User's Guide

PREVIEW® Treatment Planning Software

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ISO 13485:2003
FM99812

0086

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Rx Only
Caution: Federal law restricts this device to sale by or on the order of a Physician.

DES-MAN-1-02 Rev. P

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Introduction

M2S Preview is a system for viewing patient-specific data on a personal computer. Raw scan data is extracted from computed tomography (CT) scans, MRI, or other sources, and rendered by Preview into a three-dimensional (3D) format.

M2S Preview has many powerful viewing and measuring tools that are easy to use. Once you are familiar with the Preview tools, you will be able to determine methods for using the scan and 3D model data that best suit a specific procedure, a specific type of patient application, or an individual patient case.

Overview

This chapter will guide you through all of the aspects of M2S Preview. These sections will include:

- **Starting the Preview Program**
  Instructions on how to start the Preview program and select patient data.

- **The Main Preview Window**
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- **Verification of the Preview Model**
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System Requirements

Hardware Requirements

This version of Preview operates on a personal computer (PC) with at least 256 MB* of RAM. In the table below, the minimum and recommended hardware components for operating Preview are specified.

Hardware Component	Minimum Recommended	Recommended
Processor	800 MHz	2.4 GHz or faster
RAM	256 MB*	512 MB or more
Color Display	16-bit** per pixel (thousands of colors)	32-bit per pixel color (millions of colors)
Monitor	15-inch display (1024 x 768 pixels)	17-inch display (1280 x 1024 pixels or larger)
CD-ROM Drive	48x	48x
Hard Drive	400 MB of free hard-disk space	400 MB of free hard-disk space
Video Card	Open GL compatible, non-integrated	ATI Radeon 9000 or better

If your system falls below the minimum recommendations, we advise you ***not*** to install Preview or consult your IT technician.

* Preview performance is improved if you do not run other major applications simultaneously.

** Preview requires the color settings for your display to be set to either 16-bit or 32-bit colors. 16-bit color provides adequate color, but it does not allow the slice images to be shown with the full 8 bits of grayscale. 32-bit color should always be used when possible. See Chapter 2 for more information about setting image quality using the Window/Level feature.

Software Requirements

M2S Preview requires that your PC must use one of the following Operating Systems:

- Windows 8 (32 or 64 bit)
- Windows 7 (32 or 64 bit)
- Windows XP *

*Preview has been tested on Windows XP for accuracy, functionality and performance, but M2S does not support the XP platform.

For functionality with the M2S' PEMS, you must have a compatible web browser, such as:

- Microsoft Internet Explorer
- Mozilla FireFox
- Google Chrome

Installing Preview Software and Studies

You can receive Preview studies and software from M2S in one of two ways:

- A downloadable file received through the M2S PEMS website

  Note: In order to view your downloaded study, you must have Preview 2.4 or later on your system. If you do not, a Preview software download is available on the PEMS website (refer to instructions entitled "Installing Preview Software to your System…." which follows this section)

- A Compact Disc (CD) which features a distribution of Preview as well as the model.

  Note: With the CD option, you can choose to install Preview onto your computer or you can choose to run the patient-specific program directly from the CD.

Installing Preview Studies to your System using a Downloadable File from the PEMS Website

1. **Log onto PEMS**

   Point your Web Browser to https://pems.m2s.com and log in using the credentials given to you by M2S.

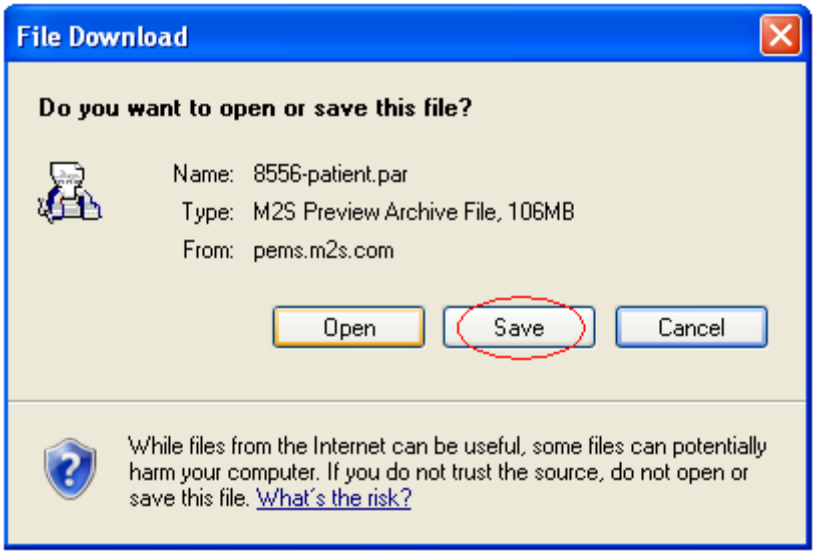
2. **From the PEMS Home Page, select the patient study you wish to download by clicking on the flashing red arrow.**

   Flashing red arrows indicate a study is available for download for up to seven days.

   A solid black arrow indicates the study has already been downloaded.

3. **You will notice that you have two choices: download a Preview Model or download a Preview Plan. Downloading the Preview model, whether blinded or unblinded, will provide you with the Preview model dataset, similar to what would be on the Preview CDs from M2S. The Preview Plan provides only the M2S measurements for import into an open Preview model.**

4. **Select the Preview model you wish to download. When the dialog box appears, click on "Save" or "Save As".**



Click "Save" or "Save As" to save your file

5. **Name the file, confirm where you would like it saved, and click OK.**

   We recommend you use a DSL, cable or T1 Internet connection to download files from PEMS. Downloads are not recommended for dial-up service. You may find that studies download quicker in non-peak hours (early am or late pm) because of less traffic on your network.

   How long will it take to download your study?

   That depends on the type of Internet connection you have, the bandwidth you have available, the volume of traffic on your network at the time of download, and your hardware and software configuration. While waiting, you may minimize the download progress window and allow it to download in the background. Be aware that any other Internet-based activities you do while downloading will affect the available bandwidth, therefore slowing down the downloading process.

6. **Once the download is complete, you will find that they are saved as single Preview Archive or .PAR files.**

7. **To open the Preview study, simply double click on the .PAR file (first confirm you have Preview software loaded on your system).**

Note: Sagittal and coronal views are not included with your Preview download. They have been omitted from the PAR files in order to reduce the time it takes to download. However, Preview has the ability to generate these views on request.

- In Preview, select Help, Edit Preferences, Other, and select "Auto Create Sagittal and Coronal Slices".

- Please note the regeneration of slices is a CPU-intensive process and may take several minutes.

Installing Preview Software to your System Using a Downloadable File from the PEMS Website

1. **Log onto PEMS**

   Point your Web Browser to https://pems.m2s.com and log in using the credentials given to you by M2S.

2. **From the PEMS Home Page, click on "Downloads" in the navigation menu.**

3. **Under the Preview Software heading, click on "Download the Full Preview Installation"**

4. **When a dialog box appears, click on "Save" or "Save As".**

5. **Save the file to your desktop, hard drive, network, or onto removable media such as a CD or flash disk.**

6. **Run the Installation Procedure**

   Once the download is completed, run the installer file and follow the instructions on-screen to install the latest version of Preview.

7. **Read the Preview Release Notes**

   After Preview installs, the Preview Release Notes dialog box appears. Read these notes for helpful hints on how to best use this version of Preview.

8. **Load a Preview Study**

   In order to load a Preview study, you may either download a Preview study through PEMS or place a patient-specific CD-ROM in your system and run Preview.

Installing Preview to your Hard Drive using the CD-ROM

1. **Insert the Preview CD-ROM into the CD-ROM drive.**

   The Installation Option dialog box prompts you to choose running Preview from

your hard drive or off the CD.

The Preview program is encoded onto each patient-specific CD-ROM. CD-ROM technology allows you to run the application directly from the CD-ROM drive with adequate performance without having to install it on your computer's hard drive. Once you insert the CD-ROM into your CD-ROM drive, you launch the program and access the patient data from the CD-ROM.

2. **Click Yes to install Preview on your hard drive.**

   By default, the Preview program copies itself to your computer's hard drive in the folder C:\Program Files\M2S, and places a Shortcut to the Preview icon on your desktop and in the Start Menu.

   Note: On some operating systems you will need to have Administrator privileges in order to install. If this is the case, the installer will alert you and you may run Preview off the CD. To install Preview to your hard drive, contact your system administrator.

   Note: If you do not install Preview on your hard drive, you will be unable to use the latest version of Preview when viewing older data sets that you may have on CD's. M2S highly recommends installing the most recent version whenever possible.

3. **Read the Preview Release Notes.**

   After Preview installs, the Preview Release Notes dialog box appears. Read these notes for helpful hints on how to best use this version of Preview.

Installation Problems?

Check the Release Notes file that comes with your Preview software.

If you experience problems while installing the Preview system, or if you have questions regarding your installation options, please see Chapter 6, M2S Preview Customer Support.

Upgrading to the Latest Version of Preview

M2S periodically upgrades its Preview software and you will receive the most current version of the software, as it becomes available, on your new patient CD-ROMs or at any time through the PEMS web site. If you are running Preview from your hard drive, you must install the new software versions onto your computer's hard drive.

Upgrading from the CD

To Upgrade from a CD with the latest version of Preview, follow the instructions below:

1. **Create a backup copy of the folder that contains measurement data.**
2. **Insert the Preview CD-ROM into your CD-ROM drive.**

   The program detects an earlier version of Preview on your computer's hard drive and displays the Preview Version Option dialog box. The dialog box prompts you to select from the available versions of Preview.

3. **Select the newest version of the Preview software.**

   The new version loads onto your computer's hard drive.

Upgrading through the PEMS Website

To upgrade from the PEMS website, select the latest version of Preview under the Downloads tab and continue with the instructions listed above.

Utilizing the Correct Display Settings

For Preview's colors and text to appear accurately, set Microsoft Windows' Appearance settings to the default, set color to 32-bit, and select small fonts. To adjust your computer's settings, perform the following steps:

1. **From the Windows *Start* menu, select *Settings*, then *Control Panel*. If using Windows XP, select *Control Panel* from the *Start* menu.**

2. **Double-click the *Display* icon. Windows XP users may need to switch to classic view first.**

3. **In the Display Properties window, click the *Appearance* tab.**

4. **In the Scheme drop-down menu, select *Windows Standard* and click *Apply*. In Windows XP, the Color Scheme drop-down menu should be at Default (*blue*) and the font size should be *Normal*.**

5. **Click the *Settings* tab.**

6. **In the Colors drop-down menu, select *Highest (32-bit)* and click *Apply*.**

7. **Click the Advanced... button, and in the Font Size drop-down menu, select *Small Fonts*. Windows XP users do not need to perform this step.**

8. **Click *Apply*, then *Close*.**

9. **Restart your computer.**

Organizing Patient Plans and Reports

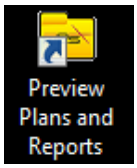
Preview creates a default folder for plan files. This folder is called **Preview Plans** and is found in your User name directory under …\<user name directory>\M2S\Preview Plans.

Accessing the folder of Plan Documents and Reports

In Preview, you will save marks, calculations, special model views, and drop slices in a plan and/or report document file. To access the folder in which your plan documents are stored, perform the following steps:

1. **In Windows XP or Windows 7**

   During the default installation, Preview will create a shortcut to the M2S directory on your desktop. Open this folder to view your M2S files.



You now have a folder for your plan files. You can read about how to save your work in a plan document in Chapter 2, **Using Preview**.

Preview Indications for Use Statement

Device Name: Preview® Treatment Planning Software

US FDA 510(k)'s:
Preview Surgery Planning Software K953616 Cleared by FDA: 27 February 1996
Preview® Treatment Planning Software K040852 Cleared by FDA: 23 April 2004

Indications for Use:

The Preview® Treatment Planning Software is intended to provide accurate, alternative two-dimensional images, as well as three-dimensional models, of patient specific anatomy from existing two-dimensional scan data of organs and tissues. The Preview® product offers the physician the capability to view existing scan data in a format that is more user friendly, and thus enhances the physician's capability to plan treatment. The Preview® product is not intended to provide medical diagnosis or a recommended treatment approach.

Chapter 2 - Using Preview

Starting the Preview Program

You can start Preview from one of two ways, depending on how you chose to install it.

You can either:

1. **Run the program from the hard drive through the use of a desktop shortcut.**
2. **Run the program from the hard drive through the use of Preview .PAR files.**

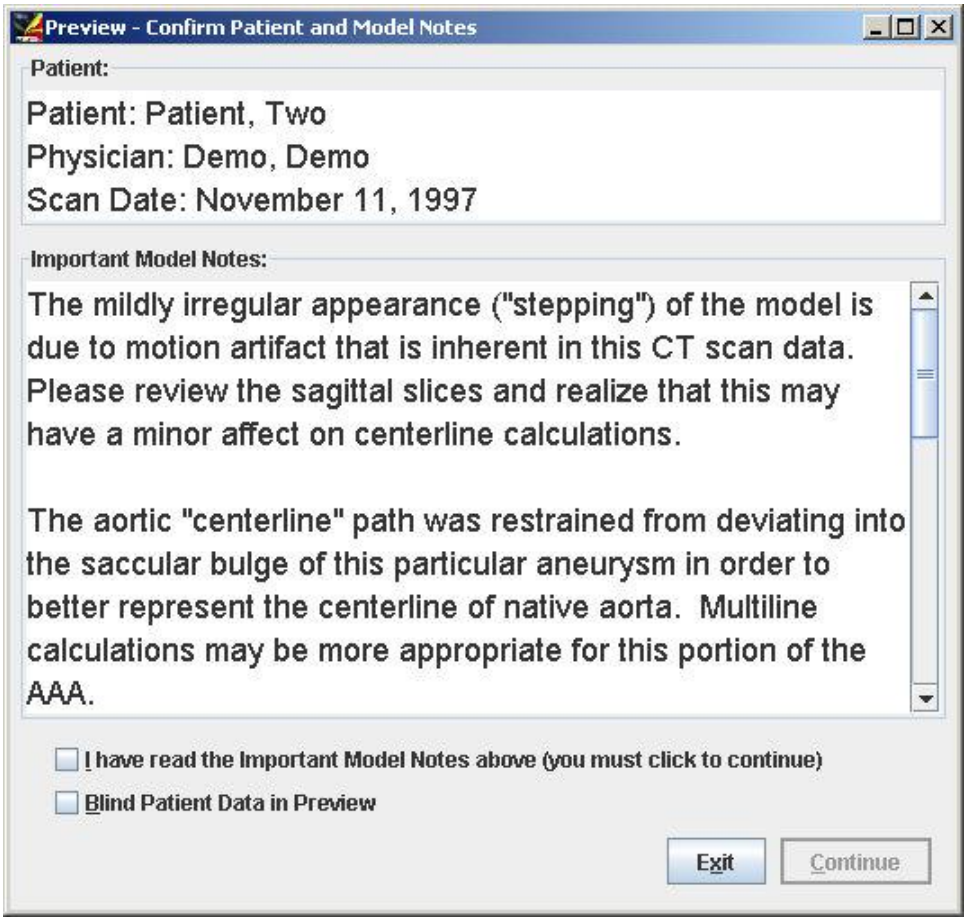
Running Preview through the Desktop Shortcut/Start Menu

Running Preview from the hard drive requires an installation of Preview to be present on your hard drive as directed by the Installation wizard from a CD-ROM or PEMS.

To run it from the hard drive, follow the steps below:

1. **On your desktop, select the Preview icon and follow the instructions from Step #3 on "Running Preview from the CD-ROM. "**

2. **Alternatively, you can run Preview through the start menu:**
    1. **Click "Start"**
    2. **Go to "All Programs" (XP or Windows 7)**
    3. **Go to "M2S"**
    4. **Click on the "Preview" listing**
    5. **Preview should load, and the confirmation window appears:**



6. **Read the model notes and click "I have read the Important Model Notes above" (If you would like to Blind the patient data, check that box as well).**

7. **To start Preview, press "Continue" and Preview's main interface will load.**

Using the M2S Preview Palette

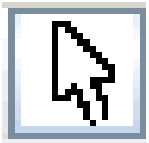
When you open the M2S Preview application, you see the Preview Tool Palette on the right end of the menu bar

: 

To select a tool from the palette, move the mouse pointer over the tool and click once. The Preview Tool Palette changes the function of the mouse, as you point and click in the Model and Slice areas.

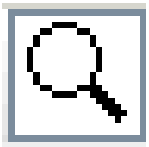
Note that when you move the mouse pointer over a tool, a box appears that names the tool and its shortcut keys.

Mark/Rotate Tool



The **Mark/Rotate** (arrow) **tool** is the standard selector tool you use to place, select, and move marks in Slice areas. In the Model area, you use the Mark/Rotate tool to rotate the 3D model. The Mark/Rotate tool is selected by default when you launch the Preview program.

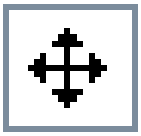
Zoom Tool



In a Slice area, clicking with the **Zoom tool** zooms in (enlarges) the selected slice image. To zoom out (reduce) a slice image, press and hold the Shift key and click on the image with the Zoom tool.

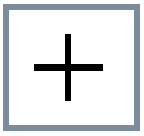
To zoom in and out on the model, click the **Zoom tool**, put the cursor in the Model area, then hold the left mouse button down and drag up to zoom in and down to zoom out.

Pan Tool



Use the **Pan tool** to pan (drag) an enlarged slice or model image in any direction within its area.

Jump Slice Tool



Use the **Jump Slice** tool on slices or the model to jump all slices and the model to the same location.

Free Rotation Tool

Use the **Free Rotation** tool to rotate the model.

Polygon Tool

Use the Selection Polygon Tool draw a polygon to measure and area and Perimeter

Projection Toggle Tool

Use the **Perspective** tool to change the model view to a perspective or orthographic projection.

Making a Menu Selection

To choose a Preview menu command, follow these steps:

1. **Move the mouse pointer to the title of a menu in the Preview menu bar.**

2. **Move the mouse pointer down to a selection in the menu and click the selection.**

Loading PAR Files

Preview studies can be exported, transported, and imported in "**PAR**" files. **"PAR"** files contain patient data that can only be opened through Preview; there are two ways that this can be done:

1. After downloading a PAR file from the PEMS website, simply double click the PAR file and selected study will be automatically loaded into Preview.

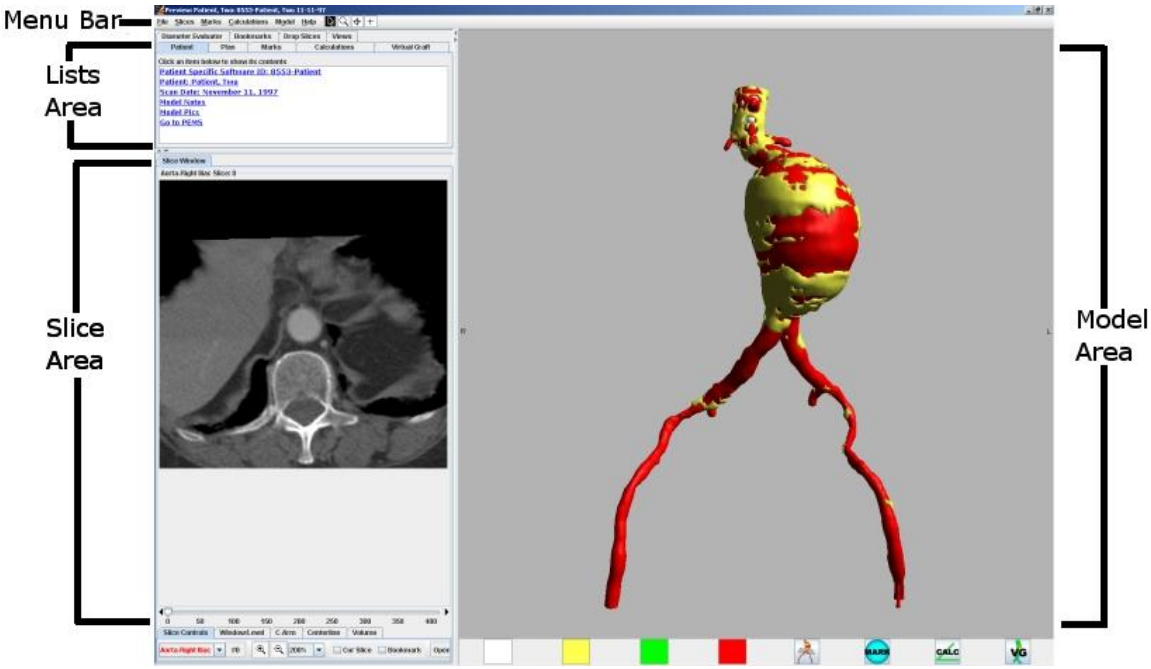
Accessing Onscreen Help

To access M2S Preview's onscreen help, click the Help menu. Preview's onscreen Help topics provide basic instructions for using Preview's features, as well as descriptions of the menu commands and Tool Palette.

The Main Preview Window

Once you verify that the correct patient data is loaded, Preview automatically opens and displays the Main Preview Window: the Aortic slices (with the first Aortic slice) at the bottom left of the screen, the 3D Model at the right with the Model View bar below it, the menu bar at the top of the screen, and a tabbed area beneath the menu bar that displays Patient information.

The Main Preview Window looks something like this (click on the areas for more information):



The Model Area

M2S creates a 3D model from raw scan data acquired from a patient's CT, MRI, or other type of scan. The model is located in the "Model Area", a rectangular region that occupies the right side of the main Preview window. The model area automatically updates based on what you do in other areas. For example, when you place a mark in the slice window, the mark will also show up on the model window.

In M2S Preview, you can view the model from any angle, with the default view being the Anterior view. For more information on this, see the section entitled **Working with a 3D Model**

Resizing the Model Area

Depending on the shape of the scanned anatomy, you may want to resize the Model area. To resize the area, you can place the mouse pointer on the left border of the Model area and drag the area to the desired size.

The Slice Area

When Preview opens, the Slice area at the bottom-left of the Main Preview Window displays aortic right iliac slices. These slices represent the original scanned images received by M2S for processing. They are available for viewing at either 1- or 2-mm intervals, depending on the size of the anatomy scanned. Typically, Aortic Slice #0 is the topmost slice in the top-to-bottom scan series. Preview provides several methods for viewing all the slices in the scan. See **Working with Slices** later in this chapter for information on viewing slices.

The first slice that will appear in the slice window is either the first aortic slice or the last viewed slice.

Note: Slice numbers in Preview do not match the image numbers that may have been printed on CT films. Use anatomical references to determine the relationship of Preview images to films.

Resizing the Slice Area

As with the model window, the slice area can be resized at the convenience of the user through one of the following options:

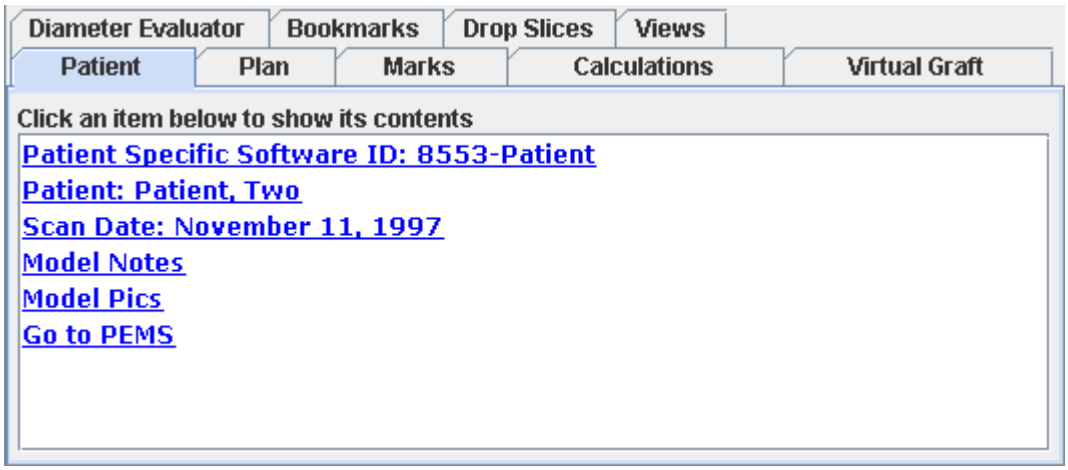
- Click the up-pointing arrow above the words “Aorta Slice: 0.” (To return the Slice area to its original size, click the down arrow.)
- Place the mouse pointer on the top or right border of the Slice area and drag the area to the desired size.

The Lists Area

The row of tabs in the top-left corner of the Main Preview Window provides access to information that is part of your Patient Specific Software and the patient treatment plan you will create. As you add to your treatment plan, Preview collects your plan’s information, which can be accessed from the different tabs.

When Preview opens, the Patient tab is selected, and the area beneath the tabs — the **Lists area** — displays the contents of the Patient tab: links to windows containing the

software ID, the patient's specific scan data, the anatomy objects, the patient's exam date and exam ID, model notes, model pictures and links to the PEMS website.



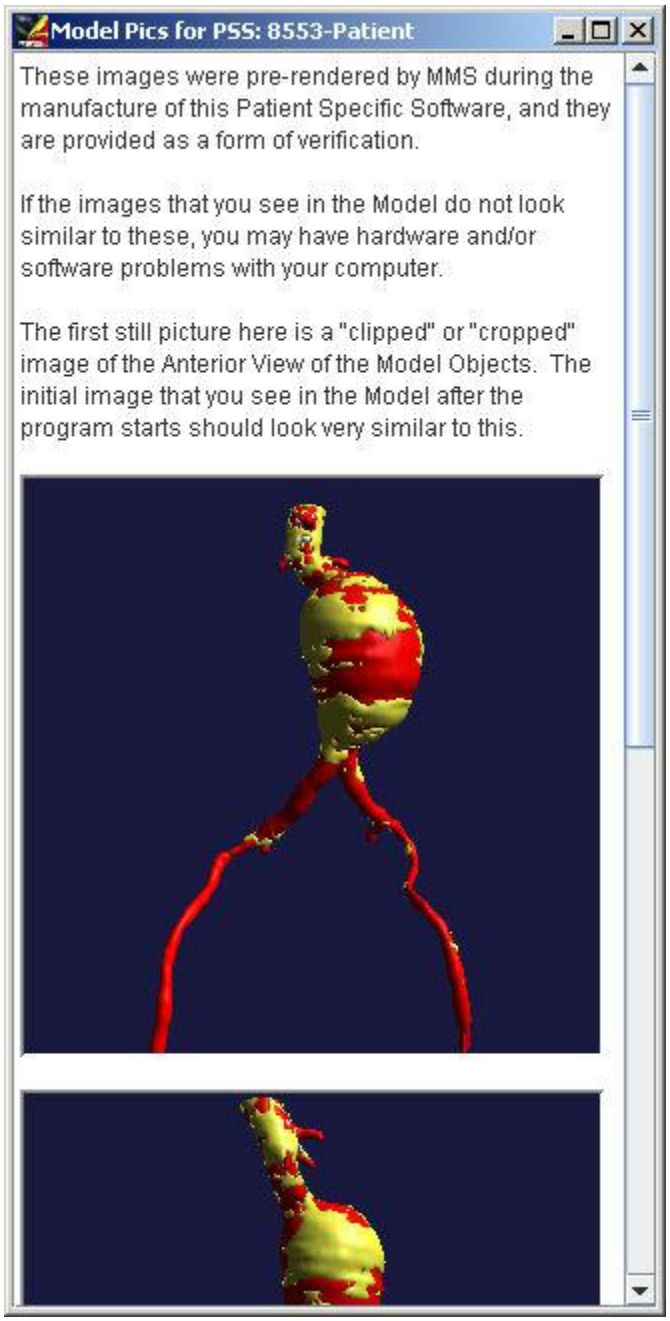
To display another tab's information in the Lists area, simply click the tab. Click the **Views** tab, for example, to display a list of Preview's preset views of the model. After you have performed calculations, click the **Calculations** tab to see a list of your plan's calculations.

Verification of the Preview Model

Before you begin working with the model and slice images provided by the Patient-Specific Software, use Model Pictures to verify that your computer has rendered the data without error.

1. **Click the Patient tab (if not already selected)**
2. **Click on the underlined, blue, "Model Pics" link.**

The "model pics" window will open and will look similar to this window.



The first image shown in the Model Pics window is the Anterior model view, and should look like the image shown in the Model area upon startup. The second and third images are selected model views using various object formats.

If the first Model Picture does not match the image shown in the Model area at startup (the Anterior model view), review the minimum hardware and software requirements described in the section entitled **System Requirements**. If your system meets those requirements, please see chapter 6**.**

If the image in the Model area shows erratic coloration, compared to the Model Picture, make sure your computer's Appearance settings are set to Microsoft Windows' defaults. See Utilizing the Correct Display Settings, or refer to the M2S website at http://www.m2s.com/company/contact-us for Preview technical support.

Reviewing Patient Information and Original Scan Specifications

The Patient tab contains patient statistics and specifications about the original scan from which M2S created the 3D model. You can access this information before, and any time during, your work with the slices and model.

If you opted to "**Blind Patient Data in Preview**", the **Patient Specific Software ID:** and **Patient** links will not open when clicked.

Viewing Patient Data

Patient data may include the patient name and age, physician, and the place and date of the original scan. This information is extracted directly from the digital data files of the patient's original scan and will vary with the information provided in the digital data.

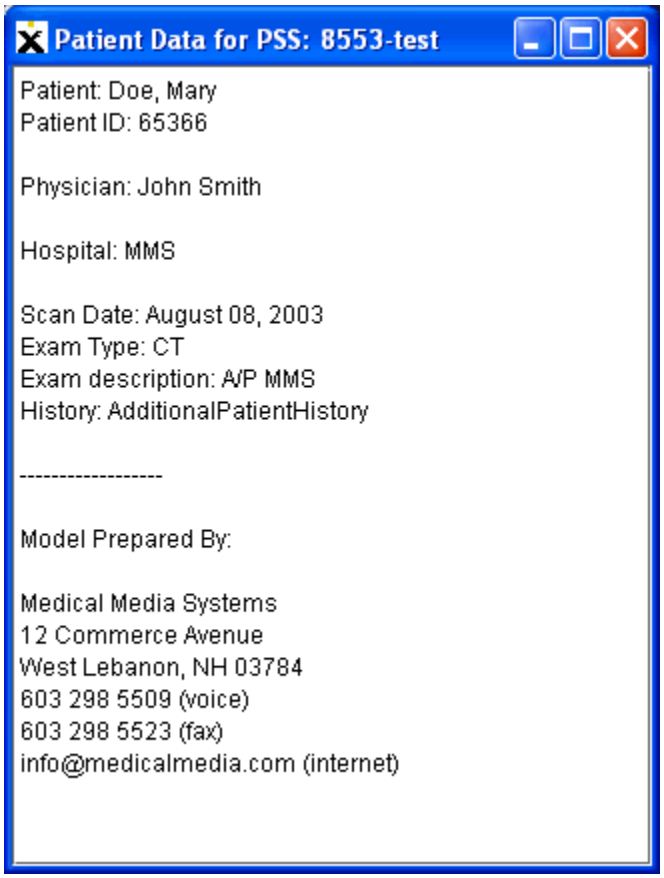
To read patient data, follow these steps:

1. **Click the Patient tab at the top-left of the Main Preview Window.**

   The Patient tab information appears in the Lists area.

