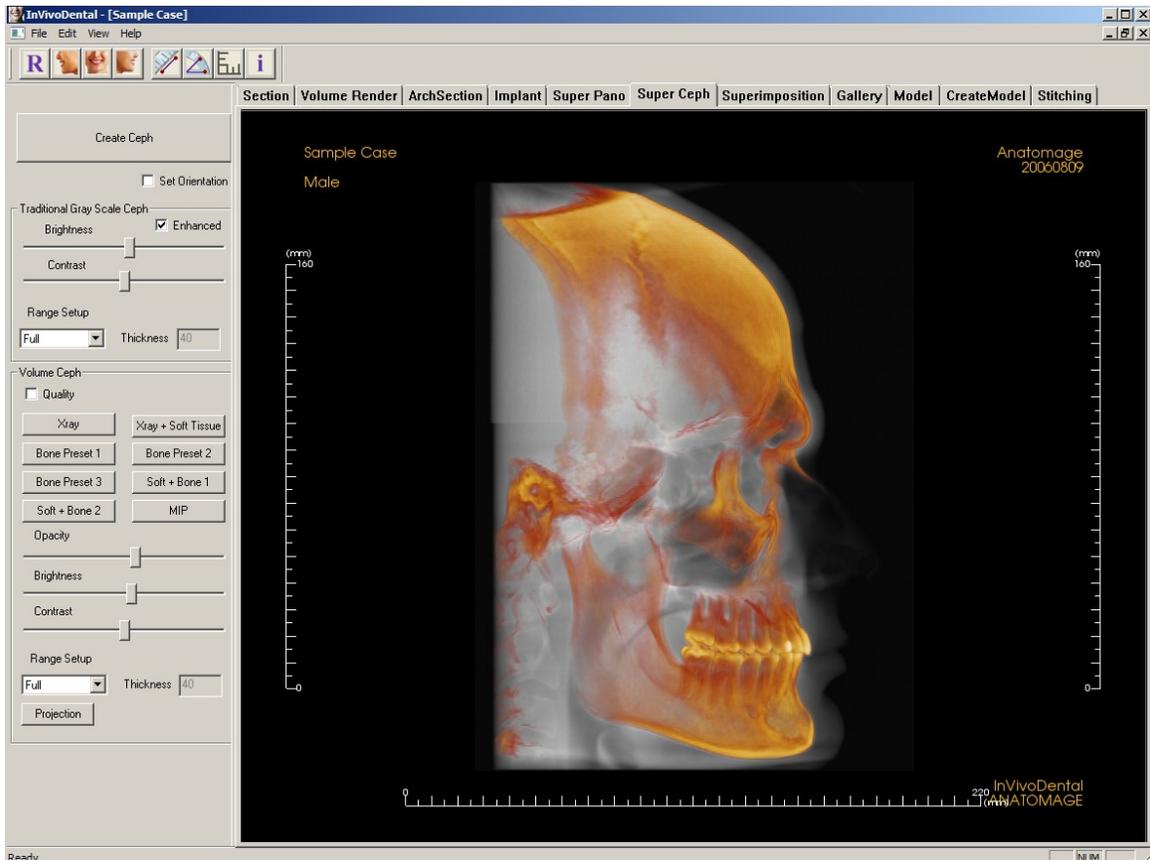
### **How to make a good Pano?**

- Make a nice U-shaped narrow focal trough encompassing the arches by adjusting the points on the focal trough.
- Adjust Gray scale threshold to filter soft tissue, so that the image is not too dark or too light.

**Please refer to Image Navigation (pg. 8) for information about controlling and adjusting these images.**

# Super Ceph Features

The **Super Ceph View Tab** gives the ability to construct and view an enhanced version of a cephalometric radiograph, take measurements, and utilize several image enhancement features, which dramatically increase its diagnostic value.



## Super Ceph: Toolbar

Shown below is the Tool Bar and tools that are loaded with the Super Ceph View Tab:



**Reset:** Resets the Modeling Window to the original view.



**Left Lateral:** Automatically orients the volume so the patient is facing left sagittal.



**Frontal:** Automatically orients the volume so the patient is facing the front.



**Right Lateral:** Automatically orients the volume so the patient is facing right sagittal.



**Distance:** After selecting this tool, click one point and move the mouse over the end of the other point you would like to measure and click again.



**Angle:** After selecting this tool, “click” your first point, then move the mouse over your second point and click it, and finally click the last point. A number in degrees will automatically display.

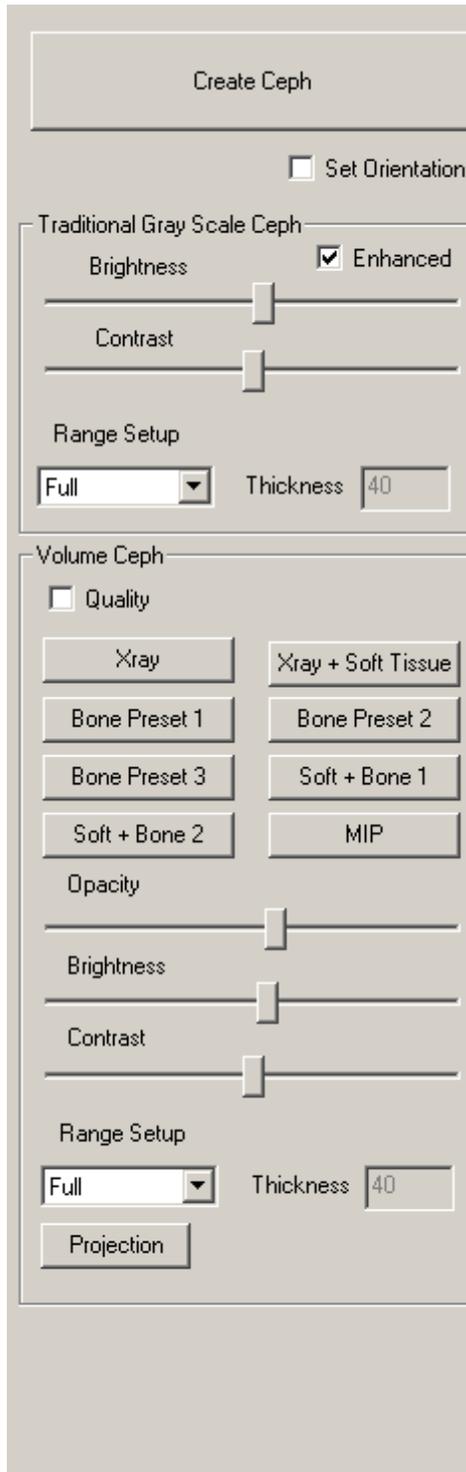


**Grid:** Toggles between two different grid layouts for use in the all of the section frames allowing quick assessment of measurements and spatial location.



**Patient Info:** Displays or hides case information embedded in the data.

## Super Ceph: View Control



### Create Ceph

- The **Create Ceph** button should only be left-clicked after the orientation of the patient's volumetric image is adjusted in the rendering window.
- The **Set Orientation** box can be clicked on to reset the orientation if a ceph was created with incorrect orientation. Once the image is orientated correctly, press the create ceph button again.

### Gray Scale Components of the Ceph

- **Brightness and contrast** can be adjusted to enhance your image.
- **The Enhanced** box can be left-clicked on or off to further enhance the quality of the image.
- **Range Setup** allows you to select which side of the patients head the ceph will be created from.

