6 Dental Planning

The Dental Planning application is used to create true-size (life-size) film images of the Mandible and the Maxilla. The resulting cross-sectional images assist oral surgeons in planning the implantation of prostheses. The patient is scanned on a CT scanner using a Dental Planning procedure (outside of IntelliSpace Portal) and then the scanned images are used in the Dental Planning analysis application.

NOTICE

Before continuing, refer to the “Instructions for Use” that came with your scanner.

Dental Planning consists of the following steps:

- Defining panoramic views.
- Defining cross-sectional planes.
- Filming the reference, panoramic and cross sectional images in true size.

WARNING

Filming to true-size can be performed only when printing directly from the Dental Planning application to an installed and configured film printer. The required film printer must be calibrated by qualified service personnel.

WARNING

When loading images into Dental Planning, all images which contain 16-bit data are converted into 12-bit images. This means that for rescale intercept equal to negative 1000, HU values above 3095 are displayed as 3095. For rescale intercept equal to negative 1024, HU values above 3071 are displayed as 3071.

Load Multiple Studies in Application

To load multiple studies in the application:

1. Use the **Ctrl** key when selecting studies from the Directory list.
2. Select the application from the Applications menu.
3. Confirm the studies are from the same patient.

NOTICE

Depending on your Portal configuration, this application may not be available.

Indications for Use

CT Dental Planning application supports users in processing, viewing, and analyzing dental CT images. The application allows examination of the patient jaw anatomy and can assist surgeons in planning oral procedures like implantation of dental implants and jaw surgery.

Intended Users

IntelliSpace Portal CT Dental Planning Application is intended to be used by adequately trained and qualified medical professionals, including but not limited to physicians and medical technicians. The main clinicians or medical and para-medical professionals who use the Philips IntelliSpace Portal CT Dental Planning Application are listed below:

- Radiologists in the radiology department/clinic
- 3D technologists in the radiology department

Other clinicians/roles using the Philips IntelliSpace Portal are listed below:

- Dentists and Dental surgeons
- Referring Physicians

Calibrate Image Size for True-size Filming

Before calibrating, make sure a printer is properly installed and appears in the filmview list.

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WARNING

Calibration of True-size filming should be performed only by qualified service personnel. Calibration must be completed the first time Dental Planning is performed, and