2. **Click the blue, underlined "Patient:" link.**

   The Patient Data window opens. It looks something like this:



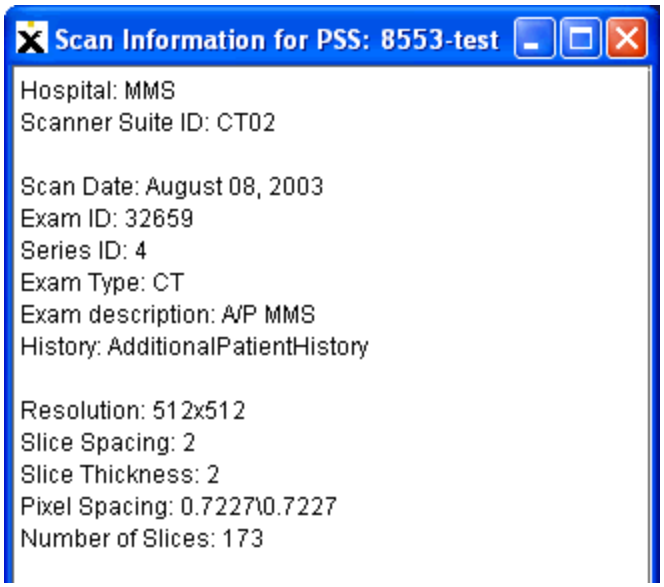
3. **Review the information, then close the window by clicking the "Close" button in the top-right corner of the window.**

Viewing Scan Information

The scan information provides useful information regarding the original patient scan. This information is extracted directly from the digital data files of the patient's original scan.

1. **Click the <u>Patient</u> tab, then click the blue, underlined "Scan Date:" link.**

   The Scan Information window opens. It contains the original scan specifications, such as scan type, orientation, and slice spacing. This data is helpful in studying and marking the slices.



2. **Review the information, then close the window by clicking the "Close" button in the top-right corner of the window.**

Working with the 3D Model

Using M2S Preview allows users to manipulate the patient-specific model in a variety of graphical representations. You can view the anatomy as well as marks and calculations made by Preview.

Viewing the 3D Model

1. **Select the Mark/Rotate (arrow) tool from the Tool Palette and click-and-hold anywhere in the Model area.**

   The Mark/Rotate tool is used to move the model within the model area and add marks within the marks area.

2. **Rotate the model.**

   Place the mouse pointer anywhere in the Model area, and then left click and drag the mouse. The image turns in any direction in which you "pull" it. You can study the model from all viewpoints. L and R are used to indicate the patient's left and right sides, and change as the model is rotated. Alternatively, select the Spin Model checkbox found under the Model menu at the top of the screen to automatically rotate the model 360 degrees. The model will continue to spin until the checkbox is deselected.

3. **Change model lighting or background color.**

   To change the background color of the Model area, select the Model menu and choose from the options within the **Background Color** submenu. To change the highlights on the model, select from the options within the **Lighting** submenu in the Model menu.

4. **Select a model view using Preview's preset positions.**

   Click the Views tab, then double-click a view in the Views list; the model turns to that view.

5. **Enlarge the model-image size.**

   With the cursor in the Model area, hold down the right mouse button, and then drag up to zoom in and down to zoom out.

6. **Notice the various colors in the model.**
   The anatomy objects derived from the patient's scan data are depicted in contrasting colors in the model. In vascular models, for example, the colors are:

   Note: The color of anatomy objects may vary.

   - Red is both bloodflow and dissection
   - Pink is an endoleak
   - Yellow is thrombus and non-calcified plaque
   - White is calcified plaque and/or stent (post-operative scans only)
   - The color of anatomy objects may vary.

7. **Control the visibility of the anatomy objects.**

   When you view the 3D model for the first time, the objects appear in an opaque format. You can change the format of an object from visible to hidden, and opaque to transparent. Select the representative colored button from the Model View bar underneath the 3D model and click once or twice to make the object transparent or hidden as needed for context. Hold down the right mouse button while moving the cursor right or left over the appropriate square to control the degree of transparency.

   Note: Making an external portion of the model invisible provides unobstructed views of internal portions of the model.

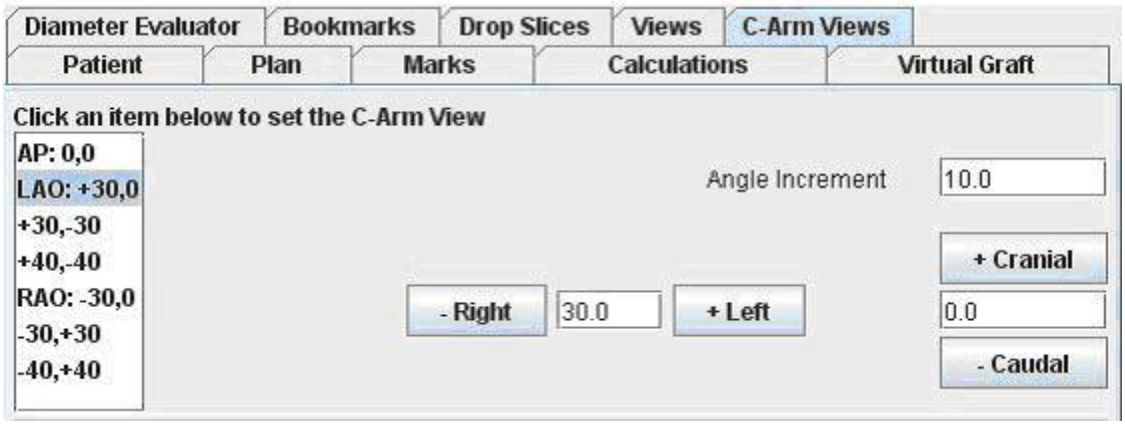
8. **Set preferences for model viewing for all subsequent Preview sessions.**

   Select **Edit Preferences...** from the Help menu. Select background color, model spin direction and speed, lighting, visibility of anatomy objects after virtual graft is inserted and other options. Click **OK** or **Apply**. Preview may need to be restarted for all preferences to be set.

C-Arm Views

Clicking the C-Arm Views tab (if available) displays the tool for setting C-Arm View. At the left of C-Arm View panel is the list of standard C-Arm views; at the right side is the C-Arm View control panel.

1. **Click the C-Arm Views tab.**



2. Select an option for the Standard Views list.

The following standard C-Arm views are available:
AP: 0,0, LAO: +30, 0; +30,-30; +40,-40; RAO: -30, 0; -30,+30; and -40,+40.

3. Customize the selection using the Control Panel.

-Right/+Left buttons change the primary angle; +Cranial/-Caudal buttons change the secondary angle; the current value of two angles is shown in the text fields between buttons.

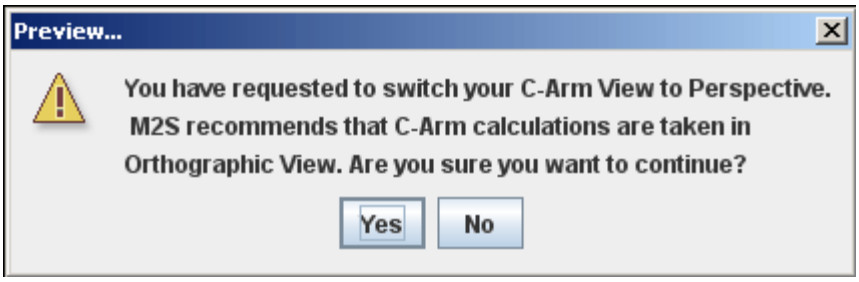
To set the angle increment, type the desired increment into the Angle Increment field.

As the model is rotated in 3D window, the primary and secondary angles are updated accordingly.

4. Perspective and Orthogonal View.

Perspective view
Denoted by the following icon:

In this view the object has apparent scale; the objects appear to get smaller and closer together the further away they are. This can cause perspective distortion.
When changing to Perspective view the following window will appear.



Orthogonal view

The default view in Preview is Orthogonal. Denoted by the following icon:

In this view the object does not have apparent scale meaning objects on the screen will appear the same size no matter how close or far away they are. Orthogonal view is recommended for C-Arm calculations.

When changing to orthogonal view the following window will appear.

Perspective and Orthogonal view

The pan function is disabled in both views.

Note: When exiting the C-Arm view tab Preview will automatically change to Perspective view.

Adding a Custom Model View

While rotating the model, you may find a view or angle that is particularly useful to you. For example, you may find an excellent view of two marks between which you have calculated a distance.

You can save this custom view in your plan document and access it later by clicking the Views tab. Your custom views will be available to include in a Preview report.

1. **Click the Views tab.**

   The Views list, showing the six preset views of the 3D model, appears.

2. R**otate the model to find a custom view.**

   In the Model area, drag the 3D image to the view you want to save.

3. **Add the current view to the Views list.**

   Click **Add View**. Preview adds the current model view to the list and assigns a numerical name to it (“View #1”).

   Note: Saving a view in the Views list is particularly helpful after placing marks, and after dropping a slice into the model. You may want to save a view that exposes the intersection of the slice and the 3D model. See Dropping a Slice into the Model, later in this chapter, for more information.

4. **Select a view.**

   To redisplay the saved view or select another model view, double-click the view name. Preview updates the model to the selected view.

5. **Delete a view.**

   Click the name of a custom view in the Views list to highlight it. Click **Delete**.

   Note: You cannot delete a pre-rendered view.

6. **Save your work.**

   Once you add views to the Views list, it is a good idea to save your plan document file. Select Save from the File menu to save changes and additions to the current file, or select Save As if you want to leave your last saved document unchanged.
   See the section entitled **Saving Your Work** for more information about saving and naming a plan document file.

You can also leave the Model area open while you work in other areas, which allows you to use the model as a reference point while working with slices and in performing calculations.

Working with Slices

A CT scan can consist of hundreds of slices, depending on slice spacing and scan length. In Preview, you can scroll through the complete sequence of CT images displayed at standardized intervals, as you might do on the CT console immediately after the scan has been performed. In addition, you can enlarge the scanned images and adjust the levels of window/level settings for enhanced visualization of anatomic and pathologic details.

In addition, M2S Preview technology provides virtual coronal and sagittal scan data, so that views from several planes are accessible to you for viewing. Preview's commands and tools help you manage the vast amount of data available.

Note: In order to view Sagittal and Coronal Slices, You must enable the "Automatically Create Sagittal & Coronal .12 slices in Cache" checkbox by clicking **Help** on the menu bar, going to **Edit Preferences,** and going to the **Other** tab.

Viewing the Axial Slices

1. **Displaying Axial, Sagittal, or Coronal slices.**

   In order to show the slice view desired, do one of the following:

   1. Click the red-lettered button below the **Slice Controls** tab (at the bottom of the screen) and select **Axial, Sagittal, or Coronal.**

   2. From the Slices menu, select **Set Slice Area**, then select **Axial**.

   The last viewed axial slice appears in the Slice area. (This will be slice #0 if you have not yet viewed other slices in this window or used the **Jump Slice** tool.) The current slice number appears above the slice image and on the **Slice #** button to the right of the slices popup menu.

The slice area showing the view of a Coronal slice

2. **View the slices in sequence.**

   To view the slices one at a time, you may:

   - Click on the arrows to the right and left of the slice slider, or

The Slice Slider

   - Use the roller wheel on your mouse if it is equipped with one.

3. **Scroll through the slices.**

   To move through more than one slice at a time, click and drag the slider on the slider bar.

   Dragging the handle to the right end of the slider moves you to the last slice of the

scan.

4. **Go to a particular slice number.**

   If you know the number of the slice at the area of interest, you can quickly move to that slice by opening the Go To Slice # dialog box. You can also use the dialog box to move a distance along the slice path in millimeters. To open the dialog box, go to the Slices menu and click "Go to slice #"

   Type the target slice number in the New Slice **#** field, or type the number of millimeters to move in the Move By Distance (mm) field and select the direction to move. Click **OK**.

Setting Image Quality

There are two options for setting slice image quality. The key difference is that only the 12-Bit mode allows for Window/Level control.

12-bit (high quality) resolution provides access to the original CT scan's 12-bit data. By selecting the 12-bit format, you access high quality CT data and can adjust the Window/Level settings of the images for enhanced discrimination of anatomic and pathologic detail.

Note: The 12-bit images are the full original data from the CT scanner with no data loss due to compression. The 8-bit images may have undergone some compression to improve screen-drawing speed and storage requirements.

High quality, 12-bit images appear more slowly onscreen than the default 8-bit images. Use the high quality setting for particular studies requiring fine discrimination. For general orientation, use the default setting of 8-bit resolution for the convenience of a faster screen response.

1. **Click the *Window/Level* tab below the Slice area.**

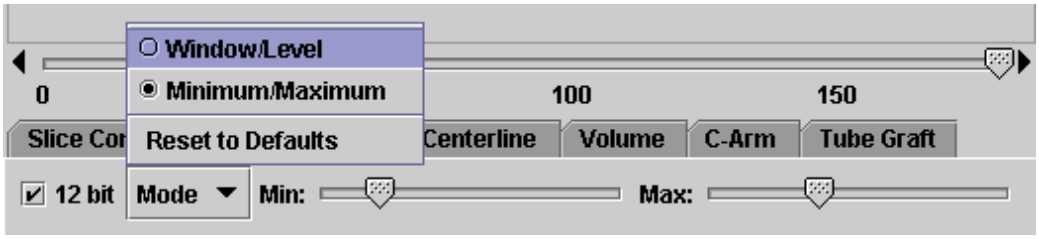
2. **If prompted, click OK to change to 12-bit slices.**

The Window/Level sliders

Within the Window/Level sliders, you can adjust both the **brightness** and **contrast** of the image, which are represented by Window and Level, respectively.

3. **Adjust the Minimum and Maximum Levels**

   Click the Mode button, and from the popup list select Minimum/Maximum. The sliders change to Minimum and Maximum controls. These controls manipulate the upper and lower limits of pixel values in the slice displays. Drag the slider handles to adjust the image.



The Minimum/Maximum sliders

4. **Restore the default settings.**

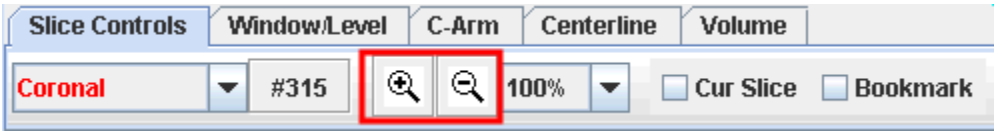
   To return to Preview's default settings, click **Mode**, then click **Reset to Defaults**. Preview resets Window/Level and Minimum/Maximum settings to the default settings.

5. **Return to 8-bit slices.**

   When you are finished with your analysis using the Window/Level controls, uncheck the 12-bit checkbox to return to the faster 8-bit slices.

Zooming in and "Panning"

In order to zoom into a slice within the slice window you can, either press and hold the **Ctrl** key and scroll the mouse or use the zoom in/zoom out buttons located at the bottom of the slice window.



The Zoom Tools

Once you zoom in, the entire slice may not be visible. In order to maintain your zoomed status and examine all parts of the slice, you may either use the scroll arrows or drag the

scroll bar. Additionally, you can press and hold the **Shift** key and click and drag your way around the slice.

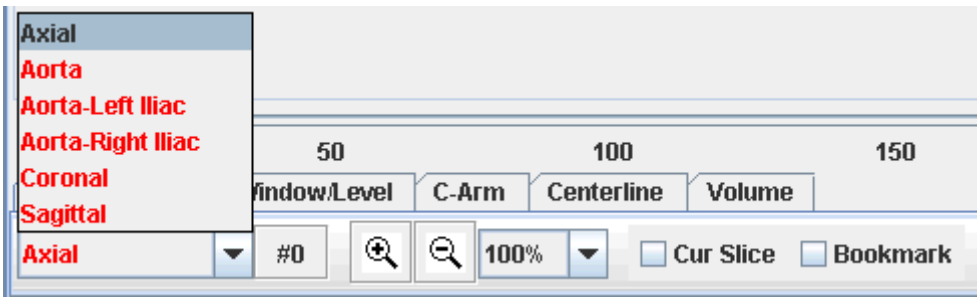
Note: The slice image can be panned only when the slice image is larger than the size of the Slice area. Also note that it might be helpful to increase the window size. To do so, click the up arrow at the top-left corner of the Slice area.

Viewing other types of Slices

Using the original axial scan data, M2S provides multi-planar reconstructions — sagittal and coronal slice sequences, as well as Aorta, Aorta-Right Iliac, and Aorta-Left Iliac slices for applicable vascular studies.

As with the original axial images, you can scroll through the reconstructions, mark them, and coordinate them with the model and axial slice views, enabling exceptional visibility and delineation of the patient's anatomy.

To change the slice type, use the menu on the bottom-left corner of the slice window.



Opening Several Slice Windows at Once

You can view two or more types of slices by opening the additional slices in their own windows. For instance, while the Slice area in the Main Preview Window displays Axial slices, you can open Sagittal slices in another window. By having several slice views open at the same time, you can see an object from several planes using the **Jump Slice Tool**.

To open several windows and resize them to fit on the screen, perform the following steps:

1. **Reduce the size of the Main Preview Window**

   Holding the cursor over the right-bottom corner of the window, click and drag it to reduce the window size. You may then need to drag the borders of the Slice

and Model areas to keep both areas in view.

2. **Open another slice window.**

   From the Slices menu, select **Open New Slice Window**. From the submenu, select the type of slice you want to view. The second slice window opens on the right side of the screen.

3. **Reduce the size of the second window.**

   If you are using a smaller screen, you may want to reduce the size of the second window. Click and drag any of the window's borders to reduce the window size.

4. **Move the window.**

   Holding the cursor on the window's title bar, drag the window to the desired location.

5. **If you wish, open and resize other slice windows.**

   You can fit about four windows on the screen and still view the model.

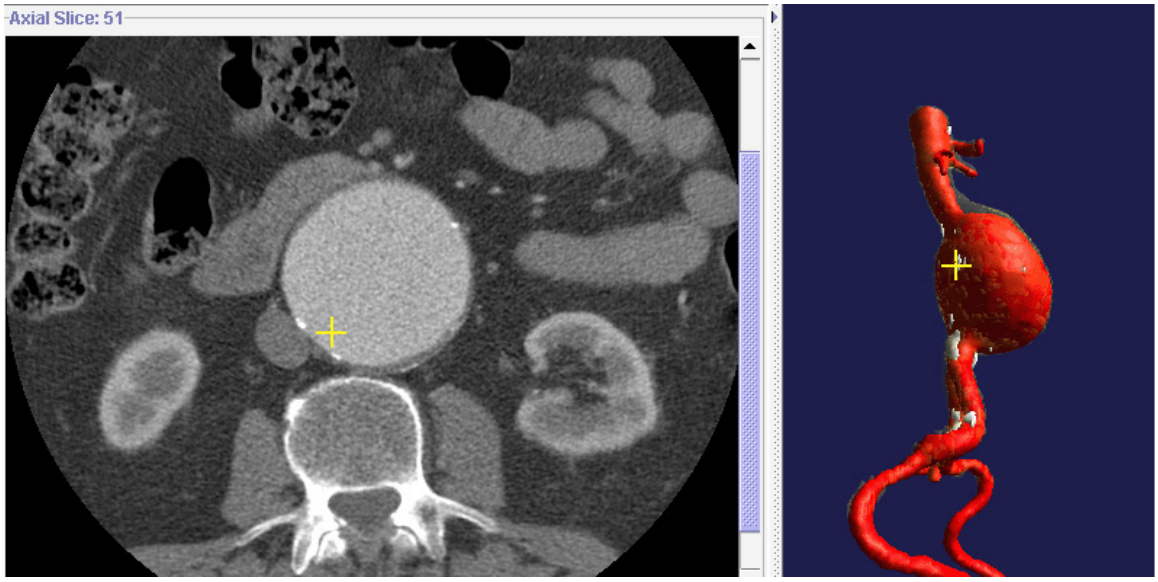
Locating Corresponding Slices: Jumping Slices

In Preview, you can quickly access original and reformatted slices that correspond to a specific location on the 3D model or on a particular scan slice.

1. **With the Model area and any combination of slice windows open, select the Jump Slice (+) tool from the Tool Palette.**

2. **Position the Jump Slice tool (+) over the model image or slice image at the location of interest and click.**

   A yellow cross indicator (+) appears on the model at that location. Preview updates the slice number of all slice windows so that they display the same location as indicated on the model. The yellow cross indicators on the slice images and in the model indicate the same location.



3. **Hiding the yellow cross indicator.**

   If you want to hide the cross indicator from view, uncheck the **Crosshair Visible** checkbox in the **Marks** tab.

"Dropping" a Slice into the 3D Model

In Preview, *Drop Slices* are helpful in many tasks. For example, use them to:

- Determine the location of 3D-model boundaries in slices.
- Define the area of an object for which you want to measure volume or path length.
- Locate a scan slice to calculate vessel diameter.
- Define the area of a flow channel for which you want to calculate a path length (centerline calculation or VirtualGraft).

Setting the Current Slice in the Model

The **Current Slice in Model** command displays the active window's current slice in the 3D model image. (If you have more than one window open, the active window is the topmost one.) As you step through slices, Preview automatically updates the model with the current slice, showing the 3D context of the slice.

1. **Prepare the model.**

   Click the **Anatomy** tab, and select an appropriate format (transparent or opaque, visible or hidden) for each of the model's objects.

2. **Set the Slice area to display the type of slices you want to drop into the model.**

   In the Main Preview Window:

   With the **Slice Controls** tab selected, click the red-lettered button. Select the slice type from the popup menu.

3. **Activate the *Current Slice in Model* command.**

   Toggle the **Current Slice button** in the model view bar.

4. **Move through the slices.**

   Preview updates the model with the slice currently displayed in the Slice area.

Locate a slice you want to “drop” in the model by scrolling or stepping through slices.

Turning off the Current Slice

When you want to discontinue the current slice display in the model, you can Toggle the **Current Slice button** on the model view bar.

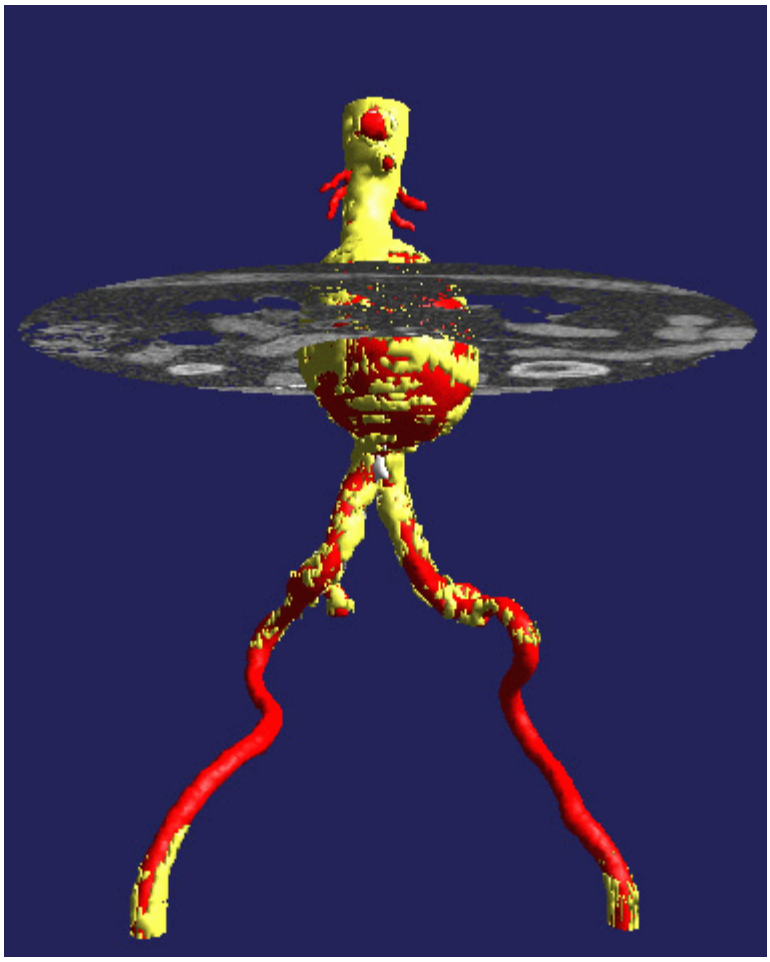
Dropping a Slice into the Model

The **Drop Slice Into Model** command places the current scan slice (from the last active Slice window) into its corresponding position in the 3D model. The same Drop Slice remains in the model, even if you view a different slice in the Slice area.

Dropping a slice helps you view and verify the relationship of the scan slice to the 3D model. You will use dropped slices later in this chapter for volume and centerline (bloodflow path) calculations.

1. **“Drop” the slice into the model.**

   Press **Ctrl-D**, or select **Drop Slice Into Model** from the Slices menu. M2S Preview sets the two-dimensional slice into the 3D model. You can make additional format changes to the model with the slice in place.



Examples of a drop slice in a 3D model

2. **Rotate the model.**

3. **Click the *Drop Slices* tab to display the Drop Slices list.**

   When you drop the slice into the model, the slice becomes an object, and its name appears in the Drop Slices list.

   Make the drop slice visible or hidden using the **Visible** checkbox.

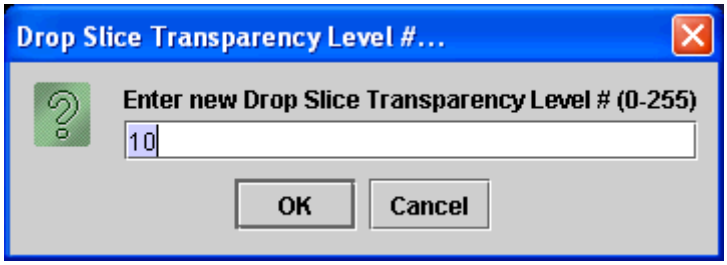
Setting Slice Transparency

Drop slices in an opaque format may obstruct your view of the model and of the relationship of slice to model. You can set the slice to a partially transparent format.

To change a slice's transparency level, perform the following steps:

1. **Select *Set Drop Slice Trans...* from the Slices menu.**

   The Drop Slice Transparency Level # dialog box opens.



Drop Slice Transparency Level # dialog box

2. **Change the transparency setting.**

   Type a transparency range between 0 (opaque) and 255 (maximum transparency). This level corresponds to 8-bit pixel values and not to Hounsfield units.

   The transparency level affects all Drop Slices and Current Slices in the model.

Deleting Drop Slices

To remove a dropped slice from the model, perform the following steps:

1. **Click the Drop Slices tab to display the Drop Slices list.**

2. **Select the slice in the Drop Slices list.**

3. **Click the Delete button.**

Marking Slices

Marks can help you with treatment planning and education. You can plot incisions, mark perimeters of objects, and measure angles and distances. Your marks become part of the plan file that you can reopen at a later time and use as an aid to pre-surgery planning and patient consultation.

The marks made on one slice are immediately visible in their corresponding locations in the axial, coronal, sagittal, and oblique slice windows. When you place marks on slices, the marks also appear in the 3D model, but may or may not be visible in the model, depending on its position and the transparency of the model's objects. Model transparency is described earlier in the section Working with the 3D Model.

Creating and Viewing Marks

1. **Place marks on a slice.**

   Point the mouse arrow to any part of the slice image and click the mouse button. A small blue circle in a yellow square is placed on the slice.

   Note: If you have deselected "Draw Mark Selection Box" in Edit Preferences, the yellow box will not be visible. To resize a mark, use the right-click method of resizing marks described under **Resizing**, **Formatting**, and **Naming Marks.**

   You can create marks on all slice types. A mark placed on an axial slice appears simultaneously on its corresponding coronal, sagittal, and iliac (if applicable to the patient data) slices, but is visible only when the corresponding slice number is displayed.

   Marks also appear in the 3D model. As you place new marks in slice windows, the model is updated with the additional marks.

A yellow box surrounds the newly created mark.

2. **View the marks in the Marks list.**

   Click the **Marks** tab to display the Marks list.

   The Marks list shows all the marks you have placed on slices. The marks are numbered in the order in which you created them.

3. **Place more Marks**

   Click on a slice to place more marks. Note that the Marks list updates to display the new marks.

Selecting a Mark

When you select an existing mark, a yellow box appears around that mark in all slices and in the model. If the mark is outside the 3D view (from side to side or up and down, or "behind" the view), the yellow "selection box" does not appear.

You may want to select an existing mark for several reasons, for example:

- To edit the mark for color, size, or transparent format.
- To give it an identifying name.
- To quickly identify it in the model, using the selection box.
- To delete the mark.
- To Jump Slice all slice windows to the location of that mark.

5. **Select a mark.**

   To select a mark, do one of the following:

   - Position the mouse pointer directly over the mark in the slice area or window, and click. A yellow box appears around the mark to indicate that it is the currently selected mark.
   - In the Marks list, click on the name of the mark you want to select.

Locating Corresponding Slices: "Jumping Slices to a Mark"

In Preview, you can quickly view other slices that correspond to a specific mark.

1. **Open slice windows**

   Using the **Open New Slice Window** command in the Slices menu, open any combination of slice windows — axial, coronal, sagittal, or, if applicable, the right or left iliac slice window. For information on opening and placing several windows onscreen, see the section **Opening Several Slice Windows at Once**.

2. **Select a mark.**

   Click the **Marks** tab to display the Marks list, then click on the mark name to select it.

3. **Select the *Jump Slices to Mark* command.**

   - In the Marks list, click the **Jump** button.
   - From the Slices Menu, select **Jump Slices to Mark**

The **Jump Slices to Mark** command updates all slice windows to display the slices that correspond to the location of the selected mark.

If the mark selected is not close enough to any slice in an oblique slice window, that window will not update, and the selected mark will not appear in them.

Deleting Marks

1. **Delete a mark.**

   Click the mark name in the Marks list, then click the Delete button or press the Delete or Backspace key.

   Delete a mark removes it permanently from all slice windows, the model, and the Marks list.

   Note: If you attempt to delete a mark that is part of a calculation, Preview will alert you before deleting the mark.

2. **Delete all marks.**

   To delete all marks, click the **Delete All** button in the **Marks** tab.

Moving Marks

You can move a mark in a Slice image by dragging it with the mouse.

1. **Select the Mark/Rotate tool.**
2. **Click the mark to select it.**
3. **Click in the center of the mark and drag it to a new position.**

Preview updates the mark position automatically on the model and all other slices. Preview also updates any calculations that involve the relocated mark.

Changing How Marks Are Displayed

1. **Display or hide marks.**

   From the Marks menu at the top of the screen, select the **Display Marks** checkbox to display all marks in all slice windows. To hide—*not* delete—the marks, uncheck the **Display Marks** checkbox. Another way to access commands that change a mark's display is to click the **Marks** tab, then click the **Display** button below the Marks list.

   To display or hide marks in the model, click the mark button in the Model View panel until the desired format is reached.