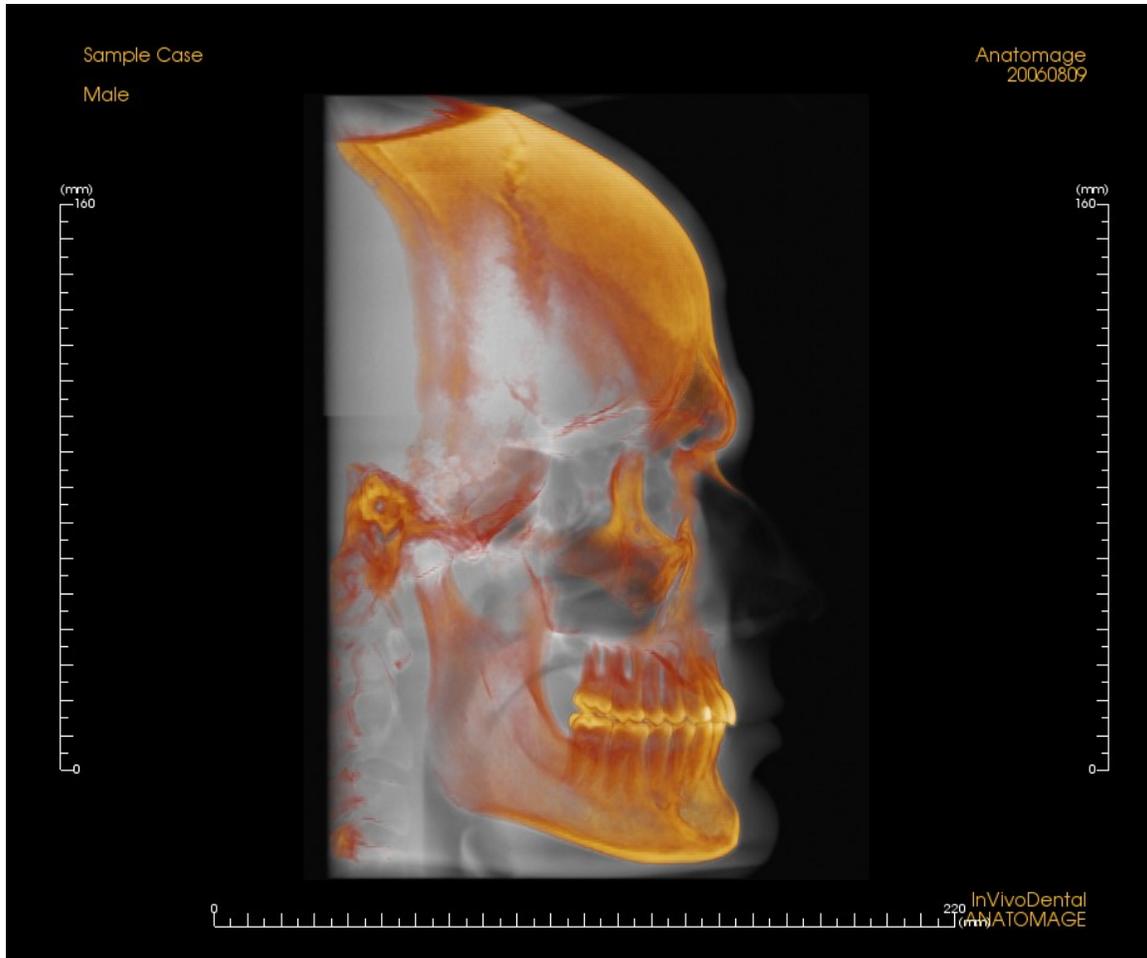
### Volume / Colorization Components of the Ceph

- Offers various enhanced views of the Ceph, must turn up the opacity slide bar to visualize it. Each has different advantages, for example the Bone Presets highlight landmarks for easier viewing, while the **“Soft+Bone”** views allow soft tissue to also be seen in the ceph.
- **Visibility, Brightness, and Contrast** can all be adjusted for image enhancement.
- **Range Setup** allows you to select which side of the patients head the ceph will be created from.
- Projection allows you to switch from parallel views of the cephalometric images to perspective views which resemble the magnification found in traditional cephalometric radiographs.

## Super Ceph: Rendering Window

This window is where the volumetric image of the patient is orientated to create a cephalometric image and where the cephalometric image will be viewed after creating it.

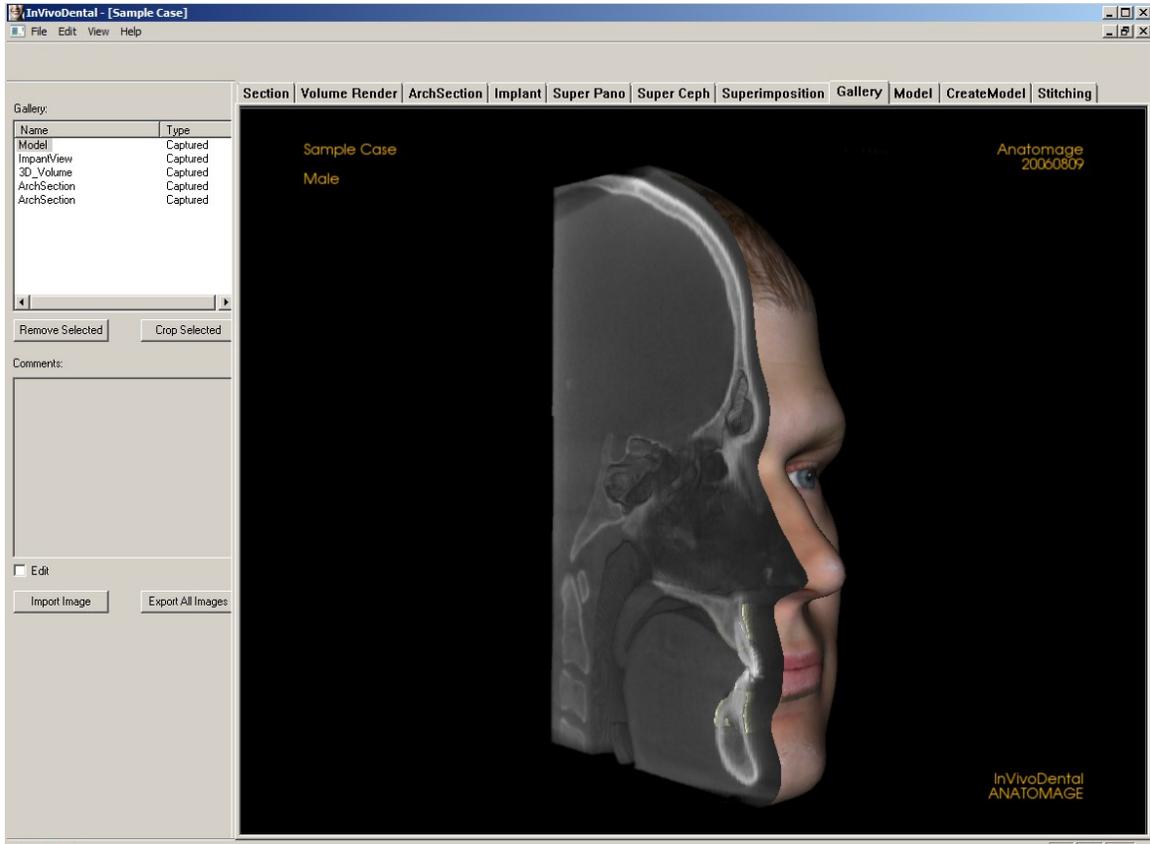
Before clicking on the “Create Ceph” button in the view controls, the patient’s volumetric image must be correctly orientated. The easiest way to do this is to line up the left and right angles of the mandible. If the cephalometric image is created with an improper orientation, it can be adjusted using the Set Orientation box in the view controls (see page 31 for more details).



Please refer to **Image Navigation (pg. 8)** for information about controlling and adjusting these images.

# Gallery Features

*In the **Gallery View Tab** you can retrieve images that have been captured. Additionally, images can be imported or exported to the location of your choice. Comments or notes can be added to describe images that have been captured.*