2. **Show mark names or hide mark names.**

   From the Marks menu, select the **Display Mark Names** checkbox to display the full names of all existing marks in all slice windows. At this point, the names probably read “Mark 1,” “Mark 2,” and so on. Instructions on customizing and editing mark names are provided in the next section, Resizing, Formatting, and Naming Marks. To hide mark names, uncheck the **Display Mark Names** checkbox. (Even if marks are hidden, their names appear in the Marks list.)

3. **Change mark visibility in the model.**

   To hide mark names in the model, click once or twice on the mark button in the Model View panel.

   To change whether or not the mark names and diameters are displayed in the model, use the **Show Mark Names** and **Show Mark Diameters** checkboxes under the **Model** menu.

4. **Display or hide mark diameters.**

   From the Marks menu, select the **Display Mark Diameters** checkbox. The diameter of a mark appears next to the mark in all slice windows. To hide mark diameters, uncheck the **Display Mark Diameters** checkbox. Click on the mark button in the Model View panel to hide mark names and diameters in the model.

5. **Display marks as filled or hollow in slice images.**

   From the Marks menu, select either the **Marks Filled** or **Marks Hollow** option.

   For some tasks, like making distance measurements, using Marks Hollow is

preferable because the marks will not obscure the area beneath them.

6. **Display or hide mark selection box.**

   To change whether or not the mark selection box is shown, toggle the **Show Mark Selection Boxes** checkbox under the Help->Edit Preferences->Other menus.

Resizing, Formatting, and Naming Marks

Assigning a custom color, size, and descriptive name to marks is useful when you want to differentiate anatomy, emphasize certain features, or depict multiple surgical options.

1. **Click the Marks tab to display the Marks list.**

2. **Double-click a mark name in the list.**

   The Edit Mark dialog box opens:

Edit Mark Dialog Box

3. **Edit the name of the mark.**

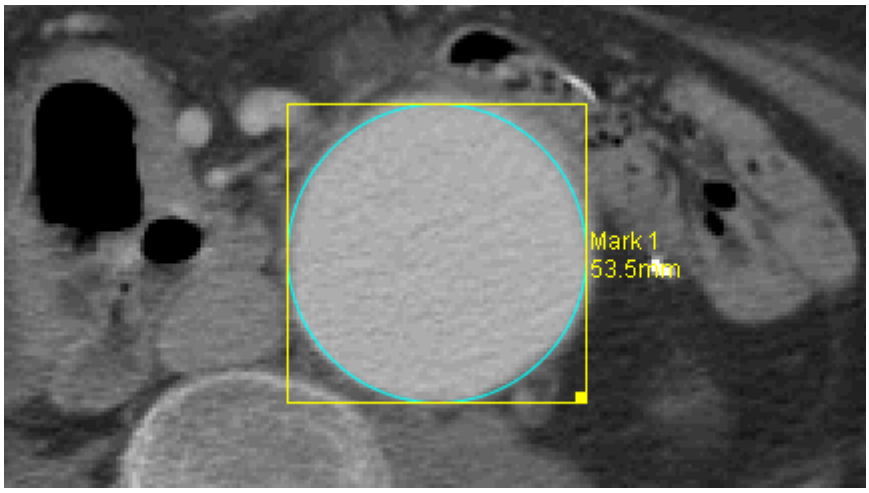
   Select a **Type** from the drop-down menu and either accept the default name or enter a new name in the Name field.

   Note: You need to select a **Type** in order for your mark or calculation to appear in the Design Your [Manufacturer Name] Graft or Custom Graft Builder window

when using the VirtualGraft feature.

4. Change the size of the mark.

To change a mark size, while in the slice, click on the mark to select it. A yellow box frames the mark. Right-click and hold anywhere inside the mark, and drag the box to the desired size.



A mark enlarged to outline the perimeter of a vessel.

5. Change the size of the mark using the Auto size tool.

The size of the mark can also be changed by using the Auto size tool. Select the Auto Size button and the current mark will enlarge to the size of the vessel on which it is located. For more detailed instructions on how to use Auto size, see Calculating Vessel Diameters.

6. Change the color of mark.

In the Edit Mark dialog box, click the box to the right of the Color button to open a drop-down list of colors. Click the color you want to select.

To select a color not in the list, click other.... In the color grid that appears, select the desired color, then click OK. When prompted, name the new color you selected, then click OK. The new color now appears in the drop-down list.

7. Adjust the transparency level of the mark.

Select the **Transparent** checkbox to make the mark semi-transparent in the model and slices. Click in the % entry field and type a value between 0 and 100 to set the level of transparency.

If, for some reason, you do not want this mark to appear in the model and slices,

uncheck the **Visible** checkbox (which is selected by default) to turn off visibility.

8. **Click *OK* to make your changes to the mark.**

   Changes you make in the Edit Mark dialog box apply only to the current mark. To apply the new properties you have selected to all subsequent marks, click **Save Defaults** before clicking **OK**.

   For instructions on calculating distance and angles between marks, see Creating Calculations between Marks.

Bookmarking Slices

A bookmark saves a reference to a particular slice number. Bookmarked slices and any accompanying comments become part of your document plan, and are printed as part of the Preview report you generate.

Creating a Bookmark

To bookmark a slice, perform the following steps:

1. **Scroll to a slice you want to bookmark.**

2. **Add a bookmark.**

   Click the **Bookmarks** tab to open the Bookmarks list and click the **Add Bookmark** button.

   The slice number appears in the Bookmarks list.

3. **Add a comment to the bookmark.**

   To note why the bookmarked slice is significant, add a comment. Click the **Comment** button, and in the Bookmark Comment dialog box, type a description of the bookmarked slice. Click **OK**. The comment appears next to the bookmark in the Bookmarks list. All bookmarks and their comments become part of the patient plan and report.

Using Bookmarks

After you create a bookmark, you can quickly access the bookmarked slice.

1. **Click the *Bookmarks* tab to open the Bookmarks list.**

2. **In the Bookmarks list, double-click the desired bookmark.**

   Preview displays the bookmarked slice in the Slice area.

Deleting a Bookmark

1. **Select the bookmark in the Bookmarks list you want to delete.**

2. **Click the *Delete* button, or press the *Delete* or *Backspace* key.**

Saving Your Work

Even if you are not finished working with the current patient data, it's a good idea to save your current marks, drop slices, etc. in a plan document file. You can continue to modify and update the plan and save it again with subsequent additions and changes.

It is important to save your work **often** so that new data changes are stored in the name file and to safeguard against data losses due to unusual circumstances such as system failure or low memory.

What You Can Save

The following components are saved in the plan document file:

- My Notes - Notes you make regarding your findings, patient assessment, and recommended treatment plan. Access from the My Notes link in the Plan tab (see below).
- Marks - All the marks on all scan slices, including their colors, sizes, and names.
- Calculations - Measurements taken between marks or between slices, and shown in the Calculations list.
- Bookmarked Slices - All the slices that are bookmarked.
- Drop Slices - All the current Drop Slices and Current Slices in the model.
- Views - Any custom views of the 3D model that you added to the Views list.
- Virtual Grafts - All the VirtualGrafts you have built.

Your data file will also contain an internal pointer to the patient-specific data for which the plan was created, to ensure that a plan document is not accidentally mismatched with another M2S Patient Specific Software data set.

Making Notes

As you work with your patient plan, you can make notes regarding your findings and recommendations in the My Notes window.

1. **Click the Plan tab.**

2. **In the *Plan* tab, click the *My Notes* link to open the My Notes window.**

3. **In the My Notes window, type information pertinent to the plan.**

4. **Copy information from other windows or applications.**

   You can also copy text from the Model Pics or Scan Data windows or from a word-processing document into the My Notes window. Highlight the desired text and press **Ctrl-C**. In the My Notes window, press **Ctrl-P** to insert the text.

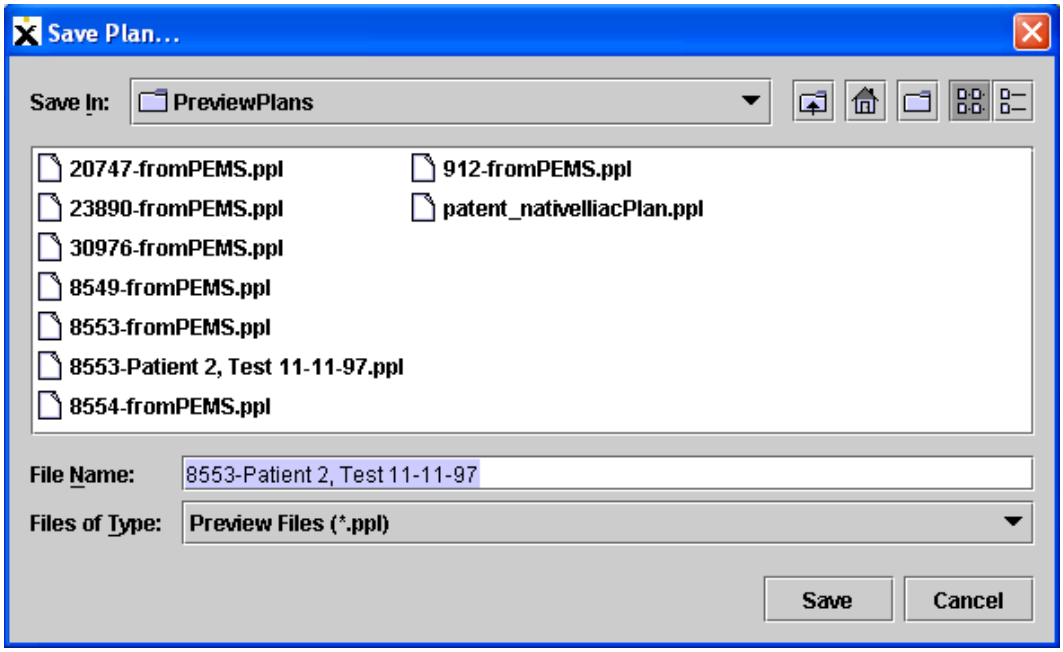
   The text in My Notes becomes part of your patient plan and Preview report.

- In Preview, select Help, Edit Preferences, Other, and select “Keep My Notes Dialog Always on Top” if preferred.

Saving and Naming the Plan

1. **From the File menu, select *Save As.***

   The Save dialog box opens



.

2. **Select the folder where you want to save your plan.**

   Preview will open to the default plan folder and give your plan a default name. If you would like to set up a new folder or rename the plan proceed to step 3, otherwise click the Save button.

3. **Click the Create New Folder icon (the third icon to the right of the Look in: drop-down list).**

   An item named “New Folder” appears in the Save dialog box list. You may need to scroll the file list to find it.

4. **Name the new folder.**

   Click the folder icon to the left of the words “New Folder.” Click on the words “New Folder” so that the blue highlighting disappears. Now drag the mouse cursor over the words “New Folder” so they are again highlighted, then type a new name for the folder (i.e., “Preview Plans”). Press the **Enter** key to save the folder name. When the line with the new name is highlighted in blue, folder naming is complete.

5. **Assign a name to your plan.**

   Double-click your new folder’s icon to “move” into it. In the Save dialog box, click in the File name: field and type a name for your plan. As with any windows-based file name, the file name can be up to 255 characters long and must exclude any of the following characters:
   / \ > < * . ? “ | : ;

6. **Save the file.**

   Click the **Save** button.

Ending the Preview Session

Exiting the Program

From the File menu, select *Exit* to exit the Preview program.

If you have not saved additions changes to marks, calculations, drop slices, or other information, Preview prompts you to do so now.

Opening New Patient Data

You must end your current Preview session and restart the program in order to open a different patient data set.

1. **Quit Preview by Selecting *Exit* from the file menu**

2. **Double Click the Preview shortcut icon on the desktop to load Preview and choose a new study.**

Opening a Saved Plan

Preview requires that you open the study before navigating to your saved plan.

1. **Double Click the Preview shortcut icon on the desktop to load Preview and choose a study.**
2. **Click *File* and *Open***
3. **Navigate to the folder that your Plan was saved in. Note: Preview defaults to saving Plans in the *Preview Plans and Reports* folder.**
4. **Select the plan that corresponds with the study you have opened in Preview.**
5. **Your saved measurements will now appear in the study.**

Chapter 3 - Creating Calculations and Aortic Aneurysm Planning

Creating Calculations between Marks

Using Preview's powerful Calculation tools, you can measure distances, angles, and percentage stenosis between marks, as well as calculate the volume and length of a bloodflow channel. Calculations become part of your plan document file and appear in Preview reports, providing vital information about vessel diameters and lengths, and relationships between objects.

When using Preview to assess a patient's anatomy for potential stent graft repair, it is important to remember that several factors can impact the accuracy of the measurements made on the scan data - scan quality, time passed since scan, stent graft used and deployment technique, to name a few. Therefore, be sure to consider all factors and use caution when evaluating length measurements made on pre-operative anatomy. For more information, see the section entitled **VirtualGraft™ Method for Sizing Bifurcated Stent Grafts.**

Measuring Distance Between Marks

In this section you will learn how to:

- Calculate the distance between two marks.
- Measure the distance between anatomy objects, such as lesion to critical structures, to assist in surgery planning.
- Measure the diameter of a blood vessel or other structure.
- Measure the length of an anatomical feature.

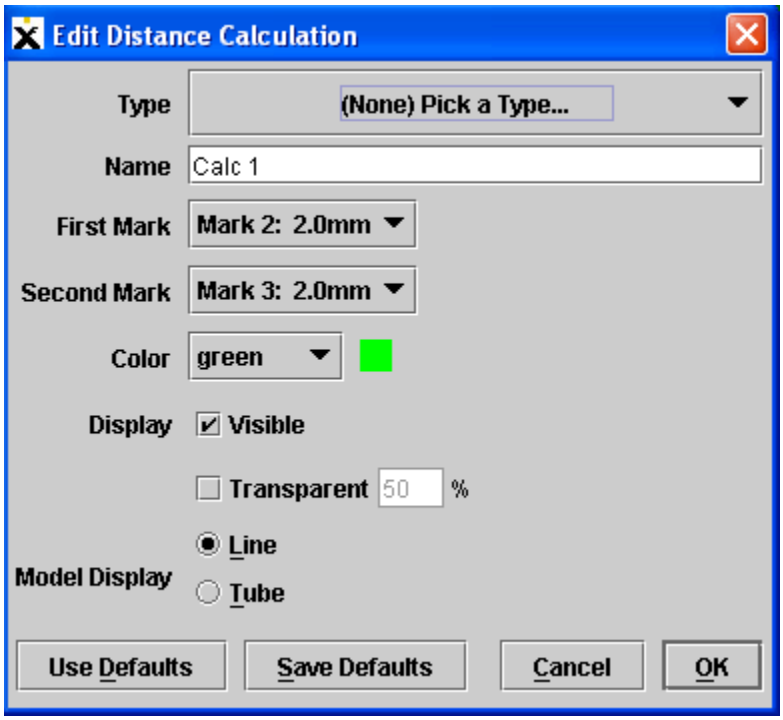
The steps are as follows:

1. **Open the "Marks" Menu by clicking on the "Marks" tab and verify that the *Display Mark Names* checkbox is checked.**

2. **Select the *New Distance Calculation* command.**

   You can select the command by going to the **Calculations** tab, Clicking on the **New Calculation** button and finally clicking on **New Distance Calculation**.

   The Edit Distance Calculation dialog box opens



Preview automatically assigns the last two marks selected in the current session as the First and Second Marks. If you want marks other than those Preview has selected, follow steps 4 and 5.

3. **Choose the First Mark.**

   Click in the First Mark field to open a drop-down list of current marks. Click to highlight the correct mark.

4. **Choose the Second Mark.**

   Click in the Second Mark field and select the second mark.

   Note: The two marks you select do not have to appear on the same slice or slice type.

5. **Name the calculation.**

   Select a **Type** from the drop-down menu and either accept the default name or enter a new name in the Name field.

   Note: You need to select a Type in order for your mark or calculation to appear in the Design Your [Manufacturer Name] Graft or Custom Graft Builder window when using the VirtualGraft feature.

6. **Choose formats for the model display.**

   Preview will display the distance between the two marks as a green graphic in the model (after you click the OK button in step 7).

   To change how the graphic is displayed, make the following selections:

   - From the **Color** drop-down menu, select the color of the graphic.
   - Use the Display checkboxes to show the graphic as **Visible** or hidden, and **Transparent** or opaque. If you make the graphic transparent, you can type the percentage of transparency in the % field.
   - Select **Line** or **Tube**.

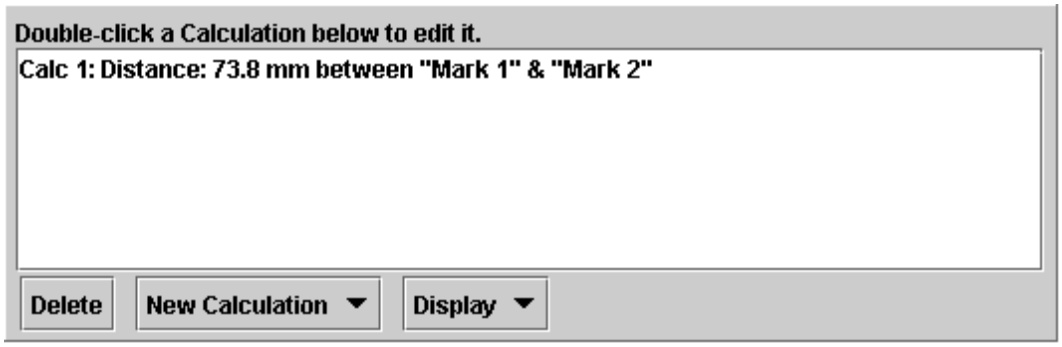
     The tube format is useful for endovascular pre-surgery planning. See the section entitled **Aortic Aneurysm Treatment Planning** for more information.

     Note: If your marks appear on a single slice, Preview displays the calculation on the slice image as well as in the model. The Color, Visible and Transparent formats apply to the calculation graphic in both the slice and model.

7. **Click the *OK* button to perform the distance calculation.**

8. **View the calculation's result.**

   Click the **Calculations** tab to view the Calculations list. The Calculations list displays the result of the measurement between the selected marks.



Calculation result displayed in the Calculations list.

Note: If you move a mark that is part of an existing calculation, Preview automatically recalculates the distance for you and updates the information in the Calculations list and in the model.

Editing a Calculation

If you need to change the endpoints of a calculation or its display properties, double-click the calculation in the Calculations list. When the Edit Distance Calculation dialog box opens, make changes and click **OK**.

Resize a Mark to Measure Diameter of an Object

By moving and sizing a mark appropriately, you can adjust the size of a mark to "fit" an object or structure depicted in a scan slice. This method is especially useful for estimating an object or vessel diameter, and can be used as an alternative to the Distance Calculation.

1. **Find the slice that provides the optimum view of the object.**

   Scroll or step through slice images to locate the best view.

2. **Place a mark on the object.**

3. **Click the Marks tab to open the Marks list.**

4. **Click Display to open the drop-down menu. If not already selected, click to select the Marks Hollow option.**

5. **Point to the "handle" on the lower right of the yellow frame around the mark, click and drag the frame to the size you want.**

   You can also **right-click** any point on the mark and resize it by dragging the mouse forward and backward.

   If you would like to adjust the placement of a mark, left-click the mark itself and drag it in any direction to adjust the location of mark on the slice.

6. **Open the Edit Mark dialog box.**

   Double-click on the mark to open the Edit Mark dialog box. The measurement in the Diameter entry box will indicate the approximate diameter of the object.

   The number to the right of the Diameter entry box is the French (or catheter) size of the diameter; the Volume number refers to the volume of the mark's sphere in cubic centimeters.

7. **Name the mark.**

To name the calculation, select a **Type** from the drop-down menu and either accept the default name or enter a new name in the Name field. Click **OK**.

Creating a Diameter Measurement Between Two Marks

1. **Place a mark on the perimeter of the vessel, and continue holding down the left mouse button.**

2. **Drag the arrow to the opposite side of the perimeter to measure the vessel's diameter.**

   The mark becomes smaller to make it easier to place.

3. **Release the mouse button.**

   The Edit Distance Calculation dialog box opens, and similarly to the Mark-to-Mark method, you can change format for model display.

   To name the calculation, select a **Type** from the drop-down menu and either accept the default name or enter a new name in the Name field.

4. **Click OK to perform the distance calculation.**

   The calculation will appear in the Model area, Slices area and the Calculations list.

5. **Change the mark location.**

   Click in the Slices area to select a mark. Click again in the center of the mark and drag it to the new location.

   Note: When you move a mark that is part of an existing calculation, Preview will automatically recalculate and display the results in the Model and Slices areas and the Calculations list.

Measuring the Percentage of Stenosis Between Marks

Calculating the percentage of stenosis in an aneurysm is an often used and useful calculation. Creating one of these calculations is very simple:

1. **Open the Marks menu.**

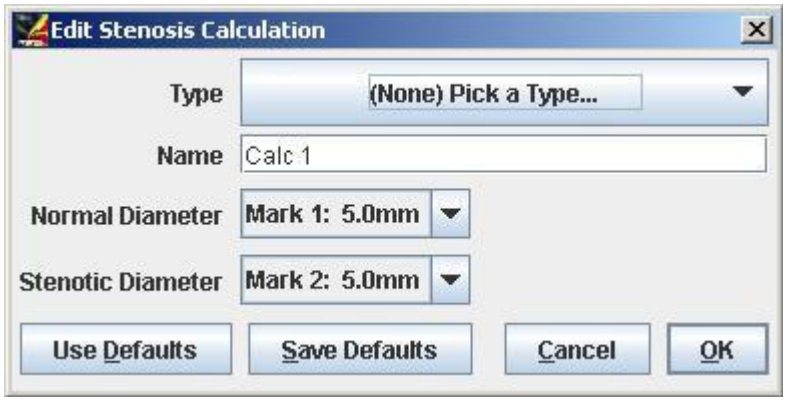
2. **If the *Display Marks* Names checkbox is not checked, select it.**

Displaying the mark names on the slices and model will help you select the right marks for your distance calculation.

3. **Select the *New Stenosis Calculation* command.**

   - From the Calculations menu, select **New Stenosis Calculation**.

   The Edit Stenosis Calculation Dialog box opens.



   Preview automatically assigns the last two marks selected in the current session as the First and Second Marks. If you want marks other than those Preview has selected, follow steps 4 and 5.

4. **Choose the First Mark.**

   Click in the First Mark field to open a drop-down list of current marks. Click to highlight the correct mark.

5. **Choose the Second Mark.**

   Click in the Second Mark field and select the second mark.

   Note: The two marks you select do not have to appear on the same slice or slice type.

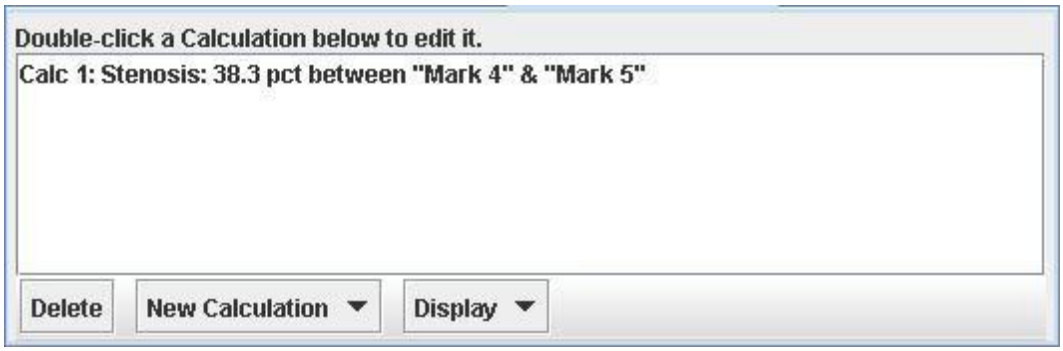
6. **Name the calculation.**

   Select a **Type** from the drop-down menu and either accept the default name or enter a new name in the Name field.

7. **Click the *OK* button to perform the stenosis calculation.**

8. **View the calculation's result.**

Click the **Calculations** tab to view the Calculations list. The Calculations list displays the result of the measurement between the selected marks.



A calculation result is displayed in the Calculations list

Note: If you resize a mark that is part of an existing calculation, Preview automatically recalculates the percentage stenosis for you and updates the information in the Calculations list.

9. **Save your plan file.**

   The calculations become part of the plan document file. Select Save from the File menu to save the new calculation in your current plan.

Calculating a Multiline Length

With Preview's Multiline Calculation feature, you can define and measure a path simply by putting down a set of marks. Preview lets you adjust the path by moving any of its marks, and then automatically recalculates the multiline length.

Note: We recommend opening a new plan document before you place your marks for a Multiline Calculation. Doing so will expedite the selection of marks in the calculation dialog box, as you will see in step 10.

1. **From the File menu, select *New* to start a new plan document.**

   If prompted, save or discard your old plan document.

2. **Click the *Anatomy* tab to view the list of anatomy objects.**

   If necessary, adjust the transparency of the model objects and use the **Zoom** tool to get the best view of the anatomy you want to mark.

3. **Select the *Jump Slice* tool from the Tool Palette**

4. **View the slice image.**

The cross (+) in the slice corresponds to the position of the Jump Slice tool in the model.

5. **Place a mark on the model by using the Mark/Rotate tool.**

6. **Make modifications to the mark.**

   Adjust the mark size, if necessary, by dragging the handle on the mark frame.

   The size you select for your marks determines the diameter of the “tube” that will depict the multi-line path. See step 14 below.

   Adjust the position of the mark, if necessary, by dragging it to the correct location (click and hold the mouse button over the mark, then drag).

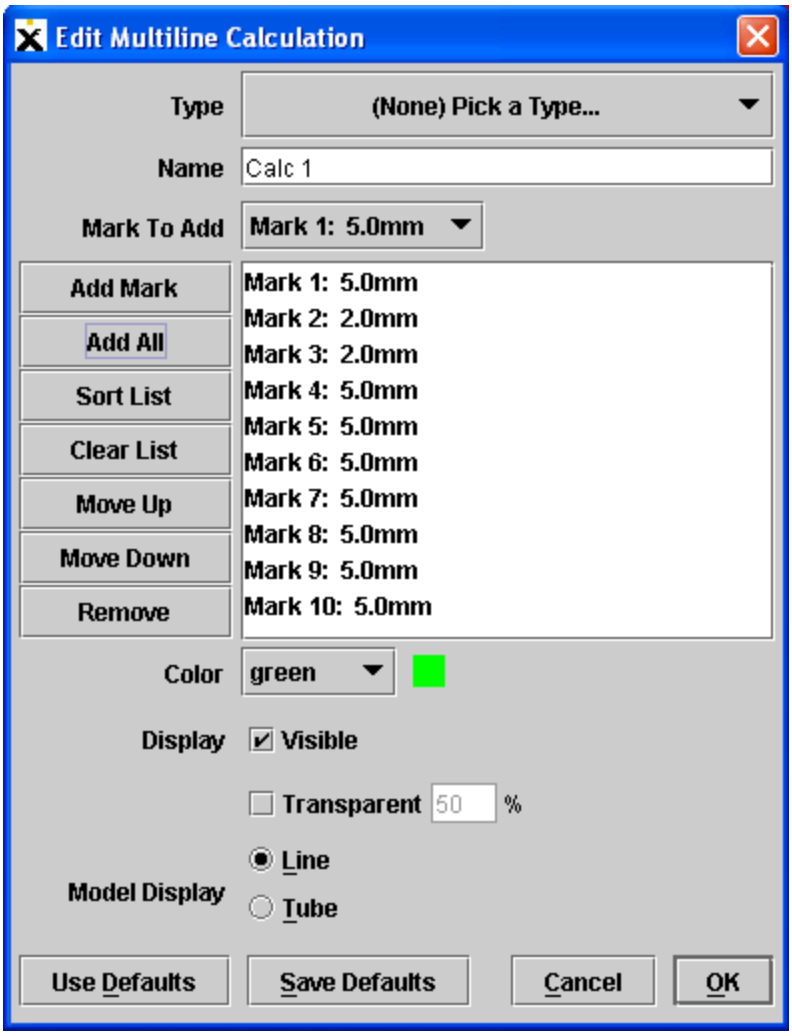
   Double-click the mark to open the Edit Mark dialog box. If you want, make further adjustments to the mark size. (To apply your size specifications to subsequent marks, click **Save Defaults**.) Click **OK**.

7. **Repeat steps 4 through 7 to place more marks to complete the path to use for the multi-line calculation.**

8. **Click the *Calculations* tab to open the Calculations list.**

9. **Click New *Calculation*, then select *New Multiline Calculation*.**

   The Edit Multiline Calculation dialog box opens.



The Edit Multiline Calculation dialog box

10. Select marks for the multiline calculation.

If you opened a new plan document in step 1, click the **Add All** button in the Edit Multiline Calculation dialog box. Preview lists all existing marks from the current plan, in order of creation.

If you don't want all existing marks to be included in this calculation, you can use **Add All**, then selectively delete the marks you want omitted. Alternatively, you can add one mark at a time: Select a mark from the Mark to Add drop-down list, then click on the **Add Mark** button. Repeat for each mark you want to add.

11. Click *Sort Marks*.

The **Sort Marks** button sorts the marks into a coherent single path that typically represents the shortest path between the set of marks, unless the

geometry of the marks is quite complex.

12. **If the sequence of marks provided by the *Sort Marks* button is not the order you prefer, re-sequence the marks.**

    In the Edit Multiline Calculation dialog box, select the mark you want to re-sequence, then use the **Move Up** and **Move Down** buttons to place it in the correct sequence.

    Note: You may want to select Display Mark Names from the Marks menu to view mark names in both the slice and model images.

13. **Remove a mark from the multiline path.**

    In the Edit Multiline Calculation dialog box, select the mark you want to remove, then click the **Remove** button to delete it from the calculation.

14. **Choose formats for the model display.**

    Preview will display the multiline in the model (after you click the OK button). Use the options at the bottom of the Edit Multiline Calculation dialog box to define the line format you want: Color, Visible or Hidden, Line or Tube, Transparent or Solid.

    If you choose a Transparent format, you can specify the level of transparency in the % entry box, or use the default value of 50%.

    Note: Tube diameters are determined by the size of the marks used in the calculation.

15. **Name the calculation.**

    Type a descriptive name for the calculation in the Name field.

16. **Click *OK* to perform the multiline calculation.**

    The multiline path you defined appears in the model, and its measured length appears in the Calculations list.

    Note: If all the marks in your multiline calculation are in one slice, the angle also appears in the slice.

17. **Save your plan file.**

    The calculations become part of the plan document file, select **Save** from the file menu to Save your plan.

Editing a Multiline Calculation

If you need to change the calculation's marks or properties at a later time, double-click the calculation in the Calculations list to open the Edit Multiline Calculation dialog box, or right-click the calculation in the Calculations list and select **Edit** from the popup menu. Make changes and click **OK**.

For more information on changing the properties of an existing calculation, see the section entitled **Making Changes to a Distance or Angle Calculation**.

Measuring an Angle Created by Three Marks

Preview measures the angle created by three selected marks. Depending on the anatomy you are marking, you may prefer to use the Jump Slice tool in the model to determine the best positions for your marks.

See steps 1 through 6 in the section entitled Calculating a Multiline Length if you require instructions on how to use the Jump Slice tool to position your marks.

1. **Select Axial, Sagittal, Coronal, or any of the oblique slices from the *Slice Controls* tab near the bottom of the screen.**

2. **Place a mark on the target slice by clicking anywhere on the slice itself.**

3. **Make modifications to the mark.**

   Adjust the mark size, if necessary, by dragging the handle on the mark frame.

   Note: The size you select for your marks determines the diameter of the "tube" that will depict the angle, if you choose to have the calculation displayed as such in the model. See step 8 below.

   Adjust the position of the mark, if necessary, by dragging it to the correct location (click the center of the mark, then drag).

   Double-click the mark to open the Edit Mark dialog box. If you want, make further adjustments to the mark size, and click **OK**. To apply your size specifications to subsequent marks, click **Save Defaults**, then click **OK**.

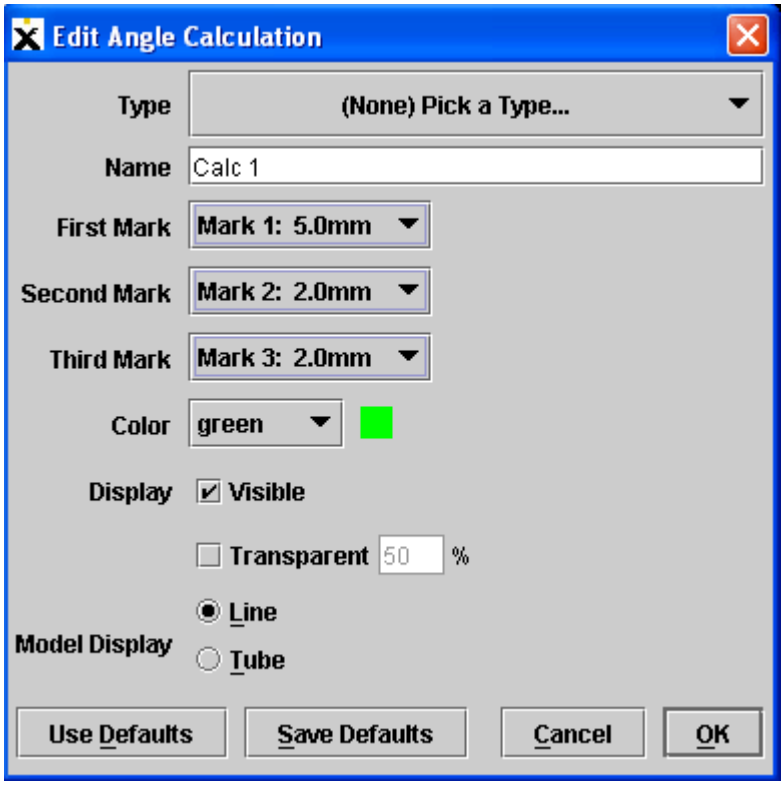
4. **Place two more marks.**

5. **From the Marks menu, make sure that *Display Mark Names* is selected.**

6. **Select the *New Angle Calculation* command.**

   - From the Calculations menu, select **New Angle Calculation tab**.

   The Edit Calculation dialog box opens:



The Edit Calculation dialog box

7. **Select the First Mark, Second Mark, and Third Mark for your angle calculation.**

   Preview automatically sets the First Mark, Second Mark, and Third Mark to the last three marks selected in the current plan document. You can click on the Mark drop-down lists to select other marks.

8. **Choose formats for the model display.**

   Preview will display the angle in the Model area (after you click the OK button). Use the options at the bottom of the Edit Angle Calculation dialog box to define the format you want: Color, Visible or Hidden, Line or Tube, Solid or Transparent.

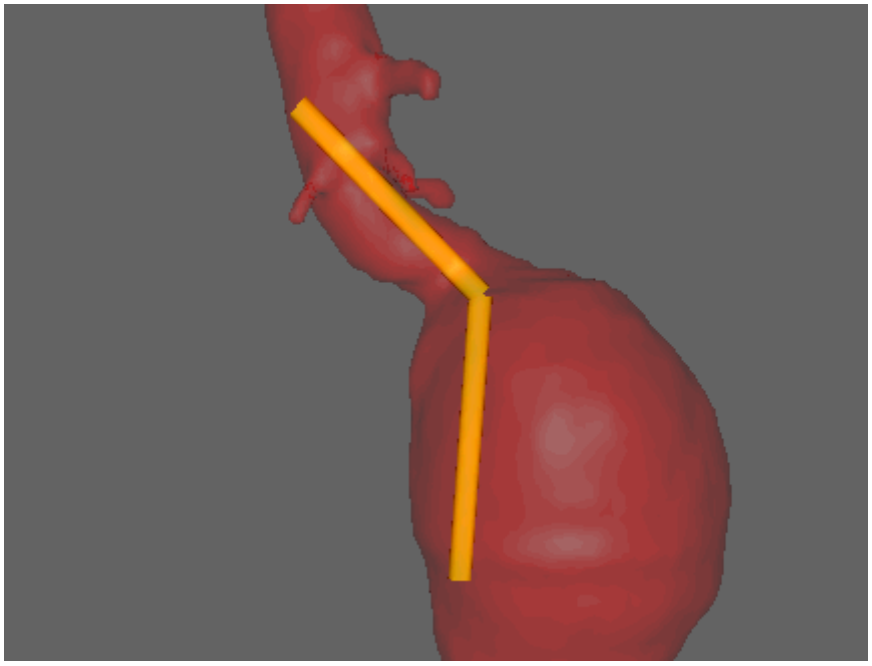
   The tube format is useful to visualize your calculation. If you choose a Transparent format, you can specify the level of transparency in the % entry box,

or use the default value of 50%.

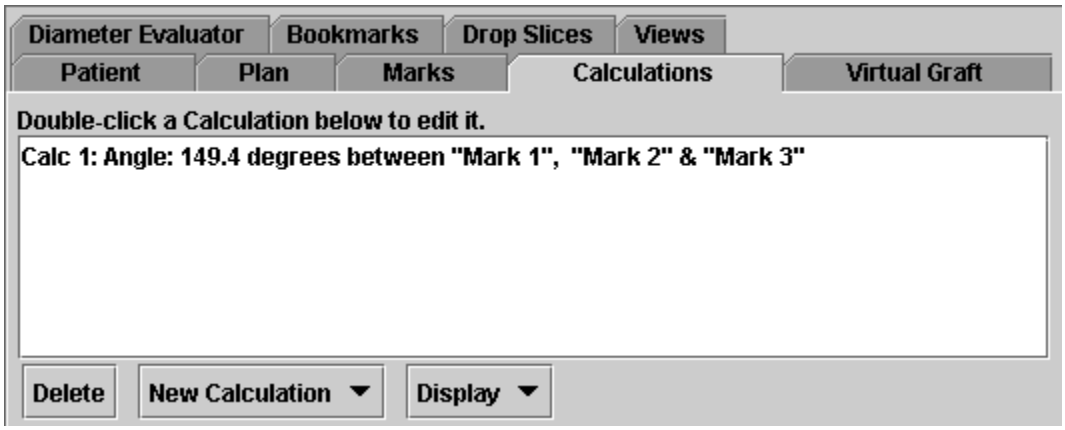
9. **Name the calculation.**

   Select a **Type** from the drop-down menu and either accept the default name or enter a new name in the Name field.

10. **Click *OK* to perform the angle calculation.**



Sample angle calculation display in model



The calculation as it appears in the Calculations list

Note: If you move a mark that is part of an existing angle calculation, Preview recalculates the angle for you and updates the information in the

Calculations list. Also note that if all three marks in your angle calculation are in the same slice, the angle also appears in the slice image.

11. **Save your plan file.**

    The calculations become part of the plan document file. Press **Ctrl-S** (or select **Save** from the File menu) to save the new calculation in your current plan.

Making Changes to a Distance or Angle Calculation

After you view a distance, angle, or multiline calculation in the model, you may want to fine-tune it. You can move marks and change the model display for an existing calculation.

1. **Reposition a mark that is part of an existing calculation.**

   With the default cursor (the arrow) click to select a mark in the slice area or window. Click again in the center of the mark and drag it to a new position. As you move the mark, you can view the change to the calculation in the model.

   When you move a mark that is part of an existing calculation, Preview automatically recalculates the distance, angle, or multiline for you and displays the result in the Calculations list.

2. **Change the tube diameter.**

   To change the diameter of a calculation's tube graphic, resize the marks that make up the calculation. Change the size of a mark in one of the following ways:

   - Double-click the mark name in the Marks list or double-click the mark in the slice. In the Edit Mark dialog box, click in the Diameter field. Type a number to define the new diameter of the selected mark in millimeters (mm).

   - In the slice, click the mark to select it. A yellow box frames the mark. Click and hold the mouse pointer over the "handle" of the frame and drag the box to the size you want.

3. **Change the model display of an existing calculation.**

   In the Calculations list, double-click on the calculation you want to change. Alternatively, right-click on the calculation in the Calculations list and select **Edit**. In the edit calculation dialog box, make the necessary changes to the display settings.

For example, you can change the calculation graphic's color, its transparency, and whether it appears as a line or a tube.

4. **Click *OK* to make your changes to the calculation.**

Make area and perimeter calculation

In Preview tool bar click the polygon tool icon to activate the tool. Once the tool is activated the icon is highlighted.

1. **Creating a Polygon**

Left click the mouse in the slice window in the desired position to start to construct the polygon. This point will be the start vertex of the polygon. Once the start vertex has been created keep clicking around the boundary of the feature, each click will create a new handler; until the start vertex has been reached at this point the polygon will be closed. Once the polygon is closed the handlers will turn blue and the area and perimeter results will be displayed in the slice window and the calculations tab. The more handlers that are created the greater the accuracy of the polygon.

2. **Reshape the Polygon**

Once the polygon has been closed the handlers can be dragged and replaced to reshape the polygon. This is done by moving the mouse over a handler were the pointer turns to a hand shape. At this point the handler can be moved to the desired position.

3. **Other tips**
   1. An unfinished polygon can be canceled by pressing the Esc. Key.
   2. To delete the last handler press the delete key.
   3. The handlers can only be repositioned when the polygon selection tool is activated.
   4. The area and perimeter calculation can be saved and reloaded by saving the plan.

Deleting a Calculation

1. **Click the *Calculations* tab.**

2. **Select the calculation you want to delete by clicking it in the list.**

3. **Right-click the calculation and select Delete from the popup menu, or click the Delete button, or press the Delete or Backspace key.**

   Note: Deleting a calculation will not delete its associated marks.

Calculating Volumes

In this section, you will use axial slices to determine the volume of scanned objects. When performing volume calculations, you will use these areas of the Preview interface:

Slices-The slice images provide a useful frame of reference for marking and measuring anatomical objects.

Model-Using the Jump Slice tool, you can quickly locate slices that correspond to key locations on the model. Using the Current Slice in Model tool, you can verify the relationship of the slice and your marks to the 3D model. You can rotate the model and its dropped slice, and view it from all angles. After performing the calculation, Preview displays the calculation as a graphic in the model.

Calculations List-Where Preview displays the calculation result.

Note: Volume calculations are not available in all studies.

Calculating the Volume of an Object

By locating axial slices at the top and bottom of a region of an object in the 3D model, you can estimate the volume of that object. **Caution**: The accuracy of a volume calculation is dependent on a number of factors, including the object's size, the complexity of the object's shape, and how clearly the object can be delineated in the slice images. An alert with this caution will appear the first time you do a volume calculation.

To calculate an object's volume, perform the following steps:

1. **Click the *Volume* tab below the Slice area.**

   If you are not on an Axial slice, Preview will automatically switch to the axial slice view.

2. **Click the button next to *Slice 1*: to "enter" the current slice.**

   Preview will "enter" the current slice number into the volume calculation dialog box for you, as you'll see later.

3. **Locate the axial slice at the bottom of the object or object region; click the button next to *Slice 2*: to enter that slice.**

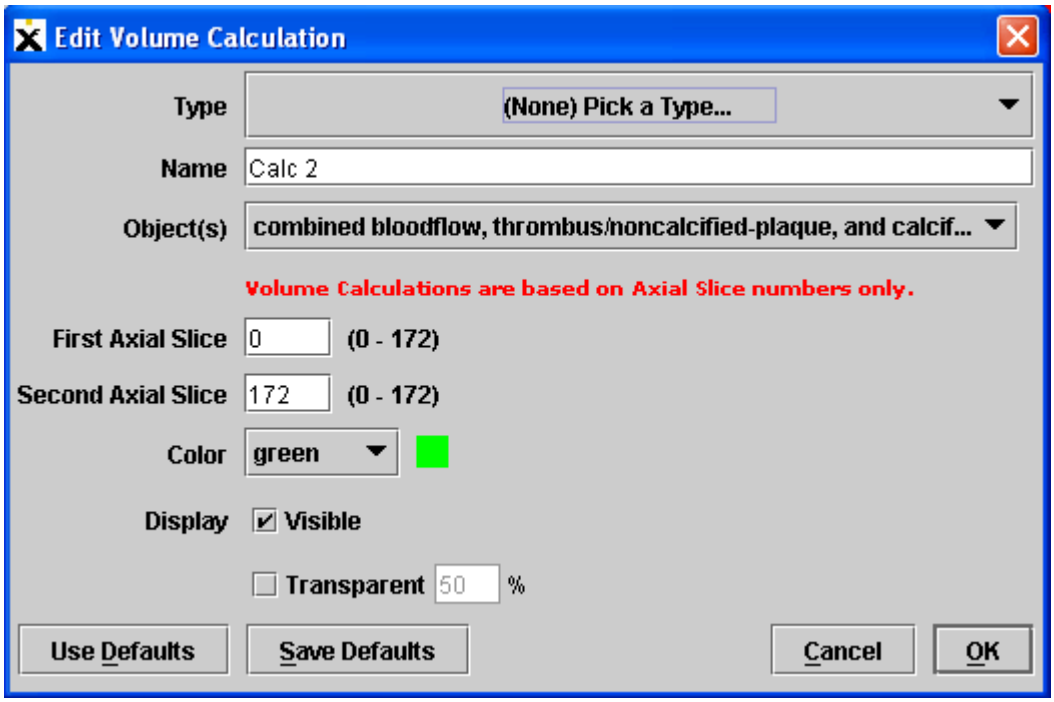
4. **Click the *Object* button to choose the anatomy you want to measure.**

   From the **Object** button's popup list, select the anatomy objects you want to measure.

   The selections include individual anatomy objects or combinations of several objects. The resulting volume of the object(s) between the upper and lower axial slices appears in cubic centimeters (cc) in red to the right of the **Object** button.

5. **To record the calculation, click the Record button.**

   The Edit Volume Calculation dialog box appears.



Edit Volume Calculation Dialog Box

   The slice numbers you entered appear in the First Axial Slice and Second Axial Slice fields.

6. **Select a Type from the drop-down menu and either accept the default name or enter a new name in the Name field.**

7. **If you need to, change either of the following:**

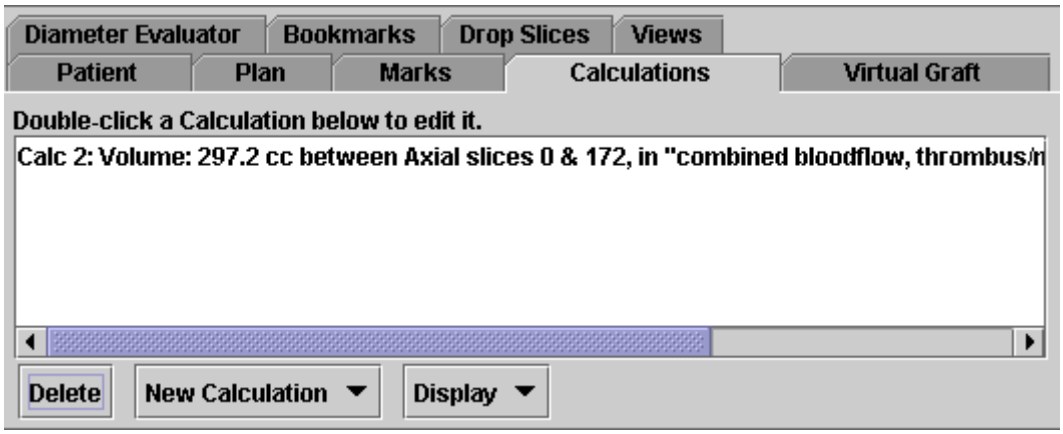
   - The object to be measured (use the Object(s) drop-down list)
   - The first and second axial slice numbers

8. **Choose formats for the model display.**

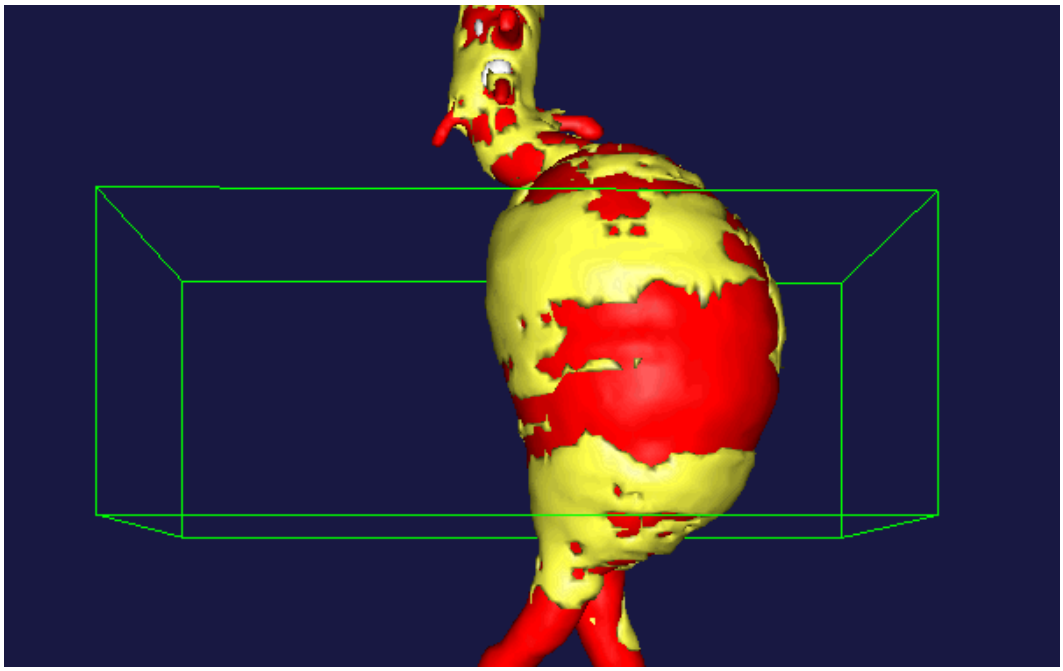
   Choose a color from the **Color** drop-down list, and select the **Visible** checkbox to see a frame in the model that shows the area being measured. If you do not want to see the frame, uncheck the **Visible** checkbox. To make the calculation transparent, check the **Transparent** checkbox. You can specify the level of transparency in the % entry box, or use the default value of 50%.

9. **Click *OK* to perform the calculation.**

10. **View the calculation results in the Calculations list and in the model.**



The volume calculation in the Calculations list



Frame indicating the volume calculation in the model

The frame around the model serves as a visual reality check for the selected area of measurement. The top and bottom show the bounds for the volume. The sides are set to the widest and deepest parts of the overall object (or the combined set of objects).

See the section entitled **Measuring Aneurysm Volume** for a specific application of the volume calculation feature.

Calculating Centerlines or Path Length

You can measure the length along the centerline of a bloodflow channel in Preview vascular applications. Preview calculates the curving path length between two slices that you specify.

> ***Note:*** Use only Aorta, Aorta-Right Iliac, or Aorta-Left Iliac slices for Centerline calculations.

1. **Select the oblique slices you want to use for the Centerline calculation.**

   In the **Slice Controls** tab, click the red-lettered button to open the drop-down menu. Select **Aorta**, **Aorta-Right Iliac**, or **Aorta-Left Iliac**.

2. **Click on the "Cur Slice" checkbox.**

   The current slice appears in the model. As you scroll through slices, Preview automatically updates the model with the current slice in the Slice area.

3. **Move through the slices to locate the slice at the top of the segment for which you want to calculate a centerline.**

   You may gain an enhanced understanding of this slice location by rotating the combined model and slice in the Model area.

4. **“Enter” the slice in the length calculation.**

   Click the **Centerline** tab. Click the button next to **Slice 1**: to enter the number of the current slice. Preview will “enter” the current slice into the Edit Centerline Calculation dialog box.

   Note: If you want to keep the slice image in the model, select Drop Slice Into Model from the Model menu.

5. **Scroll through the slices to locate the slice at the bottom of the segment you want to measure.**

6. **“Enter” the second slice in the length calculation.**

   Click the **Centerline** tab. Click the button next to Slice 2: to enter the number of the current slice. Preview will “enter” the current slice into the Edit Centerline Calculation dialog box.

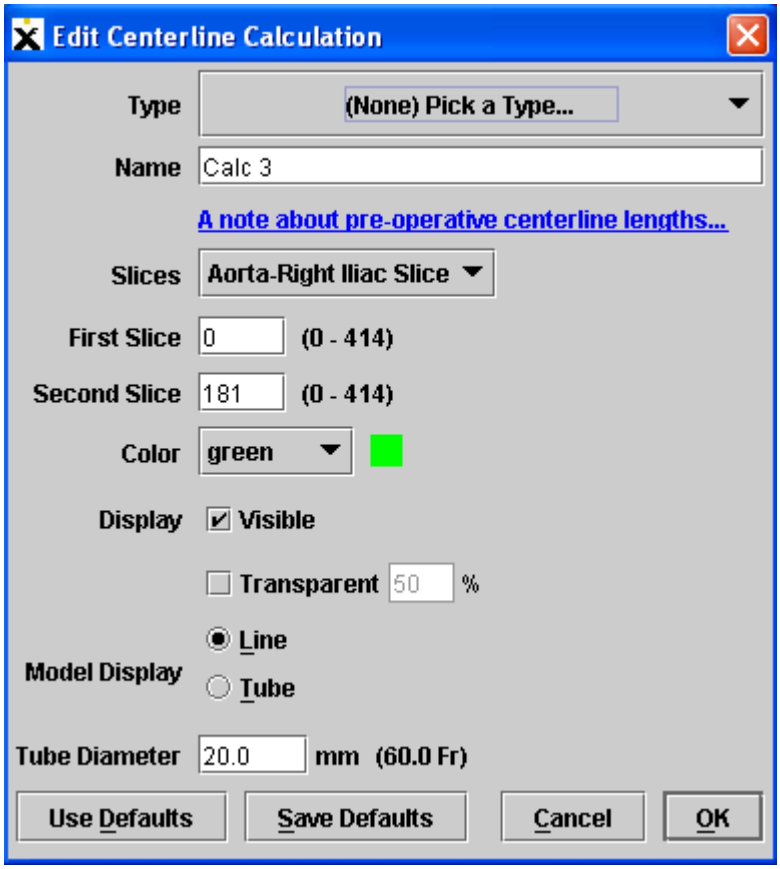
   The resulting length (in millimeters) along the center line between Slice 1 and

Slice 2 appears in red to the left of the **Record** button.

7. **To record the calculation, click the Record button.**

8. **Select New Centerline Calculation from the Calculations menu to open the Edit Centerline Calculation dialog box.**

   The Edit Centerline Calculation dialog box opens.



The Edit Centerline Calculation dialog box

9. **Select a Type from the drop-down menu and either accept the default name or enter a new name in the Name field.**

10. **Choose formats for the model display.**

    Use the format options below the slice number fields to choose the color of the calculation graphic, its visibility and transparency, and whether it appears as a line or tube.

    The Tube format is useful for endovascular pre-surgery planning. In the diameter

entry box, enter the appropriate value.

11. **In the Edit Centerline Calculation dialog box, click OK to perform the calculation.**

    The Centerline segment you defined appears in the model. The Centerline measurement appears in the Calculations list.

Viewing a Calculation

In the calculations list, highlight the calculation that you want to view. The Preview pane will show the marks associated with the calculation.

Making Changes to a Calculation

After you view a calculation in the model, you may want to make changes to its model display settings. For example, you may need to change the display from a Line to a Tube, or adjust the diameter of the tube. The Tube format can be useful in visualizing objects such as endovascular grafts or idealized blood-flow channels.

1. **Change the model display of an existing calculation.**

   In the Calculations list, double-click on the calculation you want to change. In the Edit Centerline Calculation dialog box, make the necessary changes to the model display settings.

   To change the diameter of the tube, click in the Diameter field and type a new number.

2. **Click OK to make your changes to the calculation.**

Deleting a Calculation

1. **Click the *Calculations* tab to open the Calculations list.**

2. **Click on the calculation you want to delete to select it.**

3. **Right-click the calculation and select *Delete* from the popup menu, or click the Delete button, or press the *Delete* or *Backspace* key.**

Aortic Aneurysm Treatment Planning

Preview may be used to determine treatment strategies for patients with aortic aneurysms. In this section, we describe how to use Preview in abdominal aortic aneurysm treatment planning for endovascular procedures. While the following scenarios provide examples of using Preview in vascular surgery planning specifically, the methods and tools described can be applied to many areas of surgery planning.

Making Calculations for Bifurcated Stent Grafts

The following sections provide step-by-step instructions for making a standard series of calculations for evaluating patients and sizing bifurcated stent grafts. Refer to the diagram below and its labels for the sequence and location of calculations required. The label names mirror the suggested names for calculations in this section's instructions.

Standard Data Points for Bifurcated Stent Grafts

Prox Dia 1 = Starting point of graft

Prox Dia 2 = Distal end of the proximal neck

PL1 = Proximal neck Length

PD1-AO-BIF = Length* from the renals to the aortic bifurcation

AO-RCIA 2 = Length* from the renals to the left hypogastric

AA MAX D = Maximum AAA sac diameter.

MIN/AO-BIF = Minimum aorta diameter at point of bifurcation

RCIA 1 = Beginning point of right iliac sealzone

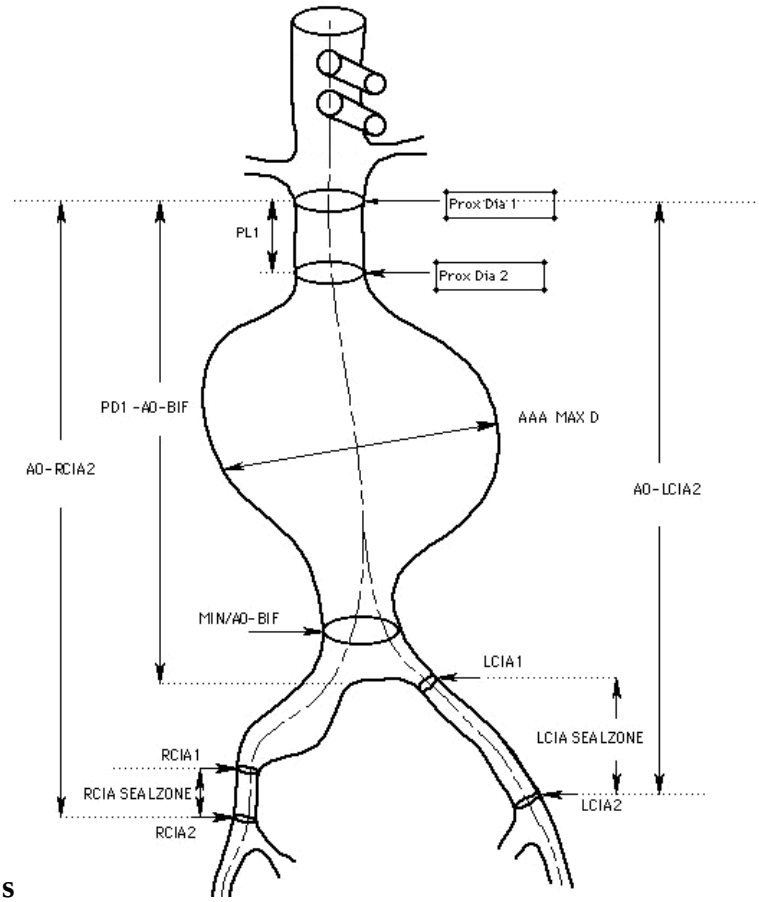
RCIA 2 = End point of the right iliac sealzone

RCIA SEALZONE = Zone in right iliac artery where graft must form a pressure seal

LCIA 1 = Beginning point of left iliac sealzone

LCIA 2 = End point of left iliac sealzone

LCIA SEALZONE = Left iliac sealzone



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Calculating Vessel Diameters

Measure vessel diameters using only **Aorta**, **Aorta-Right Iliac**, or **Aorta-Left Iliac** slices. Because these slices are at a right angle to the bloodflow path, they present a truer cross-sectional diameter. Do not use Axial slices.

Preview offers four methods for measuring vessel diameters:

- Resizing **Mark Method** and the **Auto size tool** are effective for vessels with circular shape.
- **Mark-to-Mark** and **Click-Drag-Release** methods should be used for calculating non-circular vessel cross-sections.

Resizing Mark Method

1. **In the *Slice Controls* tab, select *Aorta, Aorta-Right Iliac,* or *Aorta-Left Iliac*.**
2. **In the slice, add a Mark in the center of the lumen.**
3. **Resize the mark to fit the aorta diameter.**

   Drag the handle at the bottom-right of the yellow box that surrounds the mark. To move the mark, click at its center and drag it to the desired location.
4. **Double-click the center of the mark.**

   The Edit Mark dialog box opens.
5. **Note the diameter, select a Type from the drop-down menu and either accept the default name or enter a new name in the Name field.**
6. **Click OK.**

Auto size Method

1. **In the *Slice Controls* tab, select *Aorta, Aorta-Right Iliac,* or *Aorta-Left Iliac*.**
2. **In the slice, add a Mark in the center of the lumen.**
3. **To get an Auto size of the bloodflow, check the Bloodflow box in the Marks Tab and then select the Auto Size button.**

4. **To get an Auto size of the lumen, make sure the Bloodflow box in the Marks Tab is unchecked and then select the Auto Size button.**

5. **There are five different ways to invoke the Auto Size function. It is located on the Marks pull-down window at the top of the Preview pane, the Marks tab, right-clicking on the mark in the Marks tab, the Edit Mark window and by typing ctrl-m.**

6. **Currently, the Auto size Method only works for marks that have been created in Preview. It does not work for marks downloaded from PEMS.**

Mark-to-Mark Method

1. **Place a mark on the edge of the vessel.**

2. **Double-click in the center of the mark to open the Edit Mark dialog box.**

3. **In the Diameter field, type "3 mm", or other desired small diameter.**

4. **Click Save Defaults, then click OK.**

5. **Place a second mark on the vessel opposite the first one.**

   Click and drag either mark to reposition as needed.

6. **From the Calculations menu, select New Distance Calculation.**

   The Edit Distance Calculation dialog box opens. You can change the way the calculation is displayed in the Model and Slices area.