## Gallery: View Control



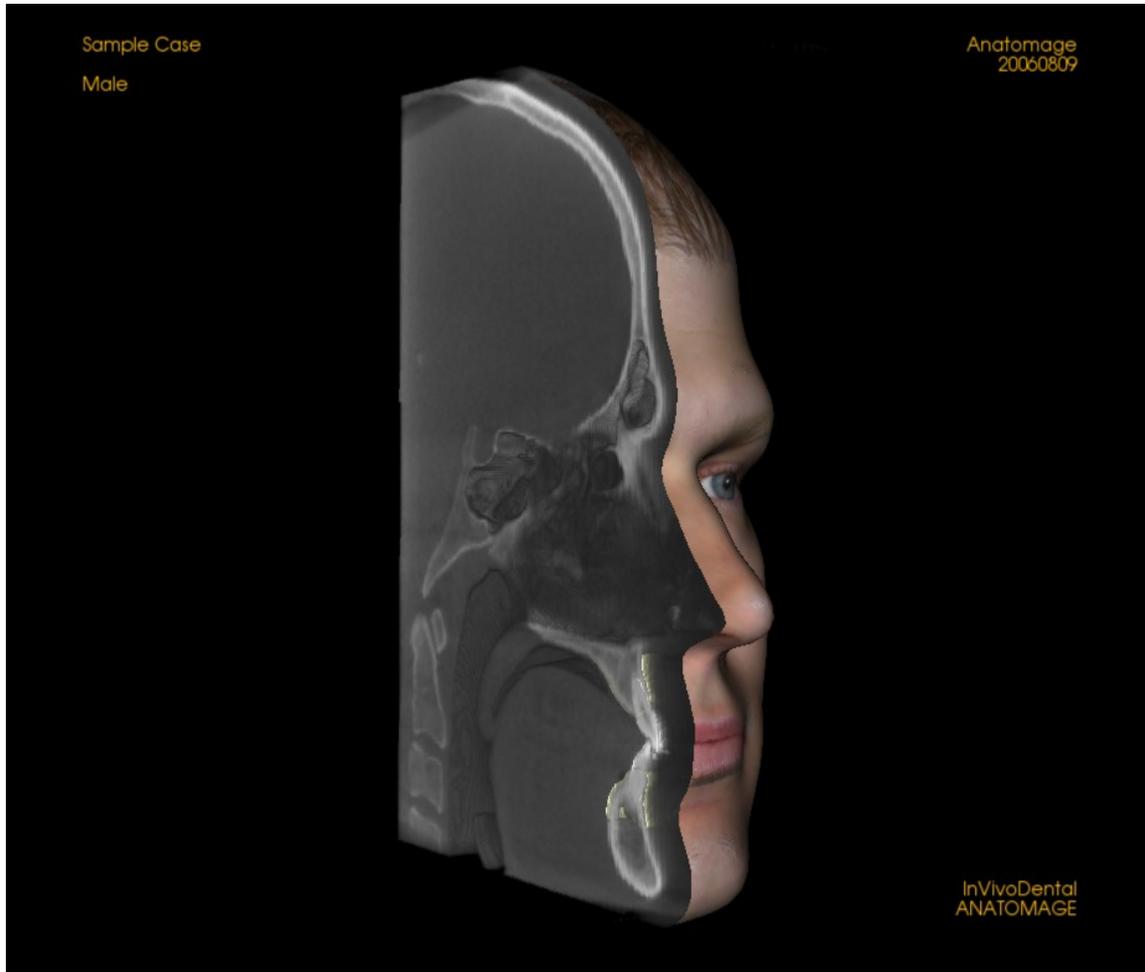
**Gallery:** Gives a list of all captured images.

- Each of these images has a “**Name**” and “**Type**” which can be renamed by double clicking on the text.
- **Remove Selected:** deletes an image form the Gallery List.
- **Crop Selected:** allows you to crop the image within InVivoDental.
- **Import Image:** enables you to browse for an image file (.jpg, .bmp, or .png ) outside of the InVivoDental software (e.g. patient photographs) for storage within the InVivo file once saved.
- **Export All Images:** opens a dialogue box to allow you to export all images in the Gallery List (as individual files) to a location of your choice in the following formats: .jpg, .bmp, or .png.  
**Note: export as .jpeg file types for Life Size exporting.** 

**Comments:** By clicking the edit button, one can add additional notes to further describe and give additional information about a particular image. To Edit a comment, just check the Edit box and then make your adjustments in the comments box.

## Gallery: Rendering Window

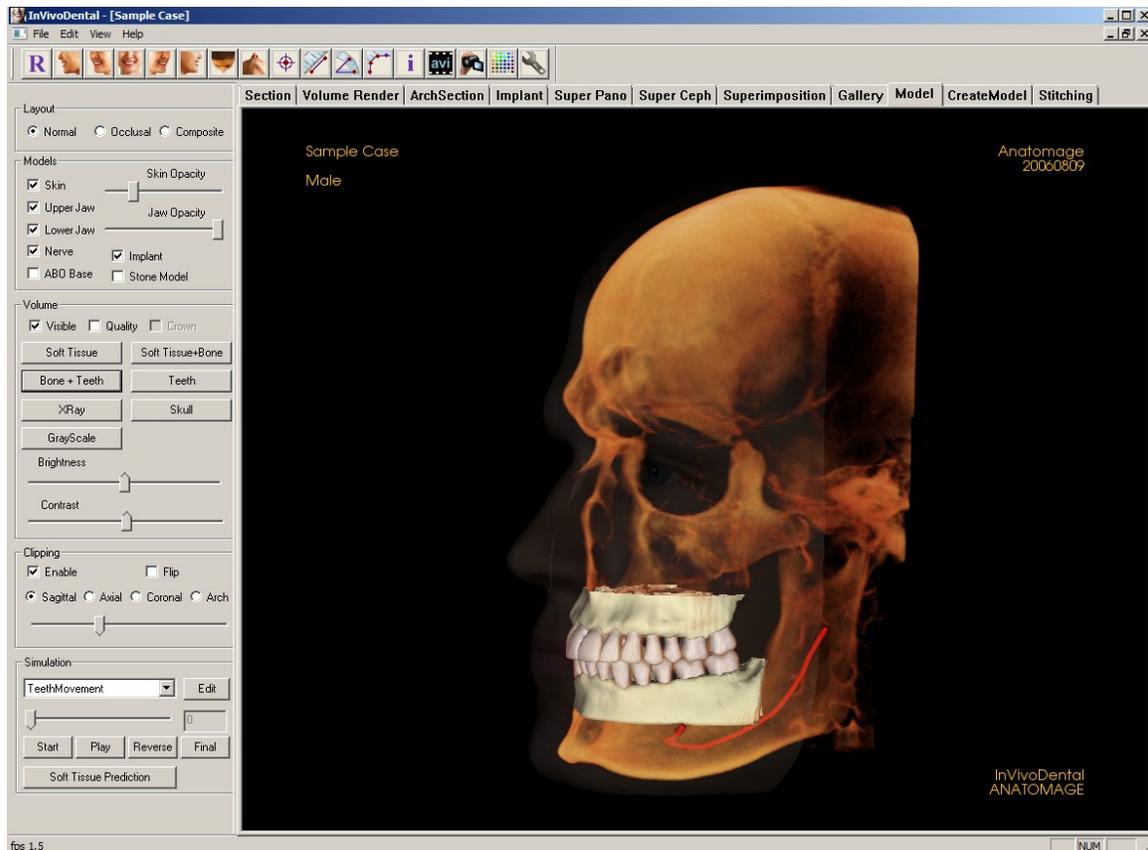
This window allows the viewing of captured and imported images. The Gallery is particularly useful for creating a workup of a particular case. Remember that the Gallery's images will only be saved if you re-save the whole file, otherwise any images captured will be lost.



Please refer to **Image Navigation (pg. 8)** for information about controlling and adjusting these images.

# Model Features

In the **Model View Tab**, is where you can view your patient's AnatoModel or 3D photograph, and simulate surgical or orthodontic simulations, as well as 3D soft tissue predictions. An AnatoModel is a 3D digital study model that is created by Anatomage via a case by case service. The dicom data of the patient is sent to Anatomage where it is modeled to create the most advanced digital study model available. This is so because the AnatoModel contains anatomy such as roots, developing teeth, impactions, alveolar bone, and so on, while other models just show the crowns of teeth. If you have not sent your case to Anatomage to get modeled, this feature will not work. The 3D photograph service that Anatomage also offers is viewed here too. Anatomage developed the technology to combine one frontal photo of the patient and the patient's CT scan, to create a 3D model that overlays the scan data.



## Model: Toolbar

Shown below is the Tool Bar and tools that are loaded with the Model View Tab:



**Reset:** Resets the Rendering Window to the original view size.



**Left Lateral:** Automatically orients the volume so the patient is facing left sagittal.



**3/4 Left:** Automatically orients the volume so the patient is facing 67° left sagittal.



**Frontal:** Automatically orients the volume so the patient is facing the front.



**3/4 Right:** Automatically orients the volume so the patient is facing 67° right sagittal.



**Right Lateral:** Automatically orients the volume so the patient is facing right sagittal.



**Supramaxillary:** Automatically orients the volume so you are oriented above the patient



**Submandibular:** Automatically orients the volume so you are oriented below the patient.



**3D Landmark Point:** When selected you may mark a point on the volume and X,Y,Z coordinates (Transverse, Sagittal, Vertical) will appear. Clicking on the point and moving the cursor can modify points. Clicking on the point and pressing, “delete”, can delete them. View Control features allow the values to be projected to 2D, hidden, or exported to a report.



**Measure 3D Distance:** When selected you may mark 2 points on the volume and distance will appear. Clicking on the point and moving the cursor can modify points. Clicking on

the point and pressing, “delete”, can delete them. View Control features allow the values to be projected to 2D, hidden, or exported to a report.



**Measure 3D Angles:** When selected you may mark 3 points on the volume and angle between them will appear. Clicking on their control points and moving the cursor can modify measurements. Clicking on the point or line and pressing, “delete”, will delete them. View Control features allow the values to be projected to 2D, hidden, or exported to a report.