7. **Select a Type from the drop-down menu and either accept the default name or enter a new name in the Name field. Click OK.**

   The diameter calculation appears in the Calculations tab.

   Note: You need to select a **Type** in order for your mark or calculation to appear in the Design Your [Manufacturer Name] Graft or Custom Graft Builder window when using the VirtualGraft feature.

Click-Drag-Release Method

Use this method for calculating non-circular vessel cross-sections.

1. **Place the arrow on the edge of the vessel.**

2. **Click and hold the left mouse button and then drag the arrow to the opposite edge if the vessel.**

3. **Release the mouse button.**

   The Edit Distance Calculation dialog box opens.

4. **Select a Type from the drop-down menu and either accept the default name or enter a new name in the Name field. Click OK.**

   The diameter calculation appears in the Calculations tab.

Calculating Vessel Centerline Lengths

You can calculate the centerline of bloodflow by specifying the upper and lower Aorta or Aorta-Iliac slices of the segment you want to measure.

> ***Note:*** Use only Aorta, Aorta-Right Iliac, or Aorta-Left Iliac slices for centerline calculations. Do not use Axial slices.

Typing Slice Numbers in the Dialog Box

One method for performing a centerline calculation is to type the appropriate slice numbers in the slice fields in the calculation dialog box. Perform the following steps:

1. **From the Calculations menu, select *New Centerline Calculation*.**

2. **From the Slices drop-down menu, select *Aorta Slice*, *Aorta-Left Iliac Slice*, or *Aorta-Right Iliac Slice*.**

3. **Enter slice numbers in the First Slice and Second Slice fields.**

4. **Select a Type from the drop-down menu and either accept the default name or enter a new name in the Name field. Click OK.**

   The calculation appears in the Calculations tab.

   Note: You need to select a Type in order for your mark or calculation to appear in the Design Your [Manufacturer Name] Graft or Custom Graft Builder window when using the VirtualGraft feature.

Using Slice Buttons in the Centerline Tab

Another method for performing centerline calculations is to scroll to the appropriate slices, and enter their numbers using buttons in the Centerline tab of the Slice area and Slice windows.

1. **Scroll through slices or use the Jump Slice tool to locate the slice at the top of the segment for which you want to calculate a centerline.**

2. **To enter this slice number in the length calculation, click the Centerline tab, then click the button to the right of *Slice 1*.**

3. **Scroll through to select the slice at the distal end of the segment you want to calculate.**

4. **In the *Centerline* tab, click the button to the right of Slice 2.**

   The length (in millimeters) along the centerline of the two selected slices appears in red to the left of the **Record** button.

5. **To record the centerline distance calculation, click the *Record* button.**

   Preview automatically enters the slice numbers in the Edit Centerline Calculation dialog box.

6. **Select a Type from the drop-down menu and either accept the default name or enter a new name in the Name field. Click OK.**

   The calculation appears in the Calculations tab.

   Note: You need to select a **Type** in order for your mark or calculation to appear in the Design Your [Manufacturer Name] Graft or Custom Graft Builder window when using the VirtualGraft feature.

Visualizing a Graft

Any centerline calculation can be visualized as a tube within the vessel. This provides a way to test the fit of a graft. To display the centerline as a tube, perform the following steps:

1. **After entering the slice numbers for the centerline calculation, select the Tube display option in the Edit Centerline Calculation dialog box.**

2. **In the diameter field, enter the diameter.**

3. **Click *OK*.**

The model displays the centerline calculation as a tube.

For complex grafts, use Preview's VirtualGraft feature. See the section entitled VirtualGraft™ Method for Sizing Bifurcated Stent Grafts for more information on VirtualGrafts and how to interpret the model display.

Evaluating the Proximal Neck

Accurate understanding and measurement of the minimum access diameter of the iliac artery may be used for planning an endovascular repair. Use Preview's oblique slices, which are perpendicular to the bloodflow channel to examine the true lumen of the iliac arteries.

Determining the Starting Point for the Graft

1. **Click the red-lettered button in the Slice Controls tab and select *Aorta-Left Iliac* or *Aorta-Right Iliac*.**

2. **Select the "Cur Slice" checkbox.**

   The current slice appears in the model. Rotate the model for optimal views of both the slice location and the renal arteries.

3. **Press and hold the *Ctrl* key to select the Jump Slice tool, and click on the 3D model at the approximate proximal starting point of the graft.**

   It is usually best to click on the model just below the renal arteries. Scroll slices up or down to refine the slice position.

4. **Click the *Centerline* tab below the Slice area, then click the button to the right of *Slice 1*.**

   Preview will enter the selected slice as Slice 1 for this and subsequent centerline calculations. This entered slice number will remain Slice 1 until you enter another slice in the Slice 1 field.

Calculating the Proximal Length Diameters

In the aorta slices, vessel cross-sections are more circular than elliptical, and therefore, allow more accurate measurement of the diameter than the axial slices.

1. **Find an aorta slice that provides a representative view of the neck.**

2. **Add a mark in the center of the *Aorta, Aorta-Left Iliac,* or *Aorta Right Iliac slice.***

3. **Resize the mark so that it covers the aorta.**

   To move the mark, click its center and drag it to the desired location.

4. **Double-click the mark to open the Edit Mark dialog box.**

   Select a **Type**, such as "Aortic Diameter at Renals", from the drop-down menu. Either accept the default name that appears in the Name field, or type in a descriptive name for the mark, such as "Prox Dia 1." This is the diameter of the proximal end of the proximal neck.

   (Prox Dia 1 is illustrated in the diagram in the section entitled **Making Calculations for Bifurcated Stent Grafts** .)

5. **Click *Save Defaults*, then click *OK*.**

   Alternatively, use the Mark-to-Mark or Click-Drag-Release methods described earlier in the chapter. See the section entitled **Calculating Vessel Diameters**.

Determine the Distal End of the Proximal Neck

1. **Scroll down through slices to examine the quality of the proximal neck.**

2. **To visualize suspected changes in aortic diameter, place a mark in the center of the aorta on any slice.**

   Because you changed the default diameter in step 5 above, the marks will be equal to the diameter measured for the Prox Dia 1 and will simplify visualizing diameter changes. To remove marks, select them and press the **Delete** or **Backspace** key.

3. **Locate the slice at the distal end of the proximal neck.**

   This will be the beginning of the aneurysm, or, in the case of conical necks, it is the location of the maximum aortic diameter recommended for the graft system used.

4. **Add a mark on the slice in the center of the aorta and resize it to measure the diameter at the distal end of the proximal neck.**

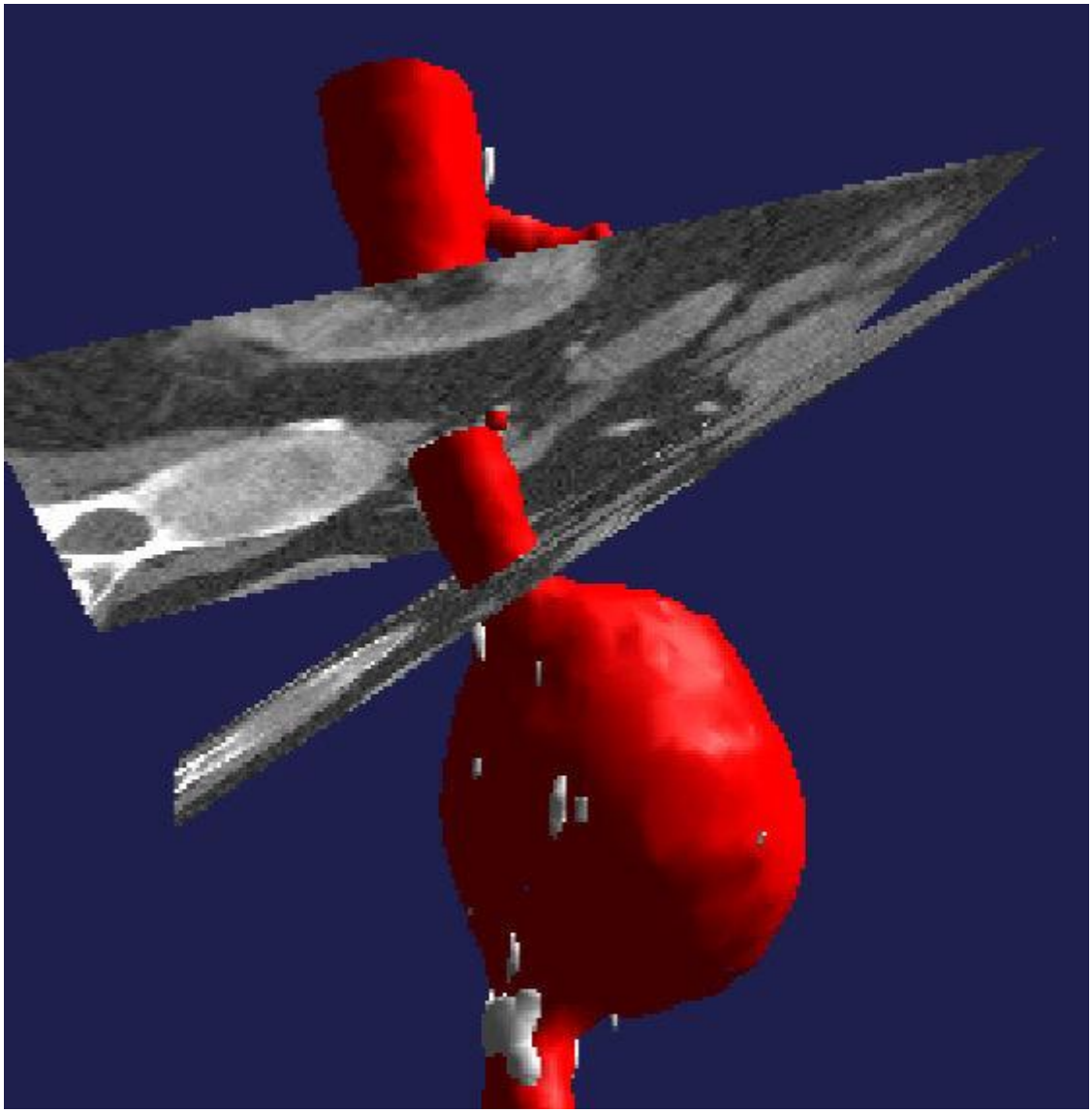
5. **Double-click the mark to open the Edit Mark dialog box.**

   Select "Aortic Diameter at Distal End of Proximal Neck" from the **Type** drop-down menu. In the Name field, type a descriptive name for the mark, such as "Prox Dia 2" or accept the default name. Click **OK**.

(Prox Dia 2 is illustrated in the diagram in the section entitled **Making Calculations for Bifurcated Stent Grafts**.)

6. **Click the Centerline tab below the Slice area, then click the button to the right of Slice 2.**

   Preview will enter this slice number in subsequent centerline calculations. This entered slice number will remain as Slice 2 until you enter another slice in the Slice 2 field.



Drop slices marking the two ends of the proximal neck

Record the Proximal Neck Length

The distance between the two selected slices appears in red to the left of the **Record** button.

1. **Click the Record button to record the calculation.**

   The Edit Centerline Calculation dialog box opens.

2. **Select "Proximal Aortic Neck Length" from the Type drop-down menu. In the Name field, type "PL1" or accept the default name. Click *OK*.**

   The Calculation list appears in the Lists area, displaying the calculation result. (PL1 is illustrated in the diagram in the section entitled **Making Calculations for Bifurcated Stent Grafts.)**

Calculating Lengths of Conical Proximal Necks

To determine the proximal neck length for conical necks, use the following method to locate the distal end of the proximal neck for a specific graft system.

1. **Review the manufacturer's specifications and your calculation of Prox Dia 1 (the aortic diameter at the top of the proximal neck).**

   From these, determine the maximum aortic diameter recommended, taking into consideration the manufacturer's oversizing recommendation. For example, a 28 mm graft may have a minimum oversizing specification of 2 mm. Therefore, 26 mm is the maximum recommended aortic diameter within the anticipated sealzone.

2. **On an iliac slice in the proximal neck area, click a mark in the center of the aorta.**

   Note: A graft's sealzones are the areas at the ends of the graft, where good apposition is required to effectively seal the aneurysm from arterial pressure.

3. **Double-click the mark, and in the Edit Mark dialog box, enter a diameter equal to the maximum aortic diameter for the graft system.**

4. **Click *Save Defaults*, then click *OK*.**

   All subsequent marks will have the diameter you entered in step 3 until you change the diameter and click **Save Defaults** again.

5. **View the mark in relation to the aorta.**

If the mark is larger than the aorta, the distal end of the proximal neck may be lower. Select the mark and press the **Delete** or **Backspace** key to remove it.

6. **Scroll through the slices to a lower location within the proximal neck.**

7. **Click marks on slices until you find a slice where the mark size is equal to the aortic diameter.**

   This is the distal end of the proximal neck.

8. **Double-click the mark to open the Edit Mark dialog box.**

   Select a **Type** from the drop-down menu. In the Name field enter a name for the mark, such as “Prox Dia 2” or accept the default name. Click **OK**.

9. **Click the *Centerline* tab below the Slice area, then click the button to the right of *Slice 2*.**

   Preview will enter this slice number in subsequent centerline calculations. (Slice 1 is still set to the slice marking the top end of the graft, as entered in the section entitled **Determine the Starting Point for the Graft**).

10. **Click *Record* to record the calculation.**

    The Edit Centerline Calculation dialog box opens.

11. **Select “Proximal Aortic Neck Length” from the Type drop-down menu. In the Name field, type “PL1” or accept the default name. Click *OK*.**

    The Calculation list appears in the Lists area, displaying the calculation result.

Mid-Aneurysm Calculations

Use the following steps to measure the maximum diameter of the aneurysm sac, the minimum lumen diameter at the aortic bifurcation, and the centerline length from the renals to the bifurcation.

Maximum AAA Sac Diameter

To measure the maximum diameter of the aneurysm, perform the following steps:

1. **Rotate the model to get the best view of the width of the aneurysm sac.**

2. **Press and hold the *Ctrl* key to select the Jump Slice tool, and click on the widest section of the aneurysm in the 3D model to jump to the corresponding slice.**

3. **Utilize the Mark-to-Mark or Click-Drag-Release methods to obtain the diameter calculation. See the section entitled** Calculating Vessel Diameters**.**

4. **Select "Maximum AAA Diameter" from the Type drop-down menu. In the Name field, type a descriptive name such as "AAA Max D" or accept the default name. Click OK.**

Alternatively, you may use the Resizing Mark method described earlier in this section. **See Calculating Vessel Diameters.**

Minimum Clearance Diameter at Aortic Bifurcation

To determine the minimum clearance for the graft, you must measure the smallest lumen diameter at the aortic bifurcation. Perform the following steps:

1. **Scroll through the slices to find the slice with the smallest lumen diameter in the region of the aortic bifurcation.**

2. **Add a mark on the aorta in the slice.**

3. **Size the mark to cover the aorta's perimeter.**

4. **Double-click the mark to open the Edit Mark dialog box.**

5. **Note the diameter, select "Aortic Bifurcation Diameter" from the Type drop-down menu, and type a descriptive name such as "AO-BIF" in the Name field, or accept the default name. Click *OK*.**

Alternatively, utilize the Mark-to-Mark and Click-Drag-Release methods described earlier in the chapter. See the section entitled **Calculating Vessel Diameters.**

Centerline Length: Renals to Aortic Bifurcation

To calculate the length of the centerline of bloodflow from the renals (top end of the graft) to the aortic bifurcation, perform the following steps:

1. **Click the *Centerline* tab below the Slice area.**

2. **Use the Jump Slice tool to find the slice just above the aortic bifurcation.**

3. **In the *Centerline* tab, click the button to the right of *Slice 2* to enter the slice number in the centerline calculation.**

   (In previous steps, Slice 1 was set to the slice marking the top of the graft.)

4. **Click the Record button.**

5. **In the Edit Centerline Calculation dialog box, select "Renal to Aortic Bifurcation" from the Type drop-down menu and type a descriptive name for the calculation (such as "PD1-AO-BIF") or accept the default name. Click OK.**

   (PD1-AO-BIF is illustrated in the diagram in the section entitled Making Calculations for Bifurcated Stent Grafts.)

Right Iliac Calculations

This section steps you through right iliac calculations. The next section focuses on left iliac calculations.

Centerline Length: Renals to Right Hypogastric

To measure the centerline length from the renal arteries to the right hypogastric artery, perform the following steps:

1. **If Slice 1 is not set to the slice marking the top of the graft, enter that slice in the Slice 1 field as shown in Determine the Starting Point for the Graft on in the section entitled** Evaluating the Proximal Neck.

2. **Scroll through the slices to a location just above the takeoff of the right hypogastric artery.**

   This slice marks the location of the distal end of the maximum graft length possible without occluding the hypogastric artery.

3. **Click the *Centerline* tab, then click the button to the right of *Slice 2* to enter the slice into the length calculation.**

4. **Click the *Record* button.**

5. **In the Edit Centerline Calculation dialog box, select "Renal to Right Hypogastric" from the Type drop-down menu and enter a name for the calculation such as "AO-RCIA 2" or accept the default name. Click OK.**

   (AO-RCIA 2 is illustrated in the diagram in the section entitled **Making Calculations for Bifurcated Stent Grafts**).

Calculate RCIA Diameter

To calculate the centerline diameter of the right iliac artery, perform the following steps:

1. **Rotate the model to get the best view of the right iliac artery.**

2. **Identify the potential sealzone segment of the vessel.**

   This segment should be free of the aneurysm and have a relatively uniform diameter.

3. **Scroll through slices to the *distal end* of the available sealzone.**

4. **Add a mark in the center of the vessel and expand it to measure the diameter.**

5. **Double-click the mark to open the Edit Mark dialog box.**

6. **Note the diameter, select "Representative Diameter at Right Common Iliac" from the Type drop-down menu and name the mark (i.e., "RCIA 2") or accept the default name. Click *OK*.**

   (RCIA 2 is illustrated in the diagram in the section entitled **Making Calculations for Bifurcated Stent Grafts**.)

Calculate Graft Length to Reach RCIA 2

To calculate the length of the graft from its proximal end to the sealzone in the right iliac artery, perform the following steps:

1. **Click the *Centerline* tab, then click the button to the right of *Slice 2*.**

2. **Click the Record button.**

3. **In the Edit Centerline Calculation dialog box, select a Type from the drop-down menu, name the calculation (i.e., "PD1-RCIA 2") or accept the default name. Click OK.**

Calculate RCIA Sealzone Length

In the three steps above, you entered the slice that marks the end of the graft as Slice 2. To enter the slice marking the top end of the sealzone and then calculate the length of the sealzone, perform the following steps:

1. **Scroll through slices to the *proximal end* of the available right iliac sealzone.**

2. **In the slice, add a mark on the artery and resize it to measure iliac diameter.**

3. **Double-click the mark to open the Edit Mark dialog box.**

4. **Note the diameter, select a Type from the drop-down menu, name the mark (i.e., "RCIA 1") or accept the default name. Click *OK*.**

5. **Click the *Centerline* tab, then click the button to the right of *Slice 1*.**

6. **Click *Record*.**

7. **In the Edit Centerline Calculation dialog box, select "Right Iliac Sealzone" from the Type drop-down menu and name the calculation (i.e., "RCIA SEALZONE") or accept the default name. Click *OK*.**

   (RCIA 1 and RCIA SEALZONE are illustrated in the diagram in the section entitled **Making Calculations for Bifurcated Stent Grafts**.)

Left Iliac Calculations

This section provides step-by-step instruction for performing left iliac calculations.
Important: Before you can take measurements in the left iliac artery, you must switch to the Aorta-Left Iliac slices.

Centerline Length: Renals to Left Hypogastric

To measure the centerline length from the renal arteries to the left hypogastric artery, perform the following steps:

1. **From the Slices menu, select *Set Slice Area*, then *Aorta-Left Iliac*.**

2. **Click the *Calculations* tab, and view previous calculations to identify the slice number used as the starting point for the proximal graft.**

3. **Press *Ctrl-G* to open the Go to Slice #... dialog box.**

4. **In the dialog box, enter the slice number and click *OK*.**

   The Aorta-Left Iliac slices move to the selected slice.

5. **In the *Centerline* tab, click the button to the right of *Slice 1* to enter the slice into the length calculation.**

6. **Scroll through the slices to a location just above the takeoff of the left hypogastric artery.**

   This slice marks the distal end of the location of the maximum graft length possible without occluding the hypogastric artery.

7. **In the *Centerline* tab, click the button to the right of *Slice 2* to enter the slice into the length calculation.**

8. **Click the *Record* button.**

9. **In the Edit Centerline Calculation dialog box, select "Renal to Left Hypogastric" from the Type drop-down menu and enter a name for the calculation such as "AO-LCIA 2" or accept the default name. Click *OK*.**

   (AO-LCIA 2 is illustrated in the diagram in the section entitled **Making Calculations for Bifurcated Stent Grafts**)

Calculate LCIA Diameter

To calculate the diameter of the left iliac artery, follow the instructions in **Calculate RCIA Diameter** in the previous section , but use the **Aorta-Left Iliac** slices. Select "Representative Diameter at Left Common Iliac" from the Type drop-down menu. Give the measurement a descriptive name such as "LCIA 2" or accept the default name.

(LCIA 2 is illustrated in the diagram in the section entitled **Making Calculations for Bifurcated Stent Grafts**)

Calculate Graft Length to Reach LCIA 2

To calculate the length of the graft from its proximal end to the sealzone in the left iliac artery, follow the instructions in **Calculate Graft Length to Reach RCIA 2** in the previous section, but use the **Aorta-Left Iliac** slices. Give the calculation a descriptive name such as "PD1-LCIA2" or accept the default name.

Calculate LCIA Sealzone Lengths

To calculate the length of the sealzone in the left iliac artery, follow the instructions in **Calculate RCIA Sealzone Length** in the previous section, but use the Aorta-Left Iliac slices. Select "Left Iliac Sealzone" from the Type drop-down menu. Give the calculation a descriptive name such as "LCIA SEALZONE" or accept the default name.

(LCIA SEALZONE is illustrated in the section entitled **Making Calculations for Bifurcated Stent Grafts**)

Evaluating Iliac Access

You can use Preview to estimate the difficulty of passing an endovascular delivery system through the ilio-femoral canal using the iliac access evaluator feature. To use this feature, perform the following steps:

Using the Diameter Evaluator Feature

1. **Click the *Diameter Evaluator* tab.**

   Preview will place tubes along the centerlines of both the RIL and LIL at the diameter indicated.

2. **Use the sliders to change the size of the tubes.**

   Preview operates in millimeters, but will show an approximate outer diameter in French. This is calculated using the conversion 3 FR = 1 mm. Check the specifications of your sheath manufacturer to make sure this is the appropriate conversion.

3. **Use the visibility slider and the color drop-down menu to change the transparency and color of the tubes.**

Use the iliac access tool to designate areas of concern for further evaluation using the oblique slices.

Using Slices to Evaluate Iliac Access

To use slices to evaluate iliac access, perform the following steps:

1. **Click the red-lettered button below the Slice area, and from the popup menu select *Aorta-Right Iliac* or *Aorta-Left Iliac*.**

2. **Scroll through the slices and examine the true lumen for calcification and minimum diameter.**

3. **Measure the diameter of the iliac artery at intervals as needed.**

4. **As necessary, select the *Cur Slice* checkbox for perspective.**

Aortic Diameter

The *Diameter Evaluator* can also be used to estimate the diameter of the aortic neck. To do this, perform the following steps:

1. **Turn on the checkbox next to Aortic Diameter.**

2. **Use the sliders to change the size of the tubes.**

   The aortic slider functions in the same way as the Iliac Access sliders. Read the description above to see how to use it.

The aortic diameter evaluator should be used to find areas of the anatomy that warrant further review using the slices. Use the **Jump Click** feature to switch quickly to the relevant slice.

Measuring Proximal Neck Angulation

To calculate angulation in areas of tortuosity, you can use a Preview feature that measures the angle created by three selected marks.

Using the Angle Calculation

To measure angulation, perform the following steps:

1. **Click the red-lettered button below the Slice area, and from the popup menu select *Aorta*.**

2. **Press and hold *Ctrl* to select the Jump Slice tool, and click on the aorta in the model at the top of the proximal neck.**

3. **On the corresponding slice, click a mark in the center of the lumen.**

4. **Rotate the model to best visualize maximum angulation and the area of acute angulation from the proximal neck and the main body of the aneurysm.**

   You are looking to see where the line “breaks.”

5. **Use the Jump Slice tool and click on the model at the point of the “break.”**

6. **On the corresponding slice, add a mark in the center of the lumen.**

7. **Use the Jump Slice tool and click on the model near the aortic bifurcation.**

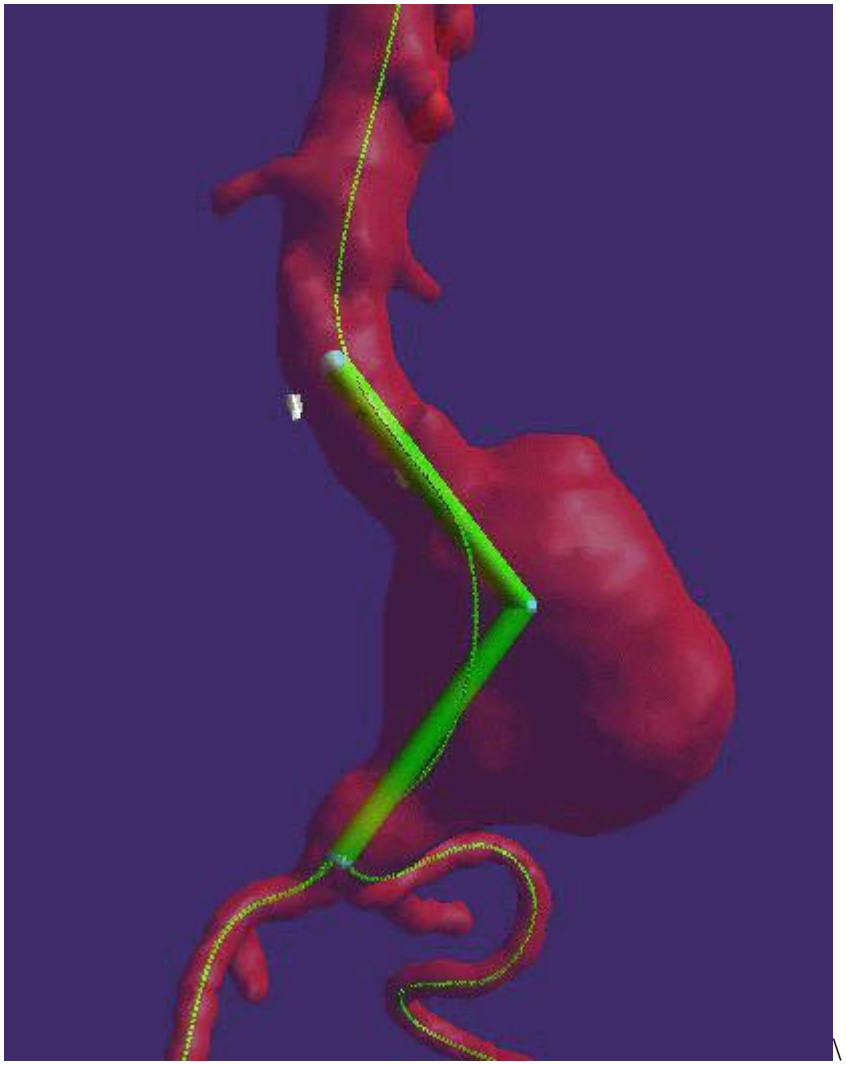
8. **On the corresponding slice, place a mark in the center of the lumen.**

   This third mark completes the last leg of the angle measurement.

9. **From the Calculations menu, select *New Angle Calculation*.**

10. **Select a Type from the drop-down menu. Accept the default name, or give the calculation a descriptive name such as “PROXIMAL NECK ANGLE.” Click OK.**

    The calculation result appears in the Calculations list and in the model.



A proximal neck angle displayed in the model

Calculating C-Arm Gantry Correction for Parallax Error

To confirm position of AAA stent grafts within in the proximal neck, especially in patients exhibiting significant proximal neck angulation, the c-arm gantry correction tool may be used. This tool is located on the slice control tabs below the slice window.

Note: C-Arm Tool. Preview includes a special C-Arm creation tool. This tool is located on one of the slice control tabs below the slice window.

If you would like to create this angle yourself, here are the steps to calculate the C-Arm gantry correction angle in the critical cranio-caudal plane:

1. **Click the *Views* tab, and double-click *Anterior* in the Views list.**

2. **Rotate the model downward so you have a direct view of the proximal neck.**

3. **With the Jump Slice tool, click the mid-line of the aorta in the model, at the level of the lowest renal artery.**

   Or you can click the anticipated location of the proximal landing point for your graft.

4. **Click the red-lettered button in the *Slice Controls* tab, and from the popup menu select *Sagittal*.**

   Adjust the magnification and then pan to visualize the sagittal plane of the proximal neck and the location of the Jump Slice cross-hair indicator (+). The cross-hair indicator marks the desired implantation level at the top of the graft.

5. **Place the cursor a short vertical distance above the cross hair in the slice and click a mark.**

6. **Add a second mark directly on top of the cross hair.**

7. **Add a third mark in a position that is perpendicular to the aorta at the location of the second mark.**

8. **From the Calculations menu, selection *New Angle Calculation*.**

   The Edit New Angle Calculation dialog box opens.

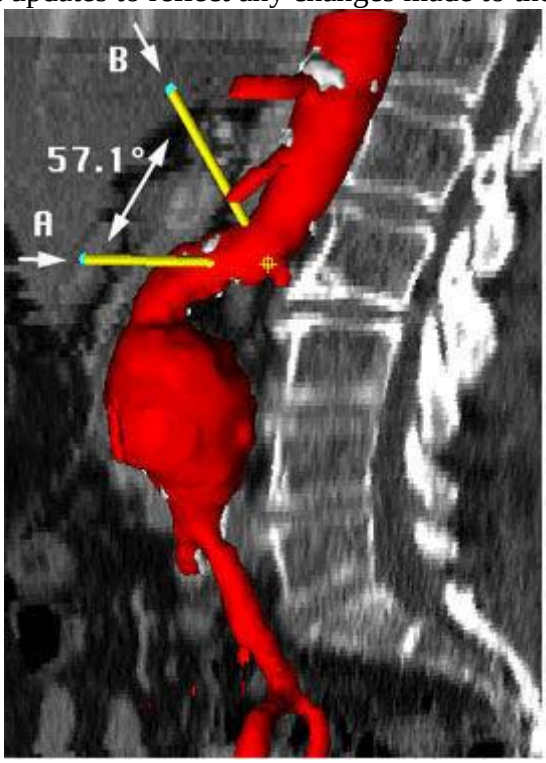
9. **Select "C-Arm Gantry Correction Angle" from the type drop-down menu. Accept the default name, or give the calculation a descriptive name such as "C-ARM CORRECTION."**

10. Select the *Tube* display option, and click *OK*.

The angle calculation result appears in the Calculations list.

11. Evaluate the correction angle in the model.

The angle is sometimes easier to see in the model. Rotate the model to a lateral view. To adjust the aiming of the angle correction, click and drag the third mark in the slice while observing its location in the model. The result in the Calculations list updates to reflect any changes made to the angle.



A correction angle in the model, shown with the sagittal Current Slice selected

Measuring Aneurysm Volume

Measuring aneurysm volume, given identifiable and consistent anatomical fiducial marks, may allow the user to compare changes in the volume of anatomy at sequential intervals.

Calculating Aneurysm Volume

To calculate the volume of an aneurysm, perform the following steps:

1. **Select one of the following as the standard anatomical fiducial option for your calculation:**

    - The lowest renal artery takeoff to the aortic bifurcation; or
    - The lowest renal artery takeoff to the right or left hypogastric artery takeoff

2. **Click the *Volume* tab below the Slice area.**

    If not already selected, Axial slices appear in the Slice area.

3. **Select the relevant object you're studying from the object drop-down menu.**

4. **Select the Jump Slice tool, and click on the model just below the renal arteries.**

5. **Study the corresponding axial slice and refine the axial slice location if necessary.**

6. **Click the button next to *Slice 1* to enter the slice number.**

7. **Scroll through the axial slices or use the Jump Slice tool to find the axial slice at the lower fiducial point (the aortic bifurcation or the hypogastric takeoff).**

8. **Click the *Slice 2* button to enter the slice number.**

9. **Click the *Record* button.**

    The Edit Volume Calculation dialog box opens.

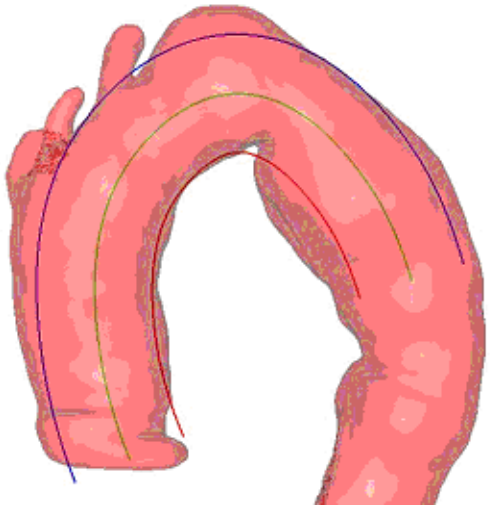
10. **Select a Type from the drop-down menu. Accept the default name or enter a new name in the Name field. Click OK.**

The resulting volume calculation appears in the Calculations list. In the model, a green box around the selected area serves as a reality check of the measurement.

Inner and Outer Curve Lengths

Purpose: In highly angulated locations along a vessel, the purpose of this feature is to provide the user with a better depiction of how a stent graft will deploy based on tortuous anatomy. Determining the behavior of a stent graft will provide a user with additional information during pre-operative case planning to support stent graft sizing decisions.

Functionality: A user can place a tube graft in the bloodflow lumen to approximate the extent that a user would like to cover with a stent graft; specifying start and stop slice locations as well as a tube diameter. Using the inner/outer curve feature, a user can then run a centerline, an inner curve line, and outer curve line down the length of the tube graft. Each of these lines independently reports a specific length measurement. The centerline length measurement can be compared to each of the inner and outer curve length measurements using an angulation ratio, simply a ratio between the inner and outer curve lengths. This ratio can be used to: 1) assess the degree of angulation in a particular location and 2) assess how likely a graft will be to twist and compress once implanted. These assessments can allow a user to better anticipate the behavior of the graft prior to implant and help a user make a more informed decision about how to size the graft based on a user's knowledge of seal zones as well as graft component twisting and torsion.

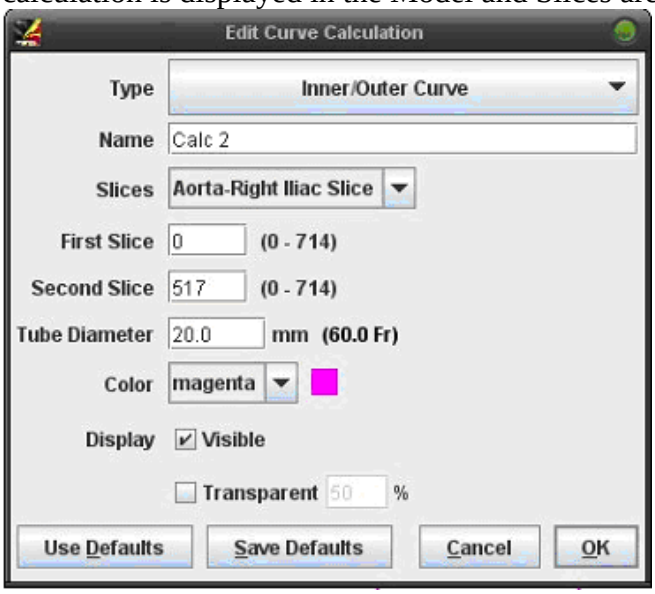


Creating a Calculation using the Inner and Outer Curve Tool

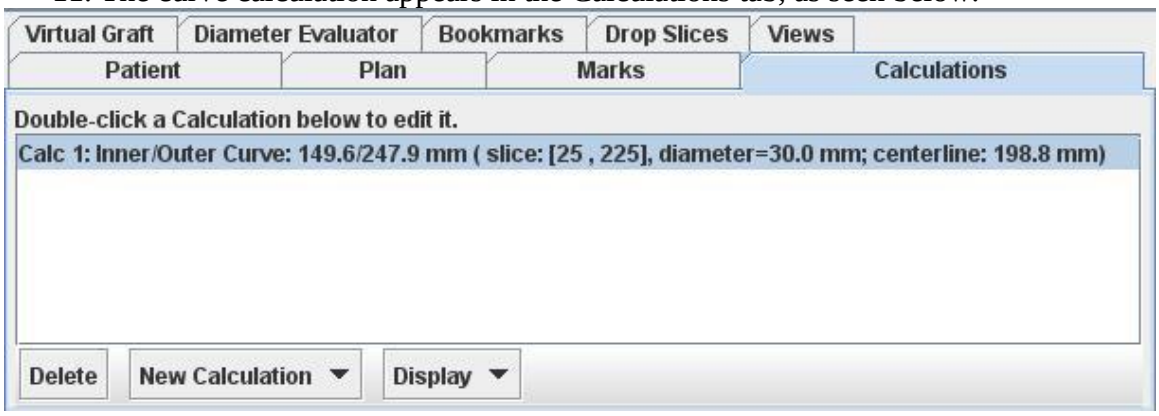
1. **From the Calculations tab or the main menu, select New Curve Calculation.**

   The Edit Curve Calculation dialog box opens. You can change the way the

calculation is displayed in the Model and Slices area.



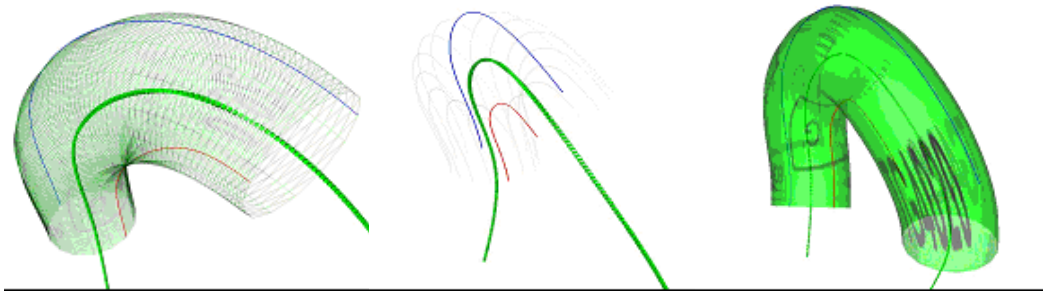
2. Type: select measurement of Inner Curve or Outer Curve or Inner/Outer Curve
3. Name: customize calculation name or accept default calculation name
4. Slices: select a slice type
5. First Slice: Start slice for calculation
6. Second Slice: End slice for calculation
7. Tube Diameter: Diameter of the tube
8. Color: Color used to display the curve
9. Display: can be hidden or set with transparent level
10. Click OK
11. The curve calculation appears in the Calculations tab, as seen below.



Changing the Inner and Outer Curve View Mode

After building a virtual graft, right click on the virtual graft button  located in the 3D model panel.

There are three view modes available:
Mesh view: show polygons and longitudes
Point view: show longitudes in dotted lines
Fill view: regular view



Mesh View Point View Fill View

Chapter 4 - Creating a Virtual Graft

VirtualGraft™ Method for Sizing Bifurcated Stent Grafts

Preview offers three options for the VirtualGraft: the Generic, Custom Tube or the Manufacturer Specific. With any method, you select the proximal starting location for a graft and then enter graft sizes. The VirtualGraft appears within the lumen in the model and allows a simple, visual evaluation of the fit of the selected graft sizes.

When using Preview to assess a patient's anatomy for potential stent graft repair, it is important to remember that several factors can impact the accuracy of the measurements made on the scan data. These include:

- the quality of the scan data itself
- the time that may have passed since the scan was taken
- the stent graft being considered
- the technique to be used in its deployment

For example, it has been theorized that stiff guide wires can straighten both the aorta and the iliac arteries and that such straightening can shorten the overall length of the anatomy from the renal arteries to the internal iliac arteries by several millimeters.

If this is true, and if a device with 'hooks' or other fixation mechanisms is used along such stiff guide wire and if the device is deployed rapidly such that the anatomy does not have time to return to normal shape before the attachment mechanisms lock it into place, then the graft may extend farther down the anatomy than anticipated based on pre-operative measurements or VirtualGraft calculations.

Therefore, use caution when evaluating measurements made on pre-operative anatomy. Be sure to take into account both the type of device and deployment technique you plan to use.

Begin by clicking the Virtual Graft tab at the top of the Main Preview Window. Preview will verify you are using oblique slice sets. If you are not, Preview will prompt you to switch and will do so automatically upon clicking **OK**.

Determine the Start Location for the Graft

To determine the start location for the graft, perform the following steps:

Note: The default start slice will be set by the oblique slice of the distal renal mark if you have made one.

1. Use the slice slider to scroll through the slices to determine the start location for the graft.

   The drop slice will move through the model.

2. Click the ***Grab Slice*** button.

   Preview will automatically enter the slice number. Alternatively, you can enter the slice number in the text field above the **Grab Slice** button.

Building the VirtualGraft

You may work with Manufacturer-Specific components, the Generic option, or custom tube to build a VirtualGraft. Before you start, review your calculations—vessel diameters and lengths—and the manufacturer's recommended oversizing recommendations. Following the steps below, you will use the VirtualGraft feature to view your selected graft in the model.

Create a Manufacturer-Specific VirtualGraft (MSVG)

You can build a graft utilizing actual components provided to M2S by the manufacturers.

> ***Note:*** The example provided here is for a modular graft design with multiple components.

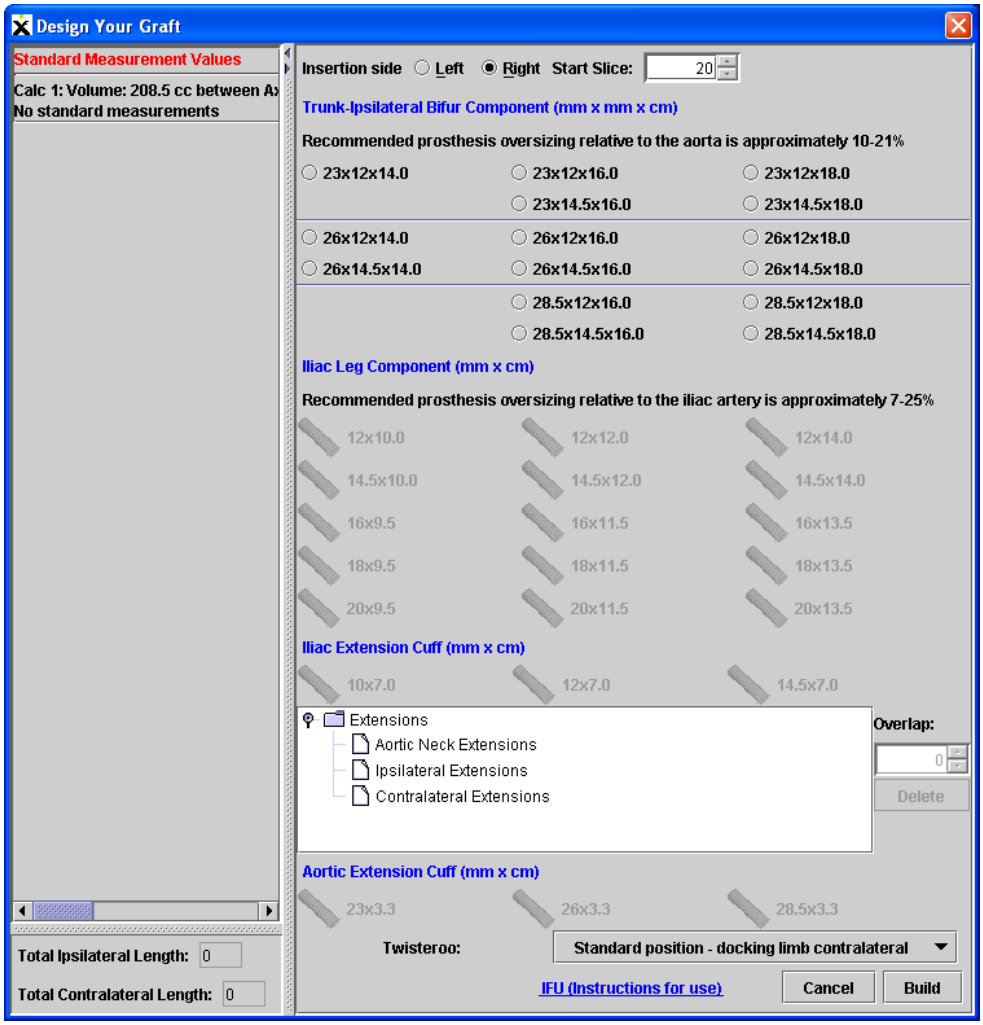
1. **Select *New Graft*.**

2. **Select a manufacturer from the list by either clicking the circle to the right of the manufacturer's name, or on the name itself.**

   Some manufacturers are currently inactive and cannot be selected from the list. If the graft you would like to use is not available, select **Generic** and follow the instructions provided later in this section.

3. **Determine your graft design interface.**

   At this point, you will be met with one of two different interfaces for designing your graft. If the **Design Your [*Manufacturer Name*] Graft** window comes up (pictured below), continue this tutorial. Some grafts will use an alternative interface which is described later in this section under Using the EZGraft Tool. This is the interface from which you can select the various components for your graft:



The Graft Design Window

To return to the Preview Main Window without building a graft, select **Cancel**.

4. **Determine an insertion side. Choose either *Left* or *Right*.**

5. **Select a *Trunk-Ipsilateral Bifur Component* from the options provided.**

   Refer to the calculations listed under Standard Measurement Values. Only measurements saved utilizing the **Type** drop-down menu will appear in this area. You can add a **Type** to a calculation by editing it. Instruction on editing a calculation is provided in the section entitled Editing a Calculation.

6. **Select an *Iliac* Leg Component, if desired.**

   To add an iliac leg component, click on the desired piece and drag and

release it into either the Contralateral or Ipsilateral folder in the Extensions window.

Preview defaults to the manufacturer-recommended overlap. To change the overlap, highlight the piece in the Extensions window and either type in a new number in the text field and press Enter, or click the up and down arrows next to the overlap text field.

Total length of components is automatically updated as components are selected from menu choices.

Extension Cuffs

Iliac and aortic extension cuffs are available within the **Manufacturer-Specific Virtual Graft** feature, if provided by the manufacturer. Preview defaults to the manufacturer-recommended overlap and deactivates components that are incompatible with existing component scenarios.

Iliac Extension Cuffs

Follow these steps to insert an iliac extension cuff, if desired:

1. **Select the dimensions for the extension cuff.**

2. **Click on the desired piece and drag and release it into the appropriate folder in the *Extensions* window.**

   Some pieces may cause alerts to appear. These warnings are determined by the manufacturer in accordance with their Instructions for Use.

   To change the overlap, highlight the piece in the Extensions window and either type in a new number in the text field and press **Enter**, or click the up and down arrows next to the overlap text field.

3. **You may also delete an extension cuff.**

   Highlight the appropriate extender component in the Extensions window and select **Delete**. Preview will remove the component from the Extensions window.

Aortic Extension Cuffs

To add an aortic extension cuff, click on the desired piece and drag and release it into the Aortic Neck Extensions folder in the Extensions window. To change the overlap, highlight the piece in the Extensions window and either type in a new number in the text

field and press **Enter**, or click the up and down arrows next to the overlap text field. To delete an aortic extension cuff, highlight the piece in the Extensions window and select **Delete**.

For some manufacturers, Preview will allow the use of aortic extension cuffs in the iliac legs provided they are the last piece on that side. Only one cuff can be used on each side.

> ***Note:*** Some overlap values are fixed and cannot be changed` in accordance with the requirements specified by that device manufacturer.

Instructions for Use

The manufacturer-specific Instructions for Use can be accessed by clicking on the blue IFU link at the bottom of the window. The Instructions for Use will load onto your browser.

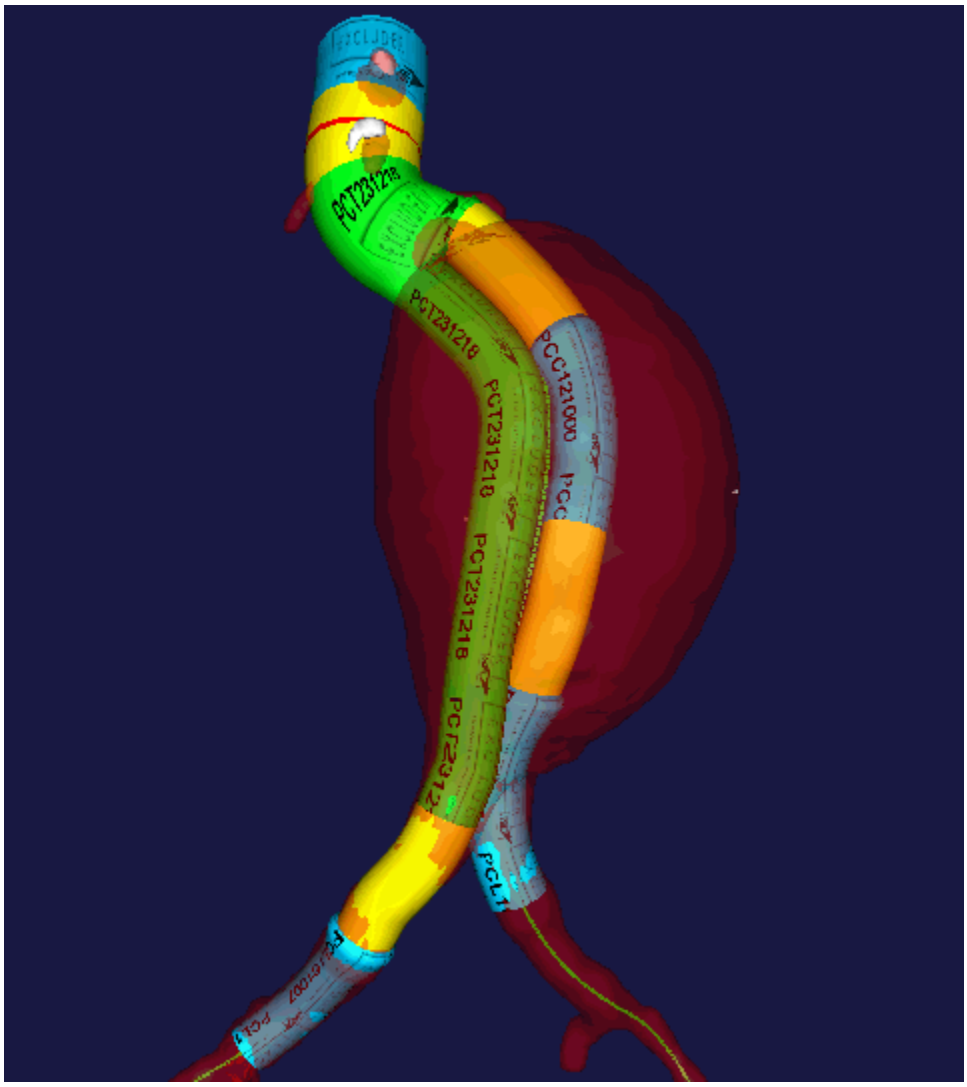
View MSVG in Model

After you have selected the components, it is important to view the scenario within the model.

1. **Select *Build* from the Design Your [Manufacturer Name] Graft window.**

   Preview places the VirtualGraft within the model and returns to the standard interface.

   Preview automatically removes thrombus from the model, and turns bloodflow transparent for better visibility of the graft. The graft components and overlap zones are indicated with different colors. The trunk-ipsilateral bifur components are green, the extenders are blue and the overlaps (with oversizing) are yellow.



A Manufacturer-Specific VirtualGraft in the 3D model of an aneurysm

The VirtualGraft scenario is listed within the Device window in the Virtual Graft tab. A separate folder appears for each graft scenario. Double-click the folder to view the components, or highlight the folder and click **Edit**.

2. **Rotate the model to view it from all sides and evaluate the graft placement within the aneurysm.**

3. **Click the *Anatomy* tab and make bloodflow visible. Click the *Virtual Graft* tab and make the graft transparent by selecting the *Transparent* checkbox. This will aid in sealzone assessment.**

Multiple Graft Scenarios

In the event you are exploring several VirtualGraft scenarios, you will have to follow these steps to view each VirtualGraft within the model.

1. **Select the VirtualGraft you wish to place in the model from the Devices window.**

   The selected graft is highlighted within a blue box.

Modify a VirtualGraft

Edit Graft Appearance

If you would like to change the VirtualGraft appearance, click the **VG** button on the Model View Bar. This works for both Manufacturer-Specific and Generic grafts.

To change or remove a VirtualGraft scenario, follow these steps:

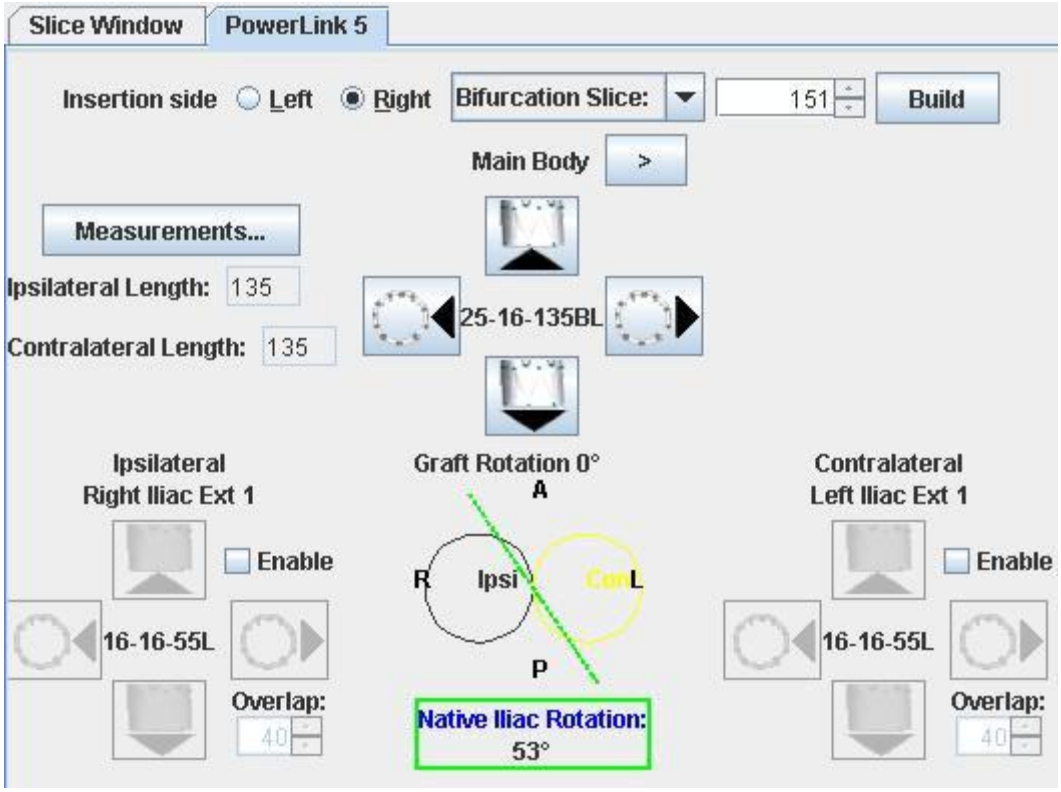
1. **Highlight the VirtualGraft in the Device window.**

2. **To adjust the components, select *Edit* or double-click the VirtualGraft listing.**

   The Graft specification window appears. Select the components you wish to change or adjust the numbers and click **Build**. The revised scenario is automatically updated within the model and the Device window.

The EZGraft Tool

Some manufacturer's devices will be displayed using a different interface. A picture of this interface is shown below.



An Example of a Design Interface

Working with the EZGraft

A graft will automatically appear in the Preview model using the minimum size components. You will use the EZ-Graft designer to edit the components to fit the anatomy.

The EZ-Graft designer consists of three different part selection tools - Insertion, Parts and Twisteroo. Each tool edits a different component of your VirtualGraft.

First, select an insertion side for the bifurcated device in your graft scenario - either left (left iliac artery) or right (right iliac artery). By default, the insertion side is set to the right. To view your changes in the model, click **Build**.

Editing a Graft

Change the Diameter and Length

To change the diameter of a device, use the buttons to the left and right of the part number. If the part number does not change, then the manufacturer does not provide a device with the requested dimensions. To view your changes in the model, click **Build**.

To change the length of a device, use the buttons above and below the part number. To view your changes in the model, click **Build**.

Hold your mouse over any button to see a description of what the tool will do.

Adding Extensions

Certain grafts have the ability to add supplementary extensions. If this option is available for left iliac or right iliac extenders, click on the checkbox labeled “enable” to add the extender to your graft. If more extenders are available for either the aorta, right iliac, or left iliac, a button with a right arrow will be available to the right of the device. Click the button to view the new extension, and as before, click on the “enable” checkbox to enable the new device. To view your changes in the model, click **Build**.

Changing the Point of Reference

Certain grafts have the ability to define their location in space relative to the point of bifurcation, as opposed to the point at which the graft begins. If this option is available there will be a combo box to the right of the “Insertion Side” option. The options in the combo box will be “Bifurcation Slice” and “Start Slice”. To view your changes in the model, click **Build**.

Changing the Overlap

The Left and Right Iliac devices have an 'Overlap' box near the part number. Use the scroll buttons or type in a number to change this value and click Build.

Twisteroo™

M2S' Twisteroo feature allows you to define the contralateral limb orientation of your graft to simulate your expected graft path.

The Twisteroo is labeled 'Native Iliac Rotation' in blue. Two circles represent the contralateral and ipsilateral limbs. Click and drag either of the limbs to rotate them.

Native Iliac Rotation

The native iliac rotation of the anatomy is calculated by comparing the location of the left and right iliac in the axial plane and calculating their rotation away from patient L/R. This angle is represented by the green line through the middle of the Twisteroo tool.

Some manufacturer devices are not intended to be fully twisted. If this is the case, Preview will prevent additional rotation.

Ordering a Manufacturer Specific Virtual Graft

Once you have created a successful VirtualGraft, you can create a parts list for the selected components that may guide you in placing an order with the device manufacturer. Follow these steps:

> ***Note:*** If you would like to quit the process at any time, click the "Cancel" button.

1. **Highlight the appropriate VirtualGraft (indicated with a blue box) in the Device window under the VirtualGraft tab.**

2. **Click *Order Form*.**

   The Product Listing window appears.

3. **Review components.**

   Preview automatically indicates component quantities in the Product Listing window. You may increase quantities, and/or select additional components to order.

4. **Click *Continue* once you are satisfied with selections and quantities.**

   An alert may appear to verify you are satisfied with accessory component quantities. Select **No** to return to previous screen and change introducer sheath quantities or select **OK** to continue.

5. **If applicable, describe your project in the text fields provided in the Describe Your Project window.**

6. **Click *Continue*.**

7. **Confirm your selections.**

   A summary window appears. It provides the manufacturer and brand name of the stent graft, a list of VirtualGraft components, and indicates Twisteroo, start slice and insertion side.

8. **Print to local printer by selecting Print.**

   The information will print as it appears on the summary window.

Click **Cancel** to quit the process and return to the Preview Main Window.

Create a Custom Tube Graft

If you would like to size a tube, or series of tubes along the anatomy centerlines, choose the custom tube.

1. **The custom Graft Builder window appears.**

2. **Determine the start location for the Custom Tube Graft.**

   Determine the start slice for the graft. For more information, see the section entitled **Determine the Start Location for The Graft**

3. **Select insertion side.**

4. **Build a Simple Graft**

   - Use the slider above the green representation of the tube to change the diameter of the tube. You can also type the diameter into the box, or click and drag the green representation of the tube.

   - Type the desired length of the graft into the box labeled 'Length'.

5. **Build a Complex Graft**

   - Follow step 4 above, and then click on the 'Complex' button. This option will allow you to build tapered grafts.

   - A tapered graft will have a different proximal and distal diameter. Use the slider above the green tube representation to change the proximal diameter and the slider below to edit the distal diameter.

   - To change the location of the taper, click and drag the green tube representation. The numbers to the left indicate how much of the tube will be at each diameter.

6. **Add additional pieces**

   - You can add up to 2 additional pieces to each tube project.

   - To enable another device, click the checkbox next to the representation of the tube.

- Size the tube as shown above.
- Edit the overlap into the proximal tube using the overlap input.

  Note: Preview represents overlap with oversizing anytime a tube that is distal to another tube is of a larger diameter. Preview indicates this as a yellow area on the side of the tube. This is an indication that there is some level of seal between the devices, however it does not take into account any manufacturer's oversizing recommendations.

- For surgery planning using discontinuous tubes, create more than one Custom Tube Project.

7. **Select *Build* to view the Custom Tube Graft within the model.**

   Preview automatically removes thrombus from the model, and turns bloodflow transparent for better visibility of the graft.

Create a Generic VirtualGraft

In the event you need to create a graft with your own dimensions, utilize the Generic VirtualGraft feature. Follow these steps:

1. **Determine the start location for the VirtualGraft.**

   See the section entitled **Determine the Start Location for the Graft**.