**Measure 3D Distance–Multiple Points:** When selected you may mark unlimited number of points on the volume and the total between the first point and the last point will appear. Clicking on the point and moving the cursor can modify points. Clicking on a point and pressing, “delete”, will delete the measurement. View Control features allow the values to be projected to 2D, hidden, or exported to a report. Note: “Right click” your mouse to indicate that you have marked your last point.



**Patient Info:** Displays or hides case information embedded in the data



**Movie Capture:** Allows the capturing and exportation of an AVI file.



**Camera Sequence:** Allows for the creation of custom camera sequences for movie capturing.

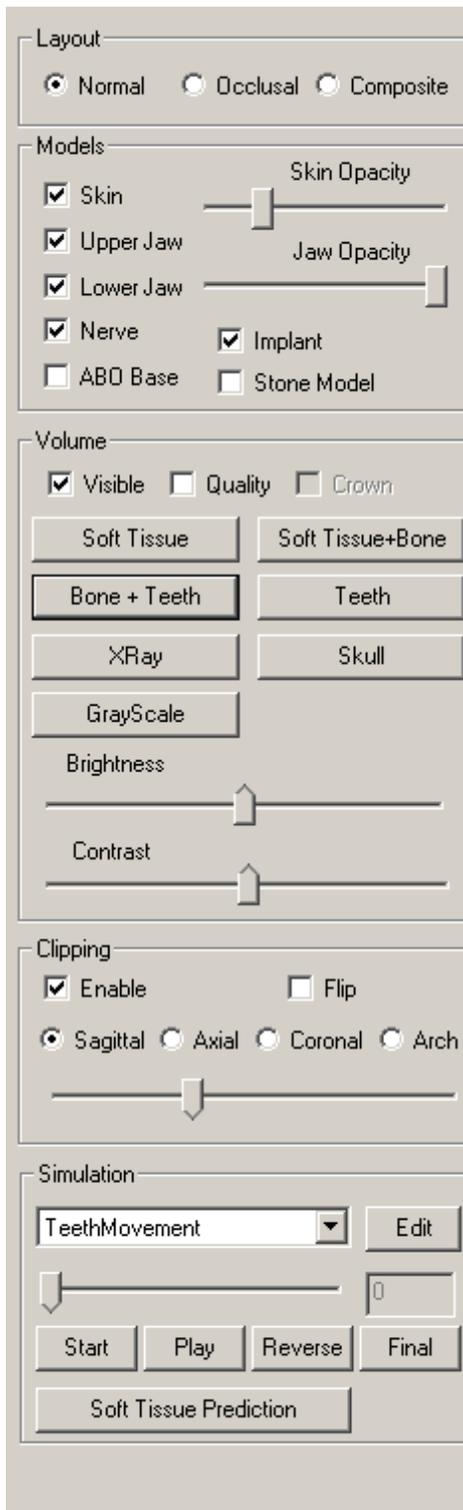


**Background:** Allows for the background color to be easily changed.



**Select Projection:** Allows option to view either parallel or perspective views in 3D.

## Model: View Control



**Layout: Normal** shows the AnatoModels in the normal patient orientation. **Occlusal** shows both arches from the occlusal perspective. **Composite** shows a composite of multiple views of the model all at once.

**Skin:** If you used Anatomage's 3D photo service, the 3D photo is available for viewing by checking the visible box. The Opacity of the photo can be changed to see the underlying anatomy of the patient.

**Upper Jaw and Lower Jaw:** If you used Anatomage's AnatoModel service, the AnatoModel is available for viewing by checking the Visibility box for each arch respectively. The Opacity of the Alveolar bone/ ABO base case be adjusted for your viewing preference.

**Nerve and Implant:** If you traced a nerve in the Arch Section Tab or placed an Implant, there visibility can be toggled with their respective boxes.

**ABO base and Stone Model:** If you have AnatoModel with ABO base or Stone Model is added, there visibility can be toggled with their respective boxes.

**Volume:** The volume rendering can also be toggled on or off so as to just view the AnatoModels or the photo. Notice that different combinations of visibility in terms of structures is possible. For example, you can view your scan with a visible photo and nerves, while hiding the implants and volume data. Many combinations are possible.

Different viewing options are available, such as “Soft Tissue” , “Teeth”, and so on. The Brightness and Contrast of the images can be adjusted with the slide bar.

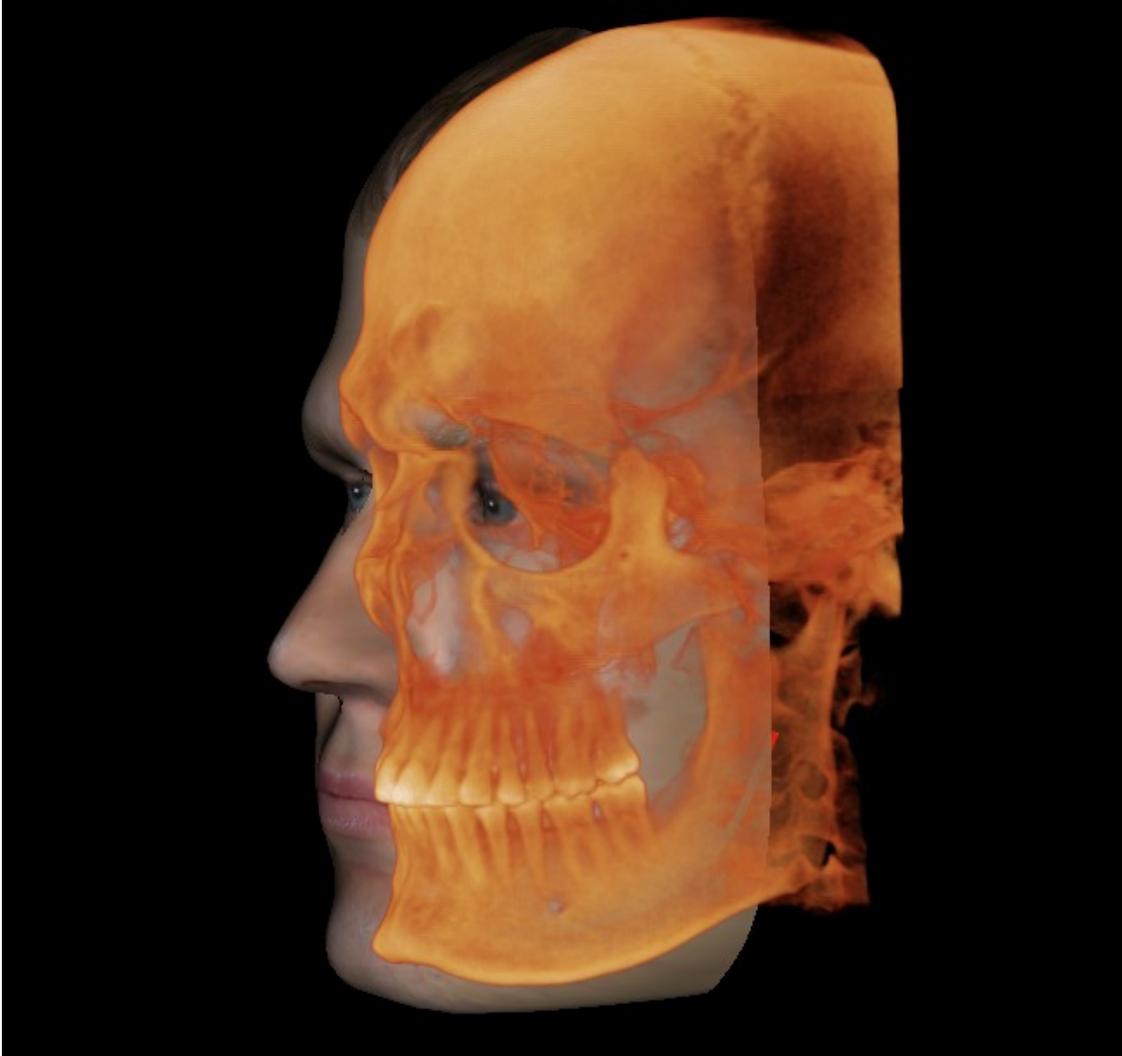
**Clipping:** Click the Enable Clipping box to slice the image along the predefined Anatomical Planes (Sagittal, Axial, Coronal, and Arch). Scrolling the mouse wheel will move the clipping plane. To switch a view to the opposite side, click “Flip.” Control the clipping with the scroll mouse or the slider bar.