2. **Decide whether to start the generic graft legs from trunk or start slice.**

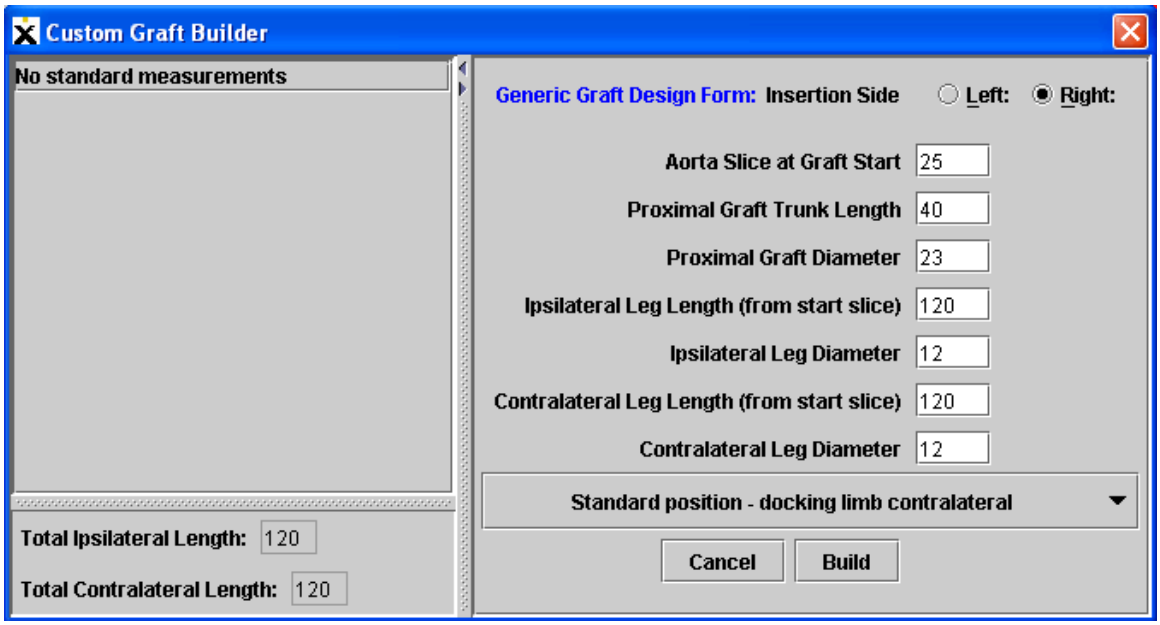
   The Preview default option is to start the graft legs from the end of the trunk. To select the option to start the graft legs from the start slice, select **Edit Your Preferences...** from under the Help menu and click the **Virtual Graft** tab. Select the appropriate radio button and click **OK**.

   Note: Preview will default to the chosen option in subsequent sessions.

3. **Select *Build Graft*.**

4. **Select *Generic* from the Select Manufacturer window.**

   The Custom Graft Builder window appears. Measurements you made and saved using the **Type** drop-down menu will appear under Standard Measurement Values. You can add a **Type** to the calculations by editing the calculation. Instruction on editing calculations is provided in the section entitled **Editing a Calculation**.



The Custom Graft Builder Window

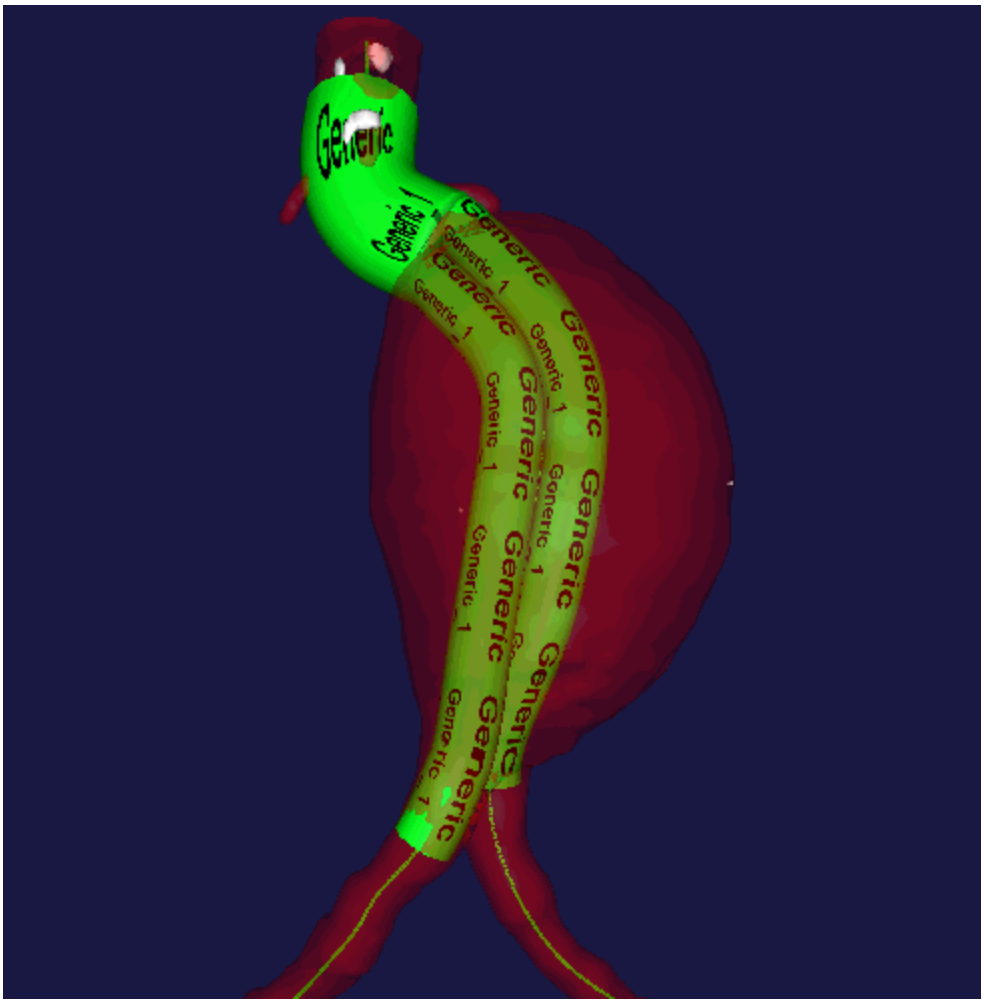
5. **Select the Insertion side.**

6. **Enter the correct information for the graft you have selected in the text fields.**

7. **Select rotation and orientation for graft deployment.**

8. **Select *Build* to view the VirtualGraft within the model.**

   Preview automatically removes the thrombus from the model, and turns blood flow transparent for better visibility of the graft.



A Generic Virtual Graft in the 3D model of an aneurysm

The Generic Graft scenario is listed within the Device window in the Virtual Graft tab. A separate folder appears for each graft scenario.

Double-click the folder to view the components. Extender components are not available within the Generic VirtualGraft feature.

Print the Generic Graft

1. **Highlight the appropriate Generic Graft in the Devices window under the VirtualGraft tab.**

2. **Click *Order Form*.**

   The Confirm Your Selections window appears. It lists graft components, Twisteroo, start slice and insertion side.

3. **Select *Print* to print to a local printer or *Cancel* to quit the process and return to the Preview Main Window.**

The information will print as it appears in the summary window. The **Create PDF** option is invalid with the Generic VirtualGraft at this time.

Evaluate the Sealzone Diameters

In areas of effective sealzone, the green VirtualGraft appears outside the model. In areas where the green VirtualGraft is not visible, the VirtualGraft is smaller than the vessel.

1. **If the VirtualGraft appears to be undersized, double-click the calculation in the Calculations list and select a different modular diameter.**

2. **If the VirtualGraft appears to be oversized, perform a cross-section analysis on the Aorta-Right Iliac or Aorta-Left Iliac slices as shown in the next steps.**

Analyze Sealzone Diameters in Slices

To perform a cross-sectional analysis by evaluating the sealzone diameters in the slices, perform the following steps:

1. **Scroll to slices in the area of the sealzone.**

2. **Add a mark in the center of the bloodflow path.**

3. **Double-click the mark to open the Edit Mark dialog box.**

4. **Set the mark diameter to the diameter of the graft you are testing.**

5. **Click *Save Defaults*, then click *OK*.**

6. **Scroll through the area of the sealzone and add marks to see the degree of oversizing.**

7. **After determining the degree of oversizing, delete the marks.**

Evaluate the Sealzone Lengths

To evaluate whether your VirtualGraft creates adequate sealzone lengths, perform the following steps:

1. **Measure the length of the proximal neck sealzone.**

Use the Jump Slice tool to find the slice where the vessel begins to be larger than the VirtualGraft. Perform a centerline calculation to measure the length from the top of the graft. Select “Proximal Neck Sealzone” from the Type drop-down menu.

2. **Measure the length of the right-iliac sealzone.**

   Select **Aorta-Right Iliac** slices. Use the Jump Slice tool to find the slice where the vessel begins to be larger than the VirtualGraft. Select the **Cur Slice** checkbox to show the slice location in the model. Perform a centerline calculation to measure the length from the distal end of the graft. Select “Right Iliac Sealzone” from the **Type** drop-down menu.

3. **Measure the length of the left-iliac sealzone.**

   Select **Aorta-Left Iliac** slices. Use the Jump Slice tool to find the slice where the vessel begins to be larger than the VirtualGraft. Select the **Cur Slice** checkbox to show the slice location in the model. Perform a centerline calculation to measure the length from the distal end of the graft. Select “Left Iliac Sealzone” from the **Type** drop-down menu.

Chapter 5 - External Applications of Preview

Printing a Preview Window

Printed output can be useful for records, discussion with the members of your medical team, and for consultation with your patient. You can print any image that appears on your screen. You can also choose slices and model views to include in your plan report, which you can then print. See the section entitled Creating a Report.

Adjusting Model Display

Prior to printing the Preview window, you may want to adjust the image **Lighting** or **Background Color**. Both options are available from the Model menu at the top of the screen.

Printing a Window

To print the Main Preview Window — which includes the Slice area, the Model area, and the Lists area — or any individual Slice window, perform the following steps:

1. **Make the window you want to print the active window.**

2. **From the window's File menu, select *Page Setup*.**

   In the Page Setup dialog box, select page size, margins, and orientation, and click **OK**.

3. **From the window's File menu, select *Print*.**

   In the Print dialog box, select the printer and number of copies.

4. **Click *OK* when you are ready to print.**

Printing Windows in a JPEG File

An alternative way to print window images is to save them to a JPEG file and then print the file. You can attach a JPEG file to an e-mail message or post it on a website. To print a JPEG file of a window, perform the following steps:

1. **Make the window you want to print the active window.**

2. **From the window's File menu, select *Save Image*.**

3. **Select an image quality.**

   In the Save Image Options dialog box, select the image quality for the JPEG file. Note that the Maximum option creates a large file that takes more disk space and may take longer to transmit online. However, you should use the Maximum option when possible to achieve the best image quality.

4. **If you are saving an image from a slice window, select the image to save.**

   When you save a slice window image, you can save the entire window or the slice image only. Note these differences in the Image to Save options:

   - **Save Current Window** saves the image with marks, mark names, etc., just as the window image appears onscreen.

   - **Save Full Slice without Window** saves the full slice image at 100% zoom, not cropped by the window. Once you select this option, you can choose to show or hide marks by selecting or deselecting the **Include Marks** checkbox.

5. **Click *OK*.**

6. **Select the destination drive and folder.**

   In the Save dialog box, click the Save In: drop-down menu to select the drive you want to save the file to. To save the file to a folder, double-click the folder's name. (For instructions on creating a new folder, see the section entitled Saving Your Work.)

7. **Name the file.**

   In the File Name field, type a descriptive name of the file. Leave the default extension — .jpg — as the file name's extension.

8. **Click *Save*.**

   The window images are saved to the designated directory, folder, and file.

9. **Print the image.**

Use Windows Explorer to open the file. From your Image Viewer's File menu, select **Print**.

Saving and Printing Windows In a Word Processing File

Another way to save and print a window is to save it to a word-processing file. To do so, perform the following steps:

1. **Make the window you want to print the active window.**

2. **Press and hold the *Alt* key and then press the *Print Scrn* key.**

   The Print Scrn key is usually to the right of the 12 function keys on the keyboard. Pressing **Alt** with **Print Scrn** causes the computer to capture only the active window.

3. **Open any word-processing program.**

   From the **Start** button, select **Programs**. From the Programs submenu, select a word-processing program such as Microsoft Word.

4. **In the document that opens, paste the image.**

   Press **Ctrl-V**, or select **Paste** from the Edit menu.

5. **Adjust the image size.**

   Drag the handle in any of the image's corners to reduce or enlarge its size proportionally. Do not drag a handle on the side of the image or it will distort the image's proportions.

6. **Print the image.**

   From the word processor's File menu, select **Print**.

7. **If desired, save the word-processing document.**

Creating a Report

Preview's report feature creates a report of your patient plan's calculations, mark diameters, notes, bookmarked slices, and model images. The report is useful documentation that you can add to your patient's medical record. Usually, you will create reports in an HTML format. The HTML format is ideal for viewing a report on your Internet browser, printing, e-mailing to colleagues, or posting on an Internet site.

Creating a Report

When you have completed a patient document plan, create a report using the following steps:

1. **Save the document plan.**

2. **From the File menu, select *Create Report*.**

3. **Select the report style.**

   In the Report Options dialog box, select HTML, text, or spreadsheet. Note the following about the various report styles:

   - **HTML (.html - Web Browser) -** HTML is the usual format for reports. Select HTML if you want your report to include slice or model images.

   - **Text (.wri - Write/WordPad) -** Although you can view a report in text style in Microsoft Word, the report may have extraneous symbols in it. The report is best viewed in WordPad (WordPad's files have the .wri extension).

   - **Spreadsheet (.txt - Tab-Delimited) -** After saving a report in spreadsheet format, open it in Microsoft Excel and follow Excel's prompts to format it. Choose "Delimited" as the file type, then select "Tabs" as the delimiter.

4. **Select items to include in the report.**

   Select the checkboxes of all items you want to include in the report. For patient confidentiality, you may choose to omit the patient's name from the report.

5. **Click *Open* to create the report and open it in the default application.**

   Preview will save the report in your Reports directory automatically so that you

can open it later.

6. **Alternatively, you can elect to simply save the report.**

   To do this, click *Save*.

7. **In the Save dialog box, select the destination drive and folder.**

   (For instructions on creating folders and saving files in Preview's Save dialog box, see the section entitled Saving Your Work.)

8. **Click *Save*.**

Viewing a Report

After you save the report, Preview asks if you want to view the report immediately. Do one of the following:

- Click **Yes** to view the report immediately.
- Click **No** to view the report later (using an Internet browser or another program).

Opening an HTML Report in an Internet Browser

You can open an HTML Preview report in an Internet browser such as Internet Explorer or Netscape, or in a version of Microsoft Word that has an HTML editor. You can print the report from any of these programs.

To open a report in a browser, perform the following steps:

1. **Double-click the browser icon.**

2. **If you are not connected to your Internet server, you can choose to work offline.**

3. **From the browser's menu bar, select *Open* from the File menu.**

4. **Browse to find your report file.**

   In the Open dialog box, select **Browse**. In the second Open dialog box, select HTML Files from the **"Files of Type:"** drop-down list. Select the drive and folder where you stored the report and click **Open**.

5. **Open the report.**

6. **If desired, print the report.**

   From the File menu, select **Print**.

Using Windows Explorer to Open a Report

You can also open your Preview report directly from Windows Explorer. Perform the following steps:

1. **Right-click on the *Start* menu and choose *Explore*.**

2. **Select the report file from the correct destination drive and folder.**

3. **Double-click on the report file name.**

   The report opens.

4. **If desired, print the report.**

   From the File menu, select **Print**.

Adding Images to a Report

After creating a report, you may decide you want to add other slice images to the report. The best approach is to add the appropriate bookmarks or views to the document plan and create a new report. If, however, you are comfortable using an HTML editor, you can save the images by using the **Save Image** command or pressing **Alt-Print Scrn**, then adding the images to the report in a program such as Netscape Composer.

E-mailing a Preview Report

You may want to share a report's findings with a colleague by e-mail. When e-mailing a report, you must send the entire folder containing the HTML file and all associated images. For convenience, you probably will want to "archive" the report folder using a zip program such as WinZip. The files must be zipped into a single zip file before sending.

1. **Open a zip program.**

2. **Select *New* to create a new zip file.**

3. **Browse to find the folder with your plan and its images.**

4. **Name the zip file you are going to create.**

5. **Add the HTML file and all the image files to the zip file.**

6. **From your e-mail program, attach the zip file to your e-mail message and send.**

   The person receiving your e-mail will need to unzip the file and open the report in an Internet browser.

   Note: You can also use some web browsers to save a web archive, which will store the report text and images together in one file. For example, in Internet Explorer, select **Save As**, then select the format **Web Archive, single file** (or a similar choice). It may be necessary to view the web archive in the same browser in which it was created.

Using Preview Images in Presentations

You may want to capture Preview images for inclusion in slide presentations. After saving an image to a JPEG file, you can modify it in a graphics application such as PaintShop Pro or Photoshop and then import it into a presentation application such as PowerPoint. Below are the basic steps for getting Preview images into a PowerPoint presentation.

Saving the Image

1. **Save the image.**

   Follow steps 1-8 in the section entitled Printing Windows in a JPEG File; or with the desired window onscreen, press **Alt-Print Scrn**.

2. **Import the image into PaintShop Pro or a similar graphics application.**

   From the graphics program's File menu, select **Open** or **Import**.

3. **Use the crop tool to remove unwanted parts of the image.**

4. **If necessary, brighten the image of the model by adjusting the brightness levels.**

   Slice images reproduce accurately. Model images, however, usually improve when you brighten them:

   - In Photoshop, press **Ctrl-L** to see a graph of the image's input levels. With the mouse, drag the far-right triangle under the graph to the left to brighten the image, and click **OK**.

   - In PaintShop Pro, from the Colors menu, select **Adjust**, then select **Brightness/Contrast**. Increase the brightness by approximately 20%-30%, and click **OK**.

Inserting Images into PowerPoint

To insert graphic images into PowerPoint, perform the following steps:

1. **In the New Slide dialog box, pick a presentation format.**

2. **Add a title to the slide.**

3. **From the Format menu, select *Slide Color Scheme*.**

   The **Slide Color Scheme** allows you to pick both the color scheme and slide format.

4. **From the choices presented, select the desired color scheme and format.**

5. **From the Insert menu, select *New Slide* to create a new slide.**

6. **Click the image frame within the slide to make it active.**

7. **From the Insert menu, select *Picture*, then select *From File*.**

8. **Browse to find your saved image.**

9. **In PowerPoint, click the *Insert* button.**

   PowerPoint inserts the image into the slide.

10. **Adjust the image.**

    Click and drag to position the image. To resize the image, click a corner and drag it to the desired size.

11. **If necessary, change the background appearance.**

    From the Format menu, select **Background** and make necessary adjustments.

Most images from Microsoft products can be imported into PowerPoint. These images include tables, Excel graphs, and Excel pie charts.

Chapter 6 - M2S Customer Support

M2S Preview Customer Support

M2S provides you with free technical support via phone, fax, and e-mail. Skilled technicians are ready to help you if you experience problems with our software or data, or if you simply have a question about ordering, installing, or operating the M2S Preview product.

Before you contact us, we suggest you follow these steps:

1. **Check the relevant sections in this User's Guide about the Preview tools you are using. Use the Index to locate additional references.**

2. **Consult your technical resource person or computer dealer for problems related to the hardware or operating system.**

3. **Check that you meet the minimum hardware and software requirements described in the section entitled System Requirements.**

4. **Refer to the M2S website at http://www.m2s.com/company/contact-us.**

Contact Information

You can access M2S Technical Support by phone, fax, or e-mail.

Telephone Support

Telephone Number: 1.603.298.5509
Hours: 8:00 am to 5:00 pm EST, Monday through Friday

When you are ready to call us, please do the following:

1. List the Preview tools you used and the steps you took when the problem occurred.

2. If an error message appeared, write down the exact text of the message. If possible, print the screen where the error occurred. (From the **File** menu, select **Print**.)

3. Have your computer turned on and be prepared to reproduce the problem or take the steps suggested by the M2S technician.

FAX Support

FAX Number: 1.603.298.5055

- If possible, please Fax a screen print where the error occurred. (From the **File** menu, select **Print**.)

After studying the information you faxed, a technical support analyst will call you to help you solve the problem.

Support via the Internet

Internet address: http://www.m2s.com/company/contact-us

Navigate to the above Internet address, where you will find the M2S Technical Support Request Form, and do the following:

1. **Fill in the form's fields.**

2. **In the Problem text box, type a description of the problem, including:**

- The Preview tools you used and the steps you took when the problem occurred.
- The exact text of any error messages that appeared.
- Your computer model and Preview version you are using.

3. **Click the Submit button below the Problem text box to send the form to M2S.**

A technical support analyst will examine the information you submit, then call or e-mail you with instructions that will help you solve the problem.

E-Mail Support

E-mail Address: preview-support@m2s.com

In lieu of using the M2S website, you can simply report a problem via e-mail. Please include in your e-mail message:

- A complete description of the problem, as noted above.
- Your computer model and the Preview version you are using.
- Your name and telephone number.

Note: If Preview detects an error, you will see a window as you exit Preview that contains instructions on how to e-mail M2S.

A technical support analyst will call or e-mail you to help you solve the problem.

Appendix

Menus, Tabs, and Tools

This section reviews the functions available via the Preview menu bar, describes how to use the row of tabs below the menu bar, and summarizes the available shortcut keys and tools.

You will notice as you become familiar with Preview that many of the commands available in the menu bar are also available within the tabs below the menu bar and those below the Slice Area. This user guide usually points you first to the non-menu commands, which in most cases are easier to use. Using shortcut keys — pressing combinations of keys — offers perhaps the most efficient way to carry out some Preview functions.

Let's first take a look at Preview's menu commands.

Menu Conventions

M2S Preview uses many of the menu conventions common to Windows applications.

Ellipses
Some menu choices are followed by an ellipsis (**Save As...**, for example). When you select this type of menu item, a dialog box appears providing additional information and requiring further instruction from you.

Right-Pointing Arrow
Some menu choices are followed by a right-pointing arrow to indicate that you need to make a selection from a submenu that appears to the right of the menu.

Dimmed Menu Selection
A "dimmed" menu selection is not available. When the menu action becomes available, the menu item appears in normal type.

Bulleted Selections
A bullet in a circle preceding a menu item such as **Marks Filled** indicates that the option is currently active. After you select the item, Preview turns off the alternate option (such as **Marks Hollow**).

Checkboxes
A check mark next to a menu command indicates that the command is currently active. In the Marks menu, for example, check marks appear next to settings such as **Display Mark Names** that are turned "on."

Keyboard Shortcuts
Keyboard alternatives ("shortcuts") for menu commands, when available, appear next to the menu command names. Keyboard shortcuts employ the Windows Control (**Ctrl**) key in combination with another key. For example, **Ctrl-D** is the keyboard shortcut for the **Drop Slice Into Model** command.

You will find a summary of keyboard shortcuts later in the appendix. .

File Menu

The File menu is a common feature in Windows applications. From the File menu, you can open, close, and save a plan document, print, create a report, and exit the Preview program.

New (Ctrl-N)

When you choose the **New** command, Preview creates a new, empty plan document file in which you can create and save marks, calculations, drop slices, and custom model views.

If you already have a plan document open, Preview prompts you to save or discard any changes, and Preview closes the current plan document before creating a new one.

Open... (Ctrl-O)

Use the **Open** command to open a previously saved plan document file for the patient data that is currently loaded.

If you already have a plan document open, Preview prompts you to save or discard any changes, and Preview closes the current plan document before opening a new one.

Save (Ctrl-S)

Use this command to save marks, custom views, drop slices, and calculations in a plan document file. If you are using a newly created document and you select the **Save** command, Preview prompts you to assign a file name and folder.

Save As...

Use this command to save and name a new plan, or to save the current plan under a new name. In the **Save As** dialog box, assign a name and folder to the plan document file.

Revert

This command discards all unsaved changes to a plan document, and reverts to the file to the last saved version.

Create Report...

Use the **Create Report** command to create a report of all your calculations, bookmarked slices, model pictures, and notes — the entire plan document or portions you select to include in the reports. Preview optionally creates the report in an HTML format that you can view on your Internet browser, print, e-mail to a colleague, or post on an Internet site.

Save Image...

Use the **Save Image** command to save a window to a JPEG file, which you can then attach to an e-mail or post on an Internet site.

Page Setup...

Select the **Page Setup** command to choose a page's size, orientation and margins before printing a Preview window.

Print (Ctrl-P)...

Use the **Print** command to print a hard copy of a Preview window.

Exit (Ctrl-X)

The **Exit** command closes the Preview program. If you have unsaved changes in an open plan document file, you are prompted to either save or discard them. You can also cancel the Exit command, or go to the M2S website to fill out a feedback form.

Slices Menu

From the Slices menu, you can access views of slices from the original patient scan. Based on the original axial scan data, Preview also gives you access to all multiplanar reconstructions — coronal and sagittal. For vascular patient applications, Preview reformats the scan data to render Aorta, Aorta-Right Iliac, and Aorta-Left Iliac slices, which are perpendicular to the flow channel.

Also see Viewing Coronal, Sagittal, and Oblique Slices in the section entitled **Working with Slices** for details on other ways to control the slice windows.

Set Slice Area

Highlighting **Set Slice Area** opens a submenu of options listing the scan types available. After highlighting **Set Slice Area**, select the desired slice on the submenu. The new slice view opens in the Slice area at the bottom left of the screen.

Axial — Selecting this option opens Axial slices, if they are not already selected. The Axial slices display scan data in the top-to-bottom sequence.

Coronal — Selecting this option opens Coronal slices, if they are not already selected. The Coronal slices display scan data in a front-to-back slice sequence.

Sagittal — Selecting this option opens the Sagittal slices, if they are not already selected. The Sagittal slices display scan data in a right-to-left slice sequence.

Aorta, Aorta-Left Iliac and Aorta-Right Iliac — These options open the Aorta and Aorta-Iliac slices, and are available only for vascular applications. These slices are reconstructed from original scan data and are created to provide a sequence of slices that are perpendicular to the center line of the flow channel.

> ***Note:*** These slices are also referred to as multiplanar reformats (MPRs) or orthogonal slices.

Open New Slice Window

Highlight **Open New Slice Window** to display a submenu of slice views. From the submenu, select the desired slice. A new window with the selected slice type opens on the right side of the screen.

You can have several slice views open at once. You can reduce the size of the Main Preview Window by dragging its right-bottom

corner up and to the left. Click **Slices** again, highlight **Open New Slice Window**, and select another slice you want to open. Adjust the size of the second window to allow you to see both slice views and the model.

Show Slices Info

Select the **Show Slices Info** command to open the Scan Information window. The Scan Information window contains details from the original digital slice data about the scan, the scan equipment, and various settings and measurements that apply to the scan data with which you are working.

Next Slice (Ctrl-])

Use the **Next Slice** command to go to the next slice in the sequence. A more convenient way to advance to the next slice is to simply press the right-arrow key on the keyboard, or to click anywhere to the right of the handle on the slider beneath the slice image.

Previous Slice (Ctrl-[ )

Use the **Previous Slice** command to move to the previous slice in the sequence. For example, if you are viewing slice 43, the **Previous Slice** command displays slice 42 in the active window. A more convenient way to move to the previous slice is to press the left-arrow key on the keyboard, or to click anywhere to the left of the handle on the slider beneath the slice image.

Go to Slice #...(Ctrl-G)

Use the **Go to Slice #** command to display a specific slice number in the active Slice window or to move a specific distance through the slices. In the **Go to Slice #** dialog box, type the target slice number in the **New Slice** # field. If you do not know the slice number you want to move to, type the number of millimeters to move along the path of the scan in the **Move By Distance (mm)** field and select the **Direction to Move**.

Zoom In

The **Zoom In** command doubles the size of the slice image in the active window and is useful for viewing a slice in enlarged detail. You can also enlarge the slice image by

using the **Zoom** tool in the Tool Palette, by clicking the **Zoom In** button below the slice image in the Slice Controls tab, or by right-clicking the mouse on the slice image.

If the image is too big to completely fit on your display, use the **Pan** tool or the sliders beneath and to the right of the slice image to reveal hidden parts of the slice.

Zoom Out

The **Zoom Out** command reduces the size of the slice image by half. You can Zoom Out slices to free up space on the screen when you want to view several slice windows simultaneously. Other ways to zoom out are to use the **Zoom** tool in the Tool Palette while holding down the **Shift** key, click the **Zoom Out** button below the slice image or right-click on the slice image while holding down the **Shift** key.

Drop Slice Into Model (Ctrl-D)

Use the **Drop Slice Into Model** command to place the slice image from the currently active window into its corresponding position in the 3D model. The drop slice appears as an object in the Drop Slices list. To remove the slice from the model, select the slice name from the list and click the **Delete** button.

Wire Drop Slice Into Model

The **Wire Drop Slice Into Model** command is the same as the Drop Slice Into Model command, except that the slice appears as a wire frame. This allows easier viewing of the model. To remove the slice from the model, open the Drop Slices list, select the slice name and click the **Delete** button.

Current Slice In Model (Ctrl-E)

The **Current Slice in Model** command inserts the current slice image from the currently active window into the 3D model. As you move to a new slice in the Slice area, the slice straddling the 3D model changes to show the new slice and its position. Use this command to find the slices you want to “drop.”

If the **Current Slice in Model** checkbox is selected, the current slice is “on.” To remove the current slice from the model, uncheck the **Current Slice in Model** checkbox, press Ctrl-E, or highlight the slice in the Drop Slices list and click **Delete**.

Wire Current Slice Into Model

This command inserts a “wire” plane in the model at the location of the current slice. The wire slice provides the clearest view on the model of the slice’s exact location. To remove the wire slice, uncheck the checkbox in the Slices menu, or highlight the slice in the Drop Slices list and click **Delete**.

Transparency in Drop Slices

This command renders all dropped slices and current slices partially transparent. Use this command for better visibility of portions of the model that might be obstructed by the drop slice. A check mark indicates that the transparency format is enabled for drop slices.

Set Drop Slice Trans...(Ctrl-T)

Use this command to adjust the level of transparency in the drop slice. In the transparent format, the darker parts of a slice image are removed (or made transparent) from the Drop Slice image in the 3D model, allowing you to see through these areas. Transparency refers to removing the darker regions, not to an overall semi-transparent format.

The box that defines the transparency range may be set anywhere between 0 (completely opaque) to 255 (maximum transparency). Entering lower numbers in the Drop Slice Transparency Level # dialog box removes the darkest areas of the slice; entering higher numbers removes most of the slice image, including the bright, white areas. Any pixel value in a drop slice lower than the transparency value will be transparent in the model view.

The transparency level corresponds to 8-bit pixel values and not to Hounsfield units. In the 12-bit-resolution mode, different Window/Level settings will change the cutoff level set with **Set Drop Slice Transparency**.

Marks Menu

Using commands from the Marks menu, you can specify how marks will appear in Model and Slice images. You can also jump the slices to the location of a specified mark.

Show Marks List

This command displays the list of marks in the current plan in the Lists area at the top-left of the Main Preview Window. Double-click a mark name to access the Edit Mark dialog box, where you can name a mark, change its appearance, jump slices in open windows to the mark, or delete it. Right-clicking a mark name in the Marks list will also give you the options to edit, delete or jump slices to that mark.