**Simulation:** To create a new simulation, first select either one of the TeethMovement or JawMovement simulations, or press Edit to make your own name. Then move the slide bar to the

right to indicate your ending point. Then click on any piece of the AnatoModel to move it, such as the teeth individually or the whole arches. After the final position is reached using the 3D move widget, press Start button to go back to step one. Then press Play, Reverse, or Final to see the final position. If your simulation is connected to a soft tissue prediction such as an orthognathic case, and a 3D photo was created, then press the Soft Tissue Prediction box to create a simulation of the soft tissue prediction. It will then be included in the general Simulation to view.

## Model: Rendering Window

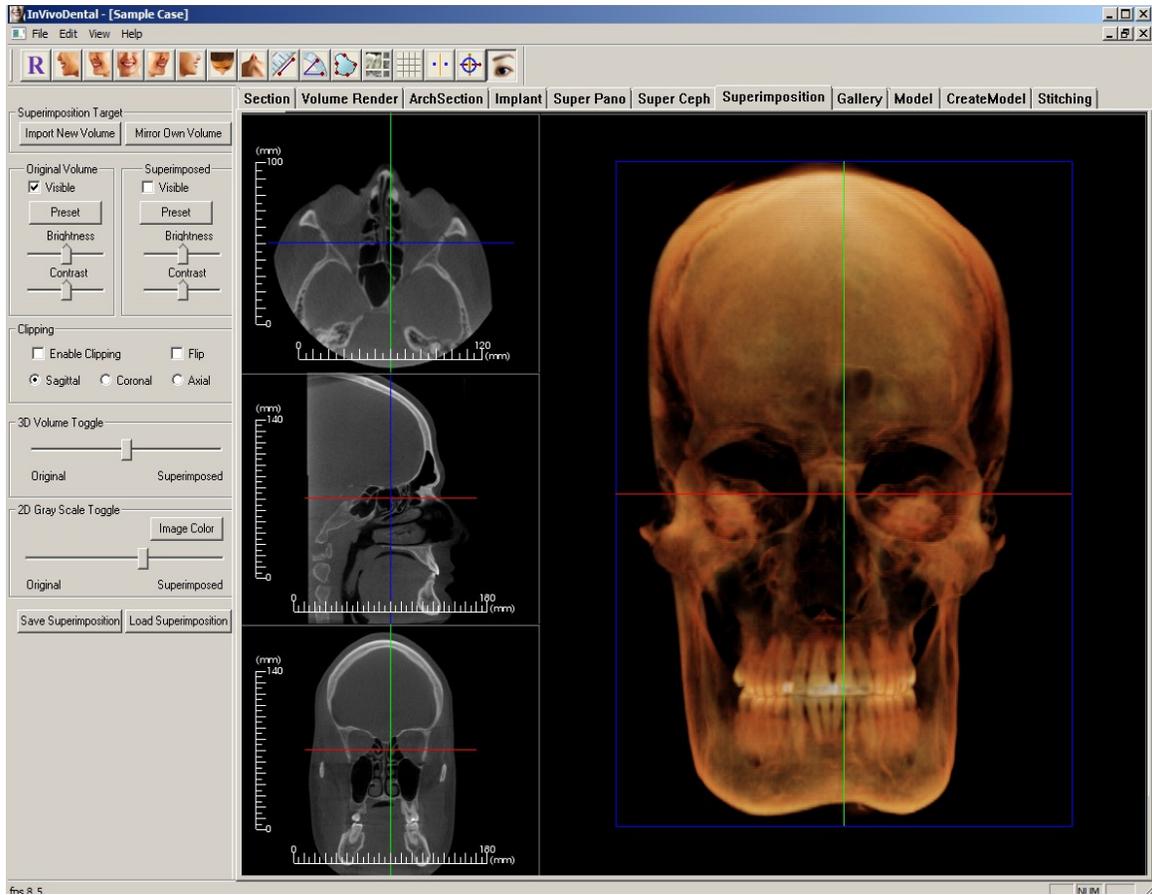
*This window allows the viewing of AnatoModels, 3D photographs, and simulation, all of which are services that must be ordered per case for this feature to work. These services provide excellent diagnostic data and case presentation material.*



Please refer to **Image Navigation (pg. 8)** for information about controlling and adjusting these images.

# Superimposition Features

*In the Superimposition View Tab, you have the ability to open two different scans at once and view them side by side, and superimpose them. This is especially useful for assessing pre and post treatment scans.*



## Superimposition: Toolbar

Shown below is the Tool Bar and tools that are loaded with the Superimposition View Tab:



**Reset:** Resets the Rendering Window to the original view size.



**Left Lateral:** Automatically orients the volume so the patient is facing left sagittal.



**3/4 Left:** Automatically orients the volume so the patient is facing 67° left sagittal.



**Frontal:** Automatically orients the volume so the patient is facing the front.



**3/4 Right:** Automatically orients the volume so the patient is facing 67° right sagittal.



**Right Lateral:** Automatically orients the volume so the patient is facing right sagittal.



**Supramaxillary:** Automatically orients the volume so you are oriented above the patient



**Submandibular:** Automatically orients the volume so you are oriented below the patient.



**Measure 3D Distance:** When selected you may mark 2 points on the volume and distance will appear. Clicking on the point and moving the cursor can modify points. Clicking on the point and pressing, “delete”, can delete them. View Control features allow the values to be projected to 2D, hidden, or exported to a report.



**Measure 3D Angles:** When selected you may mark 3 points on the volume and angle between them will appear. Clicking on their control points and moving the cursor can modify measurements. Clicking on the point or line and pressing, “delete”, will delete them. View Control features allow the values to be projected to 2D, hidden, or exported to a report.



**Area:** After Selecting this tool, click multiple points along the boundary of the desired area. Double click or right click to end the measurement. A number in millimeters square will be automatically display.



**Change Layout:** To toggle the layout click on this icon.



**Grid:** Toggles between two different grid layouts for use in the upper two section frames allowing quick assessment of measurements and spatial location.

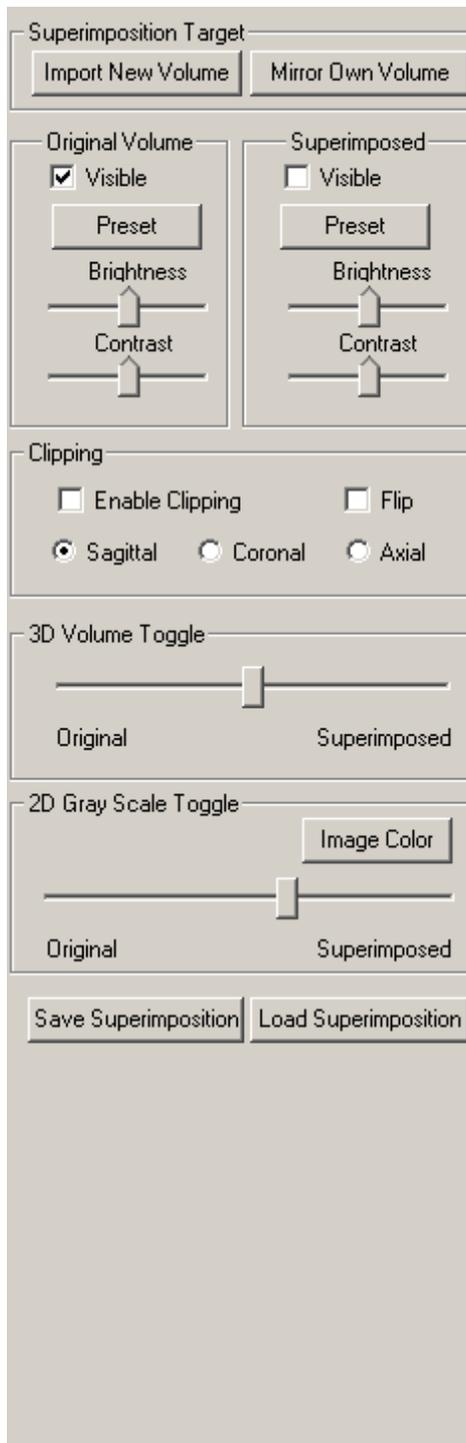


**Landmark Selector:** This icon is used to register the original volume to the second volume. Four or more anatomical points are chosen from each scan to properly align both scans at common stable landmarks.



**Superimposition Aligner:** This icon is used to make adjustments to better align the two volumes that are superimposed.

## Superimposition: View Control



**Superimposition Target:** The Import New Volume box is used to import a second volume, by opening an invivo file (.inv) of your choice.. Both volumes will be subsequently registered to each other by selecting four or more landmarks in each volume using the landmark Selector. The Mirror Own Volume box allows you to mirror the patient's anatomy to check for asymmetries.

**Original Volume and Superimposed:** The Visible box allows you to turn on and off either volume independent of each other. Different viewing presents for the volume can also be selected independent of each other. The options are Soft Tissue, Soft Tissue and Bone, Bone, and Teeth. The brightness and contrast in the original volume rendering can be adjusted independent of the second volume rendering.

**Clipping:** Click the Enable Clipping box to slice the image along the predefined Anatomical Planes (Sagittal, Axial, Coronal, and Arch). Scrolling the mouse wheel will move the clipping plane. To switch a view to the opposite side, click “Flip.” Control the clipping with the scroll mouse or the slider bar.

**3D Volume Toggle:** This slider allows you switch between the original volume and superimposed volume. Set the slider in the middle to visualize the both volume in equal opacity. Set the slider to one side if you visualize only one image.

**2D Gray Scale Toggle:** This slider allows you switch between the original gray scale slice and superimposed one. Set the slider in the middle to visualize the both in equal opacity. Set the slider to one side if you want to visualize only one image.

### Save Superimposition.

This button allows you to save the setting of the superimposition into a file. It will create “Superimposition.vdata” file. When you want to restore the superimposition, use Load Superimposition.

### Load Superimposition.

This button allows you to restore saved superimposition. Press the button and select the right data file. The superimposition file will be reloaded with the saved volume.

## Superimposition: How to Superimpose Two Volumes

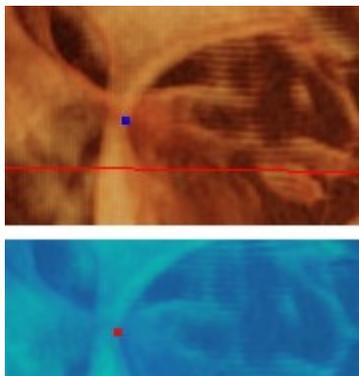
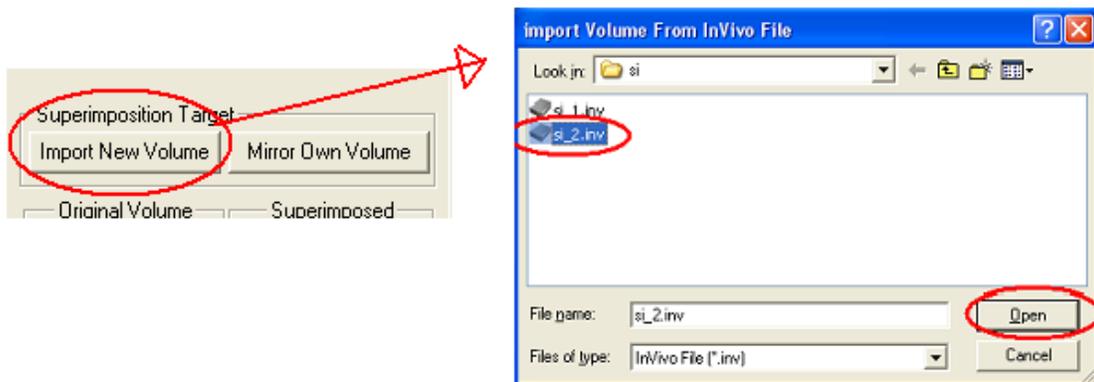
InVivoDental provides an easy to use tools for superimposition. Although it is easy to use, it is a technique sensitive feature, with the most critical step being the registration of the scan via selecting stable landmarks in both scans. This next sections shows how to superimpose two scans step by step.

**Step 1. Open First File.** Open the first file that you want to start with. You do not have to open them in any order, but starting with the pre-treatment scan may be recommended for sake of organization. See Dicom and Invivo File Loading section if you are unsure how to open an invivo file with the software.

**Step 2. Import Volume.** Go to the Superimposition Tab on the top View Tabs:



From the view controls to the left, click on the Import New Volume box to select your second file to open:



**Step 3. Registering the Two Scans to Each Other.** In order to superimpose the scans correctly and precisely as possible, strict attention must be placed in selecting at least four matching and stable landmarks in both scans. Use the Landmark Selector Icon:

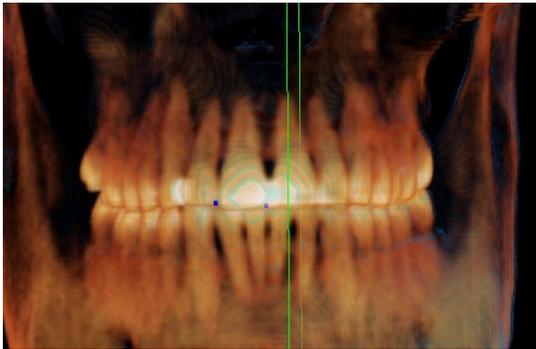
Next pick four matching landmarks in each scan. Select the first landmark on one scan, and then select the exact matching stable



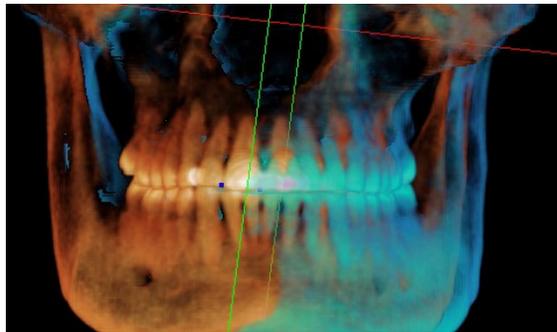
landmark on the other scan. The landmarks are selected by pressing down the center scroll wheel of the mouse, or by the space bar on the keyboard. Each point shows up as little blue or red dots, as seen in the image to the left. The image can still be rotated by grabbing it with the left mouse click as always.

Because the points are plotted on the volume rendering in 3D, careful attention must be used that the brightness is not up too high, otherwise the point could be placed away from the exact point intended. Clipping the scan is also a tool that can be employed for making the selection of the exact point easier and potentially more precise.

Once all four points are plotted one by one, click the right mouse button to register the two scans. It is recommended to practice by opening the same scan twice before trying to superimpose two different scans. You can see how precise you are by how much overlap in the two registered scans there are. The following image is of two identical data sets that are registered to each other precisely, notice the blue outline from the second scan closely overlapping the original orange colored scan.



The following image is of two volumes not registered precisely, notice the blue and orange skeletal boundaries do not line up, and the presence of double images:

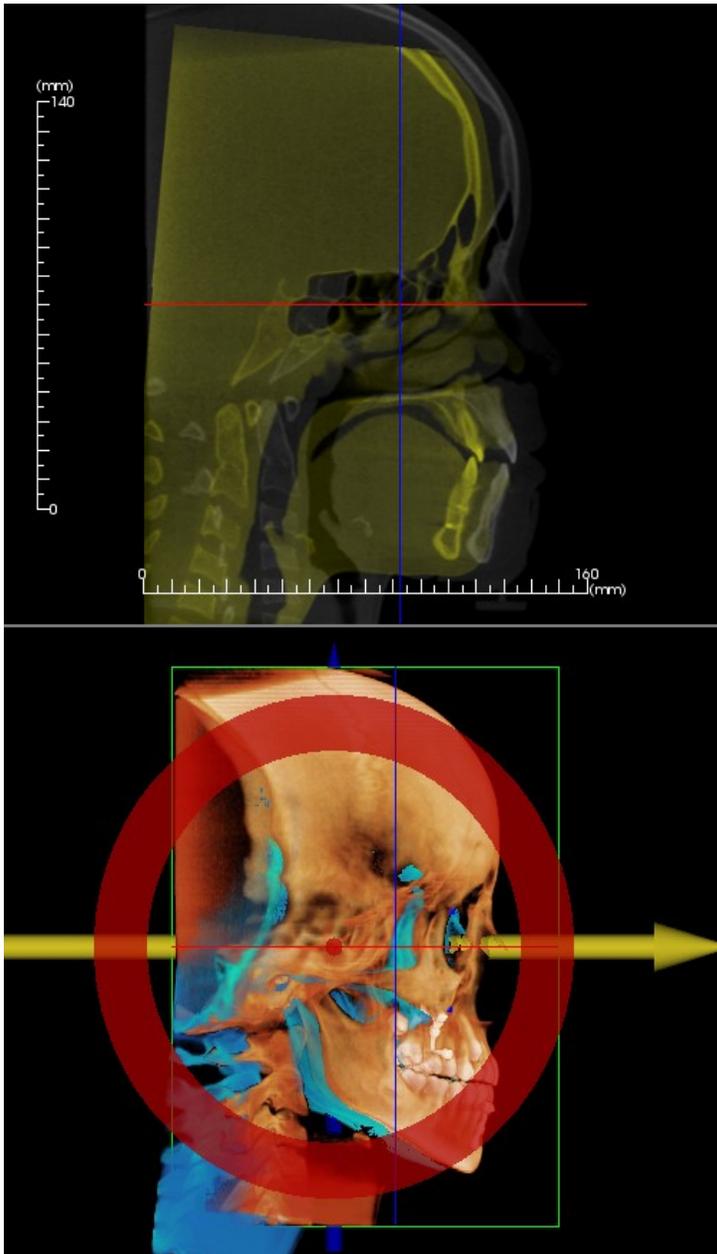


**Step 5. Making Adjustments for Precision.** The next step is to check the Cross-sections for accuracy and to make the necessary adjustments. The superimposition is shown in 3D as well as in the cross sections.