Jump Slices to Mark (Ctrl-J)

Use this command to update (jump) all slice windows to the slice with the currently selected mark. You can also jump to a mark by highlighting the target mark in the Marks list and then clicking the Jump button below the Marks list.

Auto Size (Ctrl-M)

Use this command, on oblique slices (Aorta, Aorta-Right Iliac, Aorta-Left Iliac), to resize a mark to either the full vessel diameter or the lumen diameter.

Display Marks

Select the **Display Marks** checkbox to display the marks in all open slice and model images. Uncheck the **Display Marks** checkbox to hide the marks from view in all open windows. Turning off Display Marks does not delete the marks from the plan

All Display commands are also available by clicking the **Display** button below the Marks list.

Display Mark Names

Select the **Display Mark Names** checkbox to display the mark names in all open slice and model images. Uncheck the **Display Mark Names** checkbox to hide the mark names.

Display Mark Diameters

Select the **Display Mark Diameters** checkbox to display the diameter of each mark in all open slice and model images.

Marks Filled

Select this option to assign a solid-color attribute to all marks in slice images.

Marks Hollow

Select this option to assign a hollow drawing attribute to all marks in slice images.

Calculations Menu

Open the Calculations menu to access Preview's calculations features. You can also access these features by clicking the Calculations tab below the menu bar.

Show Calculations List

Select **Show Calculations List** to show the Calculations list in the top-left corner of the Main Preview Window. The Calculations list displays all of the current plan's distance, volume, angle, multiline, and centerline calculations.

To edit the properties of an existing calculation, double-click the calculation in the Calculations list to open its corresponding Calculation dialog box, and make your changes.

To delete a calculation, select it in the Calculations list, then click the **Delete** button below the window, or press the **Delete** key or **Backspace** on the keyboard.

Alternatively, right-click on a calculation in the Calculations list and select one of the options to edit or delete it.

Display Calculations

Select the **Display Calculations** checkbox to display the lines and tubes that represent any measured distances, angles, centerlines, and volumes. Uncheck the **Display Calculations** checkbox to hide your plan's calculations. The calculation graphics appear in the model, and also in slices if the calculation's marks are on the same slice.

Display Calculation Names

Select the **Display Calculation Names** checkbox to display the names of your plan's calculations in the Slice area and/or window. By default, Preview assigns the names "Calc 1," "Calc 2," and so on to calculations. You can rename a calculation by double-clicking it and typing a new name in the Edit Calculation dialog box.

Display Calculation Results

Select the **Display Calculation Results** checkbox to display your calculation's numerical results on the slice image in the Slice area and/or window.

Show All

Un-select the “Show All” check box, under the Calculations tab to display, in the 3D model, only the calculations that have been selected. If the Calculation visibility icon below the 3D model is set to transparent, then the “Show All” check box will be grayed out.

Selecting Multiple Calculations

To select multiple calculation one at a time in the Calculation tab press the CTRL key and select the calculation to be displayed. The calculation selected will be highlighted and appear in the model.

To select multiple calculations in the Calculation tab press the Shift key and then select the group of calculations that are to be displayed. The calculations selected will be highlighted and appear in the model.

New Distance Calculation (Ctrl-K)...

Use this command to open the Edit Distance Calculation dialog box. Preview will calculate the distance between the two marks you select in this dialog box and display the results in the Calculations list and in the model.

New Centerline Calculation (Ctrl-L)...

This command opens the Edit Centerline Calculation dialog box. You can measure the length along the centerline of a blood flow channel (in Preview vascular applications) by specifying the upper and lower aorta or aorta-iliac slices of the segment you want to measure.

New Volume Calculation...

This command opens the Edit Volume Calculation dialog box. In this box, select the object you want to measure, and type the slice numbers of the upper and lower axial slices of the object to be measured.

New Multiline Calculation...

This command opens the Edit Multiline Calculation dialog box where you select and sort the marks that form the path to be measured.

New Angle Calculation (Ctrl-A)...

This command opens the Edit Angle Calculation dialog box where you select three marks that create the angle to be measured.

New Stenosis Calculation (Ctrl-C)...

This command opens the Edit Stenosis Calculation dialog box. Preview will calculate the percentage of stenosis between the two marks you select in this dialog box and display the results in the Calculations list.

Model Menu

Open the Model menu to change the background color and lighting in the Model window. The Model menu also has a Spin Model feature, which causes the 3D model to automatically rotate for better viewing.

Background Color

Select this to display a list of background colors to choose from. Click the **custom**... option to choose a background color not included in the list. A “Select the Model Background Color” dialog box will appear. Click on the desired color, and then click **OK** to set it as the model background color.

Lighting

Select this to display lighting options. Clicking **Upper Right** will light the model from the upper right, while clicking **Front** will light it from the front. The default lighting is Front.

> ***Note:*** If images of the model are to be used in presentation software, such as PowerPoint, then Front lighting may be a better choice than Upper Right lighting.

Spin Model

Select the **Spin Model** checkbox to spin the model in its current orientation. To stop the model from spinning, deselect the **Spin Model** checkbox by clicking it.

Show Mark Diameters

This will toggle whether or not Preview shows mark diameters in the model window.

Show Mark Names

This will toggle whether or not Preview shows mark names in the model window.

Help Menu

The Help Menu provides easy-to-access information about how to use M2S Preview. Help's Quick Start Topics provide steps for using many of Preview's features.

About Preview

Select **About Preview** to view the version number of your Preview software.

Help Topics

Select **Help Topics** to view the help interface.

Menu Commands

Select **Menu Commands** to display links to help pages on Preview's menus and Tool Palette. Click a link to a menu to view the menu's commands, the commands' shortcut keys, and descriptions of the commands' actions. Click the Tool Palette link for instructions on how to use the tools in the Tool Palette.

Edit Preferences...

Select **Edit Preferences** to open a window where you can set preferences for all subsequent Preview sessions.

Under the **Views** tab, select options for how the model looks after the virtual graft has been drawn, and whether to view centerlines by default.

Under the **Model** tab, setting preferences for background color, lighting, visibility of left and right indicators, and direction and speed of model spin. Select whether to build the generic graft legs from trunk or start slice in the **VirtualGraft** tab.

Under the **Other** tab, toggle whether or not the My Notes dialog is always on top, toggle whether or not Preview displays a mark selection box in the slice window and the default way that Preview creates reports.

Also under the **Other** tab are options regarding Preview and Preview Archive Files as well as general options about the automatic creation of sagittal and coronal slices.

The first option is to automatically generate sagittal and coronal slices. Turn this on if you have a fast computer with a relatively large amount of available RAM, as this

process can be quite memory intensive. With this option enabled, Preview will attempt to automatically create .12-bit versions of the sagittal and coronal slices for studies that may not have included them originally due to file size considerations.

The next two options concern the size of the cache for these .12-bit files. When creating these files for a downloadable Preview Archive (.par), Preview will put them in a temporary location and cache them. Change the slider to change the maximum size of this cache and click 'Delete Cache on Exit' to delete the cache.

Click **OK** or **Apply** to set preferences. Click **Cancel** to exit without setting the preferences. Preview may need to be restarted for all the preferences to be set.

Preview Help

Select Preview Help to open a brief walkthrough of some of the features that are new to Preview.

VirtualGraft Help

Select **Virtual Graft Help** to see a tutorial on the new Virtual Graft interface.

The Lists Area Tabs

A row of tabs under the Main Preview Window menu bar controls the display of lists where Preview collects patient and plan information. Use these tabs to access information about the model and the patient's scan, and to view your current plan and its associated marks, calculations, bookmarked slices, drop slices, and model views. The lists also provide several command buttons that allow you to perform calculations, bookmark slices, delete marks, add model views, etc. — many of the same functions available in the Preview's menus.

Patient Tab

Click the **Patient** tab to display links to information about the patient-specific software. Click the links to open windows that contain such information as details about the patient scan, the model pictures, and notes made by M2S during modeling.

Preview will also display links to PEMS in this window. Preview will always display a link titled **Go To PEMS** which will open up your browser to the current patient's page in PEMS. To access this feature, you'll need to login using your PEMS username and password. Additionally you'll have to have Internet access and the authorization to view the current patient in PEMS.

Preview will also check the PEMS system for M2S plan files during startup. If there is a plan available, Preview will display a **Download Plan From PEMS link**. Click this and enter your name and password and Preview will download and open the plan from PEMS. Preview will also save the plan in your Preview Plans directory.

Plan Tab

Click the **Plan** tab to view a summary of your Plan Document File. Click the Marks, Calculations, Bookmarked Slices, Drops Slices, or Views links to open their associated lists.

Click the My Notes link to open a text window where you can type notes regarding the current plan document. These notes become part of the patient report. See the section entitled Creating a Report.

Marks Tab

Click the **Marks** tab to show the Marks list, which lists all marks in the current plan.

To jump to a specific mark, highlight the mark name in the Marks list, then click the **Jump** button. All open slice windows display the slice with the highlighted mark.

To Auto size a bloodflow mark to be equal to the bloodflow diameter, select the Bloodflow checkbox and click the **Auto Size** button. To Auto size a lumen mark to be equal to the lumen diameter, ensure the Bloodflow checkbox is not selected and click the **Auto Size** button. To delete a mark, highlight it in the Marks list and click the **Delete** button. To change how marks are displayed, click **Display** to open a drop-down list of options. To hide the yellow cross indicator created by the Jump Slice tool, uncheck the **Crosshair Visible** checkbox.

Calculations Tab

Click the Calculations tab to show the Calculations list which displays the current plan's calculations.

To delete a calculation, highlight it in the list and click the **Delete** button. To create a new calculation, click **New Calculation** and select the appropriate calculation from the drop-down list. To change how calculations are displayed, click **Display** and select the desired options from the drop-down list.

VirtualGraft Tab

Click the **VirtualGraft** tab to build and order a Manufacturer-Specific or Generic graft. Click **OK** when the program alerts you that it will change to oblique slices.

Determine the starting point of the graft by either scrolling through the slice images in the Slice area or dropping a slice in the model by clicking the **View Start Slice** checkbox. Click **Grab Slice** to enter the start slice number in the text field.

Click **Build Graft** to select a manufacturer and graft components. The VirtualGraft scenario will be added to the devices window. Change the graft's appearance by selecting or deselecting the **Visible** and **Transparent** checkboxes. Multiple grafts can be created. Highlight appropriate graft in the devices window, and select the **Edit** or **Delete** buttons to edit or delete the graft.

Select the **Order Form** button to review graft components, add parts and auto-populate an order form.

Diameter Evaluator Tab

Click the **Diameter Evaluator** tab to evaluate the diameter throughout the aorta and the iliacs, and estimate the fit of a delivery system through them. Preview places tubes in the 3D model. Use the iliac diameter sliders to change the tube diameters in millimeters. Preview calculates the diameter in French based on the conversion 3 Fr = 1 mm.

Use the visibility slider to set the transparency of the tubes or to turn them off in the 3D model. Use the color drop-down menu to set the tubes to the desired color, including choosing a custom color.

Bookmarks Tab

Click the **Bookmarks** tab to show the Bookmarks list, which displays the slice numbers of all slices in the current plan that you have bookmarked.

To bookmark the current slice, click **Add Bookmark**. Highlight a bookmark name and click **Comment** to add a comment. The comment appears to the right of the slice number in the Bookmarks list. To delete a bookmark, highlight the slice number in the list and click the **Delete** button.

Drop Slices Tab

Click the **Drop Slices** tab to show the Drop Slices list, which displays the current plan's drop slices.

To hide a drop slice, uncheck the **Visible** checkbox. To delete a drop slice from the plan, highlight it in the list and click the **Delete** button.

Views Tab

Click the **Views** tab to show a list of the six standard views of the 3D model and any custom views you have added (see Add View below). The six viewpoints provided by Preview are Anterior, Posterior, Sagittal-Patient Right, Sagittal-Patient Left, Axial-Superior, and Axial-Inferior.

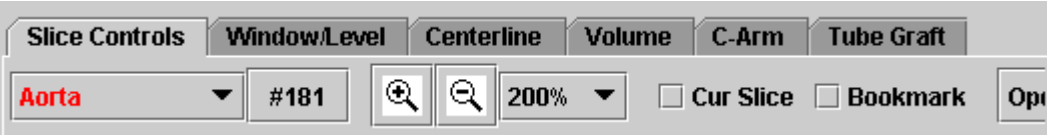
Double-click on a view name, and the model adjusts to that view's angle and zoom settings.

Add View — To save a custom view of the model, first rotate, pan, and zoom the 3D image to the desired point of view, then click **Add View**. Preview adds the view to the Views list as View 1.

To delete a custom view, highlight the view in the list, then click **Delete**. The six standard views cannot be deleted.

Slice Area Settings

Below the Slice image are up to six tabs that allow you to control the view of the CT scan slices, adjust Window/Level settings, and perform centerline, tube graft, C-Arm and volume calculations. Click any of the tabs to display their various settings and controls.



The tabs and tools below the Slice area.

Slice Controls

Click the **Slice Controls** tab to display several slice settings. The red-lettered button at the far left indicates the name of the current slice. Click the button to display a popup menu of slice options, then click an option to change the image in the Slice area.

Slice Number Button — The button to the right of the red-lettered button displays the current slice number. Click this button to open the Go To Slice # dialog box, which you can use to move to a particular slice.

Zoom Controls — The **Zoom In** and **Zoom Out** buttons offer an easy way to increase and decrease the size of the slice image. Click the Zoom In button to double the slice image; click the Zoom Out button to reduce the slice image by half. Click the button showing the current size percentage (to the right of the Zoom buttons) to open a popup menu with image-size options.

Cur Slice — Select this checkbox to drop the current slice into the 3D Model. To remove the slice, uncheck the checkbox.

Bookmark — Select this checkbox to add the current slice to the Bookmarks list.

Open — Click the Open button to open a new Slice window that displays the same slice on the right side of the screen.

Window/Level

Clicking the **Window/Level** tab displays controls to adjust the quality of slice images and their contrast and brightness.

To learn more about the **Window/Level** tab, refer to the section entitled **Working with Slices.**

Centerline

Clicking the **Centerline** tab displays the settings for calculating the centerline of bloodflow in a vascular application. (If your patient-specific software is not a vascular application, the **Centerline** tab is absent.) In the model, the heavy dotted lines depict the centerline of each flow channel. If they are not visible, open the Anatomy tab and change the obstructing objects to a transparent or invisible format. For more information on performing Centerline calculations, see the section entitled **Calculating Centerlines or Path Length**.

Selecting a flow channel — Click the button to the left of the calculation result (in red) to select Aorta, Aorta-Left Iliac, or Aorta-Right Iliac.

When you first open the **Centerline** tab, the **Slice 1** and **Slice 2** buttons show the beginning and ending slice numbers of the entire length of the selected blood-flow channel. The length of the selected channel appears in red.

Displaying the Centerline calculation result — Click the **Record** button to open the Edit Centerline Calculation dialog box. Here, you can specify the length of the blood flow channel you want to appear in the model, its color, and whether it will be displayed as a line or a tube. After you click **OK**, Preview displays the centerline tube or line in the model. It also calculates the centerline's length and displays it in the Calculations list.

C-Arm

Clicking the **C-Arm** tab displays the tool for creating a C-Arm angle calculation.

This tool automates the creation of an angle calculation based on a particular aortic slice. This saves time and effort involved in trying to describe an angle in 3-dimensional space. The tool begins by simply taking the number of the aortic slice at the press of the **Create Angle Calc** button. The tool then gets the orientation of this slice and calculates the angle of this slice in the sagittal plane relative to the axial plane. The tool places three marks, one in the center of the slice, one directly anterior to this mark, and one at the anterior crossing of this oblique plane with the sagittal plane through the first mark. The angle is then calculated between these three marks, putting the one in the center of the oblique slice in the middle of the angle. This angle represents the angle of the oblique slice in the cranio-caudal plane and is used for a pre-operative assessment of the proper C-Arm angle.

After clicking the **Create Angle Calc** button, the **Show View** button will become enabled. This indicates that Preview has also created a 'C-Arm View' and put it in your

list of views. To go to this view immediately click **Show View**. The tool works by taking the same angle calculated above, but rather than creating an angle, it centers the Preview model window on the selected centerline cube and rotates the view until it is looking at the anatomy at this angle. In this way it simulates the view from the C-Arm.

Note: After clicking **Show View,** the model will now rotate around the center of this angle calc instead of the center of the model. To change back to the normal mode of rotation, click on the Restore View button which used to say 'Show View'.

Volume

Clicking the **Volume** tab displays the settings for measuring the volume of specified objects in the scan. (Note that the Volume tab is not available in all studies.) For more information on calculating volumes, see the section entitled **Calculating the Volume of an Object**.

When you first open the **Volume** tab, the **Slice 1** and **Slice 2** buttons show the beginning and ending slice numbers of the entire length of the selected object, and the volume of the object appears in red.

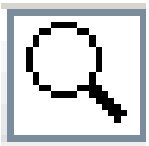
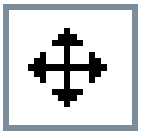
Selecting an object — Click the **Object** popup list to select the object you want to measure.

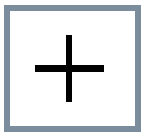
Displaying a volume calculation — Click the **Record** button to open the Edit Volume Calculation dialog box. Here, you can specify the length of the object you want to measure and the color of the wireframe box that will surround that portion of the model.

After you click **OK**, Preview calculates the volume amount and displays it in the Calculations list. A wire-frame box appears in the model around the measured object.

The Preview Tool Palette

The Tool Palette consists of the five tool buttons in the menu bar at the top of the Main Preview Window or slice windows. The Tool Palette provides you with quick access to four important Preview functions: marking/rotating, zooming, panning images, jumping slices, and free rotation. To activate a tool, click on the tool button in the Tool Palette. The following tables describe the tools and alternative shortcuts.

Button	Description
	*Mark/Rotate* tool: In a slice image, it functions as a Mark tool, which you use to insert, select, and move marks. In the Model, it functions as a *Rotate* tool, which you use to rotate the model. *Shortcut*: The Mark/Rotate tool is the default tool in Preview. To rotate the model, just click anywhere in the model window and drag the mouse. To zoom into the model, just right-click and drag the mouse forward or backward. Shortcut in the Slice area: Just click anywhere in a slice to drop a mark in that part of the slice.
	*Zoom* tool: Use to enlarge or reduce an image. To enlarge a slice image, click the Zoom tool, then click anywhere in the slice image. To reduce the image size, click the Zoom tool, and while holding down the Shift key, click in the slice image. To change the size of the model, click the Zoom tool, put the cursor in the Model area, then hold the mouse button down and drag forwards to zoom in (enlarge) and backwards to zoom out (reduce). *Shortcut in the Slice area:* Right-click in the Slice area to zoom in; right-click while holding down the Shift key to zoom out. *Shortcut in the Model area*: Right-click in the Model area and drag mouse forward to zoom in; right-click and drag backwards to zoom out.
	*Pan* tool: Use to drag (pan) the Model or zoomed slice images from side to side and up and down. *Shortcut*: Holding down the Shift key changes the cursor into the Pan tool. Hold down the *Shift* key and left mouse button, and drag the image with the mouse.

	Note: When using the Jump Slice tool in the model, only the anatomical objects are detected. The tool will ignore drop slices, marks and calculations that may be "in front" of the object. Also, if you click the dark-blue background, the jump slice will not update.
	*Jump Slice* tool: Click this tool, then click a location in a slice or the model. All Slice windows jump to that location, and a cross indicator appears in the corresponding location in the model. Can be used in both the Model and Slice areas. *Shortcut:* Holding down the *Control* key changes the cursor into the Jump Slice tool. Hold down the *Control* key and click the desired location. The cross marker appears at the same location in each Slice window and in the Model.
	*Free Rotation* tool: Click this tool, then click a location in the model. Left click and drag in the left-right direction to rotate the model about a vertical axis. Left click and drag in the up-down direction to rotate a model about the horizontal axis. *Shortcut:* Hold down the left and right arrow keys to rotate the Model about the vertical axis. Hold down the up and down arrow keys to rotate the Model about the horizontal axis. Hold down the *Alt* Key and the left and right arrow keys to rotate the Model clockwise and counterclockwise.
	*Polygon Tool*: Click this tool to turn on or off the polygon tool. When the tool is selected a polygon can be constructed by using the left click on the mouse. The polygon is completed once the start vertex has been reached. The area and the perimeter results are displayed both in the slice window and the calculations tab.
	*Projection tool: Click this tool to toggle between a perspective (default) and orthographic projection of the model. If the "C-Arm Views" tab has been selected then Orthographic view will be the default.*

Preview Measurement Type Definitions

Type	Definition	Detail
Volume from Renal to AO Bifur	Volume of contents of aorta and iliac vessels, measured on axial slices from distal renal artery to aortic bifurcation	
Volume from Renal to Right Hypogastric	Volume of contents of aorta and iliac vessels, measured on axial slices from distal renal artery to take-off of right internal iliac artery	
Endoleak Volume from Renal to AO Bifur	Volume of endoleak, measured on axial slices from the distal renal artery to the aortic bifurcation	
Endoleak Volume from Renal to Right Hypogastric	Volume of endoleak, measured on axial slices from the distal renal artery to the aortic bifurcation	
Maximum AAA Diameter	Maximum diameter of aneurysm sac on slice perpendicular to bloodflow centerline	
Gate Mark	Mark on a modular graft that defines the attachment zone of the contralateral limb	
Aortic Bifurcation Diameter	Diameter of the aorta at the point of bifurcation	
Minimum Suprarenal Aortic Diameter	Minimum diameter of suprarenal aorta on orthogonal slice	
Minimum Distal Aortic Diameter	Minimum diameter of distal aorta on orthogonal slice at aortic bifurcation	
Aortic Diameter at Renals	Diameter of aorta 1mm below distal renal artery measured on slice perpendicular to bloodflow centerline	Diameter represents adventita-adventia diameter.
Aortic Diameter 15mm Below Renals	Diameter of aorta on orthogonal slice 15mm	

	below distal renal artery	
Aortic Diameter at Distal End of Proximal Neck	Diameter of aorta on orthogonal slice at most distal extent of proximal neck	
Aortic Diameter at Top of Stent-Graft	Diameter of aorta at proximal end of stent-graft measured on slice perpendicular to bloodflow centerline	1st slice where proximal end of stent appears as a full circle. Diameter represents adventita-adventia diameter.
Aortic Diameter 10mm Below Top of Stent-Graft	Diameter of aorta 10mm below top of stent-graft measured on slice perpendicular to bloodflow centerline	Diameter represents adventita-adventia diameter.
Aortic Diameter at Most Distal Stent-Graft Apposition*	Diameter of aorta at most distal extent of stent-graft apposition measured on slice perpendicular to bloodflow centerline	Location is one slice proximal to end of aortic stent-graft apposition above stent-graft bifurcation point. Diameter represents adventita-adventia diameter.
Aortic Diameter at Most Proximal Stent-Graft Apposition	Diameter of aorta on orthogonal slice at most proximal extent of stent-graft apposition	
Right Common Iliac Aneurysm	10% increase in vessel diameter within the right common iliac artery	
Left Common Iliac Aneurysm	10% increase in vessel diameter within the left common iliac artery	
Minimum Access Diameter of Right External Iliac	Minimum lumen diameter on orthogonal slices within right external iliac artery	
Minimum Access Diameter of Right Common Iliac	Minimum lumen diameter on orthogonal slices within right common iliac artery	
Minimum Access Diameter of Left External Iliac	Minimum lumen diameter on orthogonal slices within left external iliac artery	
Minimum Access Diameter of Left Common Iliac	Minimum lumen diameter on orthogonal slices within left common iliac artery	
Representative Diameter	Representative lumen	

of Right External Iliac	diameter on orthogonal slices within right external iliac artery	
Representative Diameter at Right Common Iliac	Representative lumen diameter on orthogonal slices within right common iliac artery	
Representative Diameter of Left External Iliac	Representative lumen diameter on orthogonal slices within left external iliac artery	
Representative Diameter at Left Common Iliac	Representative lumen diameter on orthogonal slices within left common iliac artery	
Diameter at Right Iliac Proximal Stent-Graft Apposition	Diameter of right iliac artery at proximal extent of stent-graft apposition measured on slice perpendicular to bloodflow centerline	Diameter represents adventita-adventia diameter.
Diameter at Right Iliac Distal Stent-Graft Apposition*	Diameter of right iliac artery at distal extent of stent-graft apposition measured on slice perpendicular to bloodflow centerline	Diameter represents adventita-adventia diameter.
Diameter at Left Iliac Proximal Stent-Graft Apposition	Diameter of left iliac artery at proximal extent of stent-graft apposition measured on slice perpendicular to bloodflow centerline	Diameter represents adventita-adventia diameter.
Diameter at Left Iliac Distal Stent-Graft Apposition*	Diameter of left iliac artery at distal extent of stent-graft apposition measured on slice perpendicular to bloodflow centerline	Diameter represents adventita-adventia diameter.
Proximal Aortic Neck Length	Centerline length of the proximal aortic neck	
Left Iliac Sealzone*	Vessel centerline distance from proximal to distal points of complete graft apposition within left iliac	Vessel centerline length between the most proximal to most distal slice locations showing complete stent-graft apposition within the left iliac artery. Calculated using slices reformatted perpendicular to vessel

		centerline.
Renal to Aortic Bifurcation	Centerline length from renal artery to common iliac (aortic) bifurcation	
Renal to Left Hypogastric	Centerline distance from distal renal artery to left internal iliac	
Renal to Right Hypogastric	Centerline distance from distal renal artery to right internal iliac	
Right Iliac Sealzone*	Vessel centerline distance from proximal to distal points of complete graft apposition within right iliac.	Vessel centerline length between the most proximal slice to most distal slice locations showing complete stent-graft apposition within the right iliac artery. Calculated using slices reformatted perpendicular to vessel centerline.
Proximal Neck Graft Apposition*	Vessel centerline distance from proximal to distal points of complete graft apposition within proximal aortic neck	Vessel centerline length between the most proximal slice location showing a complete, circular stent in aortic apposition to the most distal slice location showing complete circular aortic stent-graft apposition. Calculated using slices reformatted perpendicular to vessel centerline.
Right Iliac Graft Apposition*	Vessel centerline distance from proximal to distal points of complete graft apposition within right iliac	Vessel centerline length between the most proximal slice to most distal slice locations showing complete stent-graft apposition within the right iliac artery. Calculated using slices reformatted perpendicular to vessel centerline.
Left Iliac Graft Apposition*	Vessel centerline distance from proximal to distal points of complete graft apposition within left iliac	Vessel centerline length between the most proximal to most distal slice locations showing

		complete stent-graft apposition within the left iliac artery. Calculated using slices reformatted perpendicular to vessel centerline.
Distance From Distal Renal to Top of Graft	Vessel centerline distance from distal renal artery to proximal end of aortic stent graft	Vessel centerline distance from most distal renal artery to most proximal slice location showing 50% circumference of aortic stent. Calculated using slices reformatted perpendicular to vessel centerline.
Angle Proximal Neck to AAA Body	Angle of proximal neck of the aorta relative to main body of the aneurysm (3D, angle of deviation)	Calculated as the 3D angle between three points: a) center of aorta at proximal end of stent-graft; to b) center of aorta at location of distal graft apposition; to c) center of the aortic bifurcation.
Angle Suprarenal Aorta to Proximal Neck	Angle of suprarenal aorta relative to aortic proximal neck (3D, angle of deviation)	Calculated as the 3D angle between three points: a) center of the aorta just below celiac origin to b) center of aorta at distal renal to c) center of aorta at location of distal graft apposition.
C-Arm Gantry Correction Angle	Angle in the cranio-caudal plane between a line perpendicular to the aorta at the proximal landing target and anterior-posterior view	
NASCET	North American Symptomatic Carotid Endarterectomy Trial Measurement	Stenosis measurement
ECT	European Carotid Trial Measurement	Stenosis measurement

*M2S' assessment of stent-graft apposition is based upon stent alone. Please note that there is significant variation in the configuration of stent-grafts: some with stents completely covered by fabric and others with bare-metal stents at proximal and distal

ends. Contact the manufacturer if you are not sure about the configuration of the graft used for this patient.

Keyboard Shortcuts

Menu Command	Key Combination	Command Description
Auto Size	Ctrl-M	Auto size the current mark to be the diameter of the bloodflow or lumen. This feature is only available for oblique marks created in Preview. It is not available for marks downloaded from a PEMS plan.
Current Slice in Model	Ctrl-E	Insert the current slice into its corresponding position in the 3D model.
Delete	Delete key or backspace key	Remove the selected mark, calculation, dropped slice, current slice, bookmarked slice, or custom view.
Drop Slice Into Model	Ctrl-D	Insert the current slice into its corresponding position in the 3D model.
Exit	Ctrl-X	Exit the Preview program.
Free Rotation	Arrow key Alt + right/left arrow keys	Rotate the model about a vertical or horizontal axis. Rotate the model counterclockwise or clockwise.
Go to Slice #...	Ctrl-G	Display the Go to Slice # dialog box, which you can use to go to a specific slice number in the active window.
Jump Slices to Mark	Ctrl-J	Update (“jump”) all slice images to the location of the selected mark or the last mark placed on a slice. This feature is available only when a Mark is selected.
Jump Slice Tool	Control key	While holding down the Control key, click a slice image to jump all slice images to the same location. Can be used in both the Model and in Slices.
New	Ctrl-N	Open a new plan file in which you can save marks, views, and calculations for the patient-specific data that is currently loaded.
New Angle Calculation	Ctrl-A	Open the Edit Angle dialog box to measure the angle created by three selected marks.
New Centerline Calculation	Ctrl-L	Open the Edit Centerline Calculation dialog box to measure the centerline of a bloodflow channel.
New Distance Calculation	Ctrl-K	Open the Edit Distance Calculation dialog box to measure the distance between two marks.

New Stenosis Calculation	Ctrl-C	Open the Edit Stenosis Calculation dialog box to measure the percentage stenosis between two marks.
Next Slice	Ctrl-] Or Right Arrow	Display the slice that follows the current slice.
Open	Ctrl-O	Display a selection box from which you can open a previously saved plan file.
Pan Tool	Shift key	While holding down the Shift key and left mouse button, move the mouse to drag (pan) the model or zoomed slices from side to side and up and down.
Previous Slice	Left Arrow	Display the slice that precedes the current slice.
Print	Ctrl-P	Print a hard copy of the active window.
Save	Ctrl-S	Save changes to the current plan file.
Set Drop Slice Trans...	Ctrl-T	Open the Drop Slice Transparency Level # dialog box to adjust the level of transparency in dropped slices.
Zoom In (model)	Right-Click and drag mouse up on model	Enlarge the model image.
Zoom Out (model)	Right-Click and drag mouse down on model	Reduce the size of the model image.
Zoom In (slice)	Right-Click on image	Enlarge the slice image.
Zoom Out (slice)	Shift and Right- Click on image	Reduce the size of the slice image.
Window Level	Alt and hold left mouse button while dragging mouse horizontally on slice window	Adjusts window (brightness) of slices
Window Level	Alt and hold left mouse button while dragging mouse vertically on slice window	Adjusts level (contrast) of slices