To make the cross sections bigger, use the Toggle Layout icon from the tool bar:

If you notice that the superimposition is not totally precise in one of the sections, you can move the volume to make it match up more precisely by using the Superimposition Aligner icon from the tool bar:



For example, notice in the sagittal section shown to the left that the superimposed volume is not totally overlapped. Using the Superimposition Aligner tool, all you would need to do is move the volume in the anterior-posterior direction until the sections align. This is done by clicking on the yellow arrow in the Aligner Widget and dragging it forwards or backwards.

One should go through each anatomical plane to check for precision. The cranial base should match up perfectly because it is stable, however the vertebrae will usually be off because the patient's head is always tilted somewhat differently in each scan.

# Common How To Tasks

## How to Trace A Nerve

- Go to **Arch Section** View
- Make sure Pano Image is in Section Mode Not X-ray Mode.
- Adjust Focal Trough such that nerve pathway is visible in Pano Image
- Move pointer to Pano Image
- Review nerve pathway while using scroll wheel. If the nerve is not clearly visible scroll mouse wheel.
- If the nerve is not clearly visible adjust focal trough.
- When the nerve was identified through the pano image, press “New Nerve” button in Nerve Pathway section of Control Panel.
- Starting from mandible foramen pick point by point.
- If nerve is not clearly visible, use scroll wheel to find the nerve and continue picking.
- If traced near mental foramen, move pointer to cross section view.
- Use scroll wheel to find the exit of the nerve.
- Pick points connecting the nerve exit
- Press “Done” button in Nerve Pathway section of Control Panel.

## How To Create Reports In Life Size

- Go To **Arch Section View**
- Check **Adjust** button in Vertical Range and Orientation.
- Adjust Upper and Lower limit by dragging green lines.
- Un-check **Adjust**
- Adjust Focal Trough (Arch Spline) or re-draw Arch Spline by Pressing Arch Spline Button.
- Change Layout Mode to **Print Out**
- Change to a desired Layout Choice by **Change Layout** button
- Adjust Cross section width and interval
- Move cursor to set cross section in desired location.
- In **Print Out** mode, user cannot zoom the image since they are to be printed out in life size.
- If desired structure is not visible in cross section, adjust axial cursor or focal trough.
- Switch pano image to **Xray** Mode and turn on **Ruler**
- Turn on Arch Spline Ruler and turn off Arch Spline Control Points
- Turn off cursor if necessary
- Go to View Menu and choose “**Capture to Gallery**”
- Go to **Gallery** Tab
- See **Print Preview** in File Menu
- Print out a test page.
- If you want to change format, go to **Print Layout Setting** in File Menu
- If you want to put your own logo, replace “printLogo.bmp” file in installation folder. Installation folder is typically “C:\Program Files\Anatomege\InVivoDental”
- After Print Layout Setting is change, make sure you re-do “Print Out” mode switching and recapture image. Otherwise the image could be still in previous Print Layout Setting.

## How To Create a Positive Airway View

- Go To **Volume Rendering** View
- Select “Inverse” Preset
- Reduce Opacity such that the internal structure starts to show up
- Change the view point to Top View (Press Top View button in tool bar)
- Use sculpting tool to remove undesired part
- Change the view point and repeat sculpting operations.
- After the desired airway is isolated, increase Opacity
- Adjust Brightness and Contrast to set the right visualization.

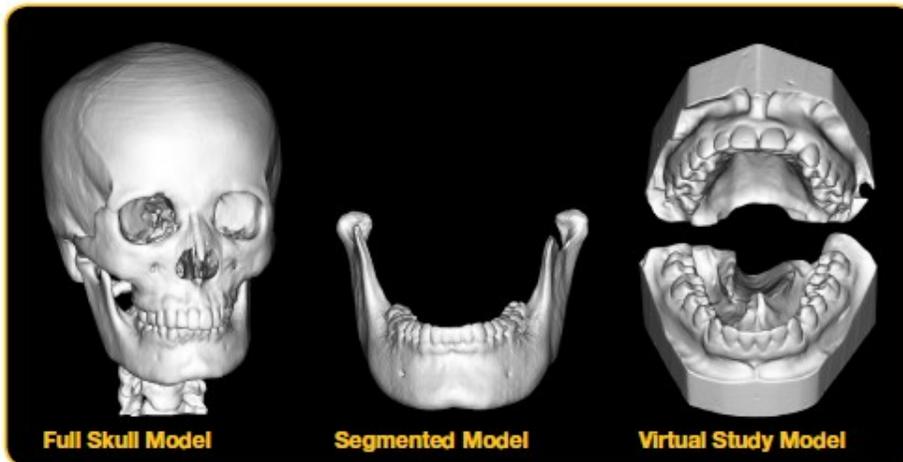
# The AnatoModel Service and the InVivoDental Plugin Modules

## CreateModel Module for *InVivoDental*

The *CreateModel* Module for *InVivoDental* is a powerful tool that converts DICOM files into STL format. It allows the ability to quickly and easily perform 3D segmentation of anatomy to turn CT scans into 3D surface models. These STL files can be used for various CAD/CAM systems including SLA manufacturing.

### How the *CreateModel* Module will enhance your imaging:

- Virtual Model Surgical Simulations
- Create Virtual Study Models from Scanned Stone Models
- Create Custom Fit Devices from STL Surface Models
- Create Physical Models from STL Files with 3D Printer
- Connect DICOM Scans to CAD/CAM Systems
- Expand Service Offerings for Imaging Centers
- Advanced Research and Analysis



**ANATOMAGE**  
[www.anatmage.com](http://www.anatmage.com)  
 408.885.1474

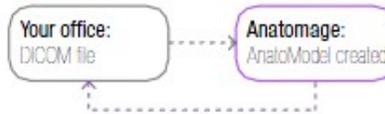
Please contact a sales representative for a Software Demonstration and a Free Software Trial.

## AnatoModel Service

The AnatoModel service is an effective way for you to provide enhanced diagnosis for your patients without any extra work for you or your staff. With a single CBCT scan our AnatoModel technicians create dynamic digital study models that replace bulky stone models, as well as 3D face modeling from a simple digital photograph of your patient.

### How the AnatoModel process works:

Because we realize how valuable time is to your practice our process is conveniently simple and quick. Send us your CBCT DICOM data and we do the rest. You will quickly receive your digital study models and 3D face models electronically. No shipping, no storage, no time wasted for your staff.



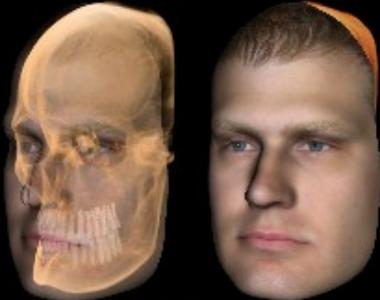
### AnatoModel Features:

Advance your practice with these innovative services and reduce cost, chair-time, messy impressions, stone model storage, and most importantly have enhanced clinical treatment.



**Digital Study Models**

- No impressions.
- Better diagnosis; root, impaction, developing teeth.
- Impress patient with treatment simulations.
- Anatomically accurate articulations.



**3D Face Modeling**

- No expensive equipment.
- Regular digital camera only.
- Accurate soft tissue and hard tissue relations.
- Impress patient with 3D VTO simulation.

### **ANATOMAGE**

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408.885.1474

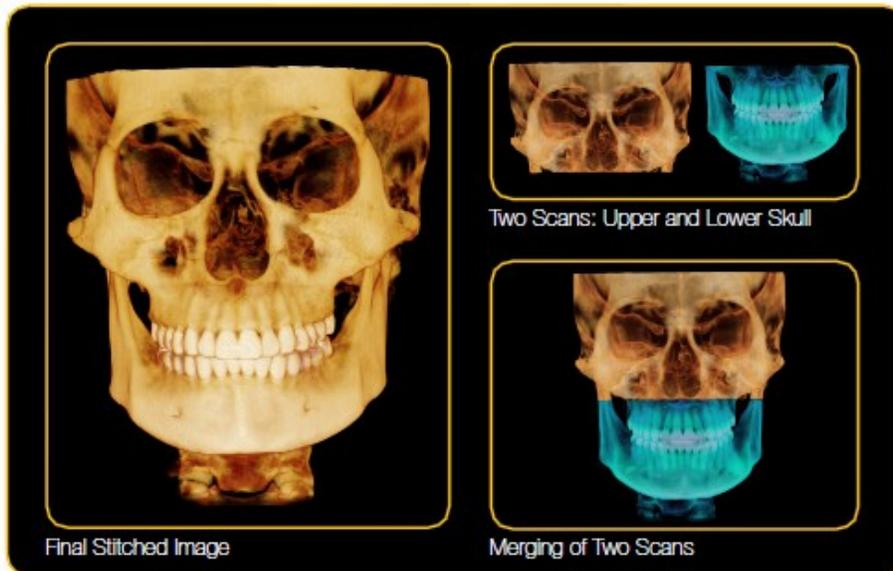
Please contact a sales representative for more details and a Digital Model Demonstration.

## Stitch Module for *InVivoDental*

The Stitch Module for *InVivoDental* is a powerful tool that can double the value of your CBCT machine. The Stitch Module can merge multiple small field of view DICOM images into one larger 3D image. This Module is invaluable when you encounter a limitation with your scanner.

### How the Stitch Module will enhance your imaging:

Use your CBCT machine to its fullest potential with help from the Stitch Module for *InVivoDental*. If your CBCT machine cannot capture both jaws, you can scan the mandible and maxilla separately and merge them together using this tool. Similarly if your scanner cannot capture the entire dental arch simply scan the left and right arch separately and merge them together with the Stitch Module. The Stitch Module expands your machine's field of view.



### **ANATOMAGE**

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Please contact a sales representative for a Software Demonstration and a Free Software Trial.

## Glossary

*Three-dimensional imaging is an emerging field in dentistry. Some clinicians may not be familiar with the expressions and phrases conveyed in this manual. As a result, the terms listed below provide clinicians with some background conventional dental and medical imaging terminology in addition to definitions specific to InVivoDental software.*

**A** **Anatomic Planes of the Body** Constructed planes based upon anatomical principals that help to define slices or views of the human body.

- **Arch-** Any plane that divides thru the arch from at a right angle to the cortical bone.
- **Axial-** A plane that divides the body along the long axis into superior and inferior halves. Also known as the transverse plane.
- **Coronal-** A plane that divides the body into anterior or posterior halves. A plane that divides perpendicular to the sagittal plane.
- **Sagittal-** A plane that divides the body into right and left halves (the median or midsagittal plane divides the body into equal right an left halves).



**Anatomic Plane Clipping** The process of virtually separating/segmenting a 3D structure along one of the aforementioned Anatomic Planes of the Body. This allows an internal view of a 3-D volume rendering which helps to visualize certain landmarks and structures.

**Capture** The process of exporting a high quality 2-D image (or screenshot) of 3-D rendering and saving it as a separate file in **BMP, JPEG, or PNG** file formats

**Bitmap (BMP)** BMP is a standard Windows image format on DOS and Windows-compatible computers. BMP format supports RGB, Indexed Color, Grayscale, and Bitmap modes. This tends to create larger file sizes.

**JPEG** The JPEG format supports 24-bit color and preserves the broad range and subtle variations in brightness and hue found in photographs and other continuous-toned images. JPEG is supported by most browsers. JPEG compresses file size by selectively discarding data. The JPEG format does not support transparency. When you save an image as a JPEG file, transparent pixels are filled with the Matte color. File size is similar to PNG. These files also preserve the actual image true size creating life Size image.

**PNG** Developed as a patent-free alternative to GIF, Portable Network Graphics (PNG) format is used for lossless compression and for display of images on the World Wide Web. Unlike GIF, PNG supports 24-bit images and produces background transparency without jagged edges. PNG format supports RGB, indexed-color, grayscale, and Bitmap-mode images. PNG preserves transparency in grayscale and RGB images. File size is similar to JPEG.

**Coordinate Indicator:** In InVivoDental colored lines indicators within the Pano Section show where you are spatially located within in the Pano Section Rendering Window.

**Color Mapping-** The color map contains predefined RGB values. When activated, each pixel containing its own grayscale value is replaced with its red, green and blue values which can be helpful in enhancing the diagnostic process.

**Color Profiles-** Similar to Color Mapping, but adds levels of transparency based upon density.

**Cone Beam Computed Tomography (CBCT)**- Utilizes a cone shaped x-ray beam with specialized sensors, which can collect hundreds of slices with a single rotation. According to the manufactures and independent studies, this technology greatly reduces the radiation dose to be significantly less than a full mouth series of periapical and bitewing radiographs.

**DICOM**- Acronym for Digital Imaging in Communication in Medicine. The introduction of digital medical image sources in the 1970's and the use of computers in processing these images after their acquisition led the American College of Radiology (ACR) and the National Electrical Manufacturers Association (NEMA) to form a joint committee in order to create a standard method for the transmission of medical images and their associated information. The DICOM Standards Committee exists to create and maintain international standards for communication of biomedical diagnostic and therapeutic information in disciplines that use digital images and associated data. <http://medical.nema.org/>

**Density Scalar Adjust**- tonal value adjustment feature in InVivoDental that can be performed to adjust the way the density values and recalibrate the scale according to established Hounsfield Units.

**Density Profile**- An InVivoDental software feature that controls the amount of tissue (e.g. bone) that allows you to evaluate bone density and assess the bone quality in a region of bone directly around an implant in the Density Profile frame. It is also a great way to tell how close to the sinus you may be. These algorithms are based upon Hounsfield Units of density.

**Hounsfield Units (H.U.)**- The Hounsfield scale is a quantitative scale for describing radiodensity was established by Sir Godfrey Newbold Hounsfield, one of the principal engineers and developers of computed axial tomography (CAT, or CT scans). Specifically, distilled water is specified on the Hounsfield scale, as a reference, as 0 units ("HU", or Hounsfield units), air is specified as -1000 HU.

Air:	-1000	Calculus:	+100 to +400
Fat:	-50	Bone:	+1000
Water:	0	Enamel:	+3000
Muscle:	+40		

These were chosen as universally available references and were oriented to the key application CT was developed for: imaging the internal anatomy of living creatures based on organized water structures and mostly living in air, e.g. humans.

**InVivo File (\*.inv)**- InVivo document file type (\*.inv). InVivo Files are specific to InVivoDental software applications and are composed of three-dimensional CT scan data. InVivo files can only be opened with InVivoDental software. Additionally, saving an existing three-dimensional CT scan with InVivoDental software as an InVivo File can only generate InVivo files. When a three-dimensional CT scan is saved as an InVivo File, it is a compressed into a single file, instead of multiple files as standard DICOM CT data usually exists. This provides significant advantage of transferring, sharing, storing, and loading of three-dimensional CT scan data.

**Life Size**- This is a term used in InVivoDental software to describe an image captured in its true dimensions. These images can be viewed or printed to scale and truly life size (1:1).

**Pano Cursor**- Yellow, Red, and Purple coordinate indicators. These Pano Section Coordinate Indicators show where you are spatially located within in the Pano Section Modeling Window.

**Parallel Projection- Orthogonal view of a 3-D object where** parallel lines remain parallel and there is no convergence or divergence of the projected image. The image will be displaced without enlargement or distortion.

**Perspective Projection**- A system for creating an illusion of depth or *three-dimensional space* on a *two-dimensional* surface. Mathematically based on the fact that parallel lines or edges appear to converge and objects appear

smaller as the distance between them and the viewer increases. This concept is important for recreating traditional radiographs where the beam diverges from the source.

**Arch Spline** - A smooth curve that runs through a series of given points. This is used to define panoramic or other Arch Spline within InVivoDental software.

**Maximum Intensity Projection (MIP) Rendering-** MIP finds the brightest texel alpha from all the texture slices at each pixel location and displaces it. MIP is a contrast enhancing rendering tool. Structures with higher alpha values tend to stand out against the surrounding data.

**Source to Image Distance-** The distance the radiographic source is from the patient's mid-sagittal plane. In the US it is 60 inches (5 feet) internationally it may be 150 cm.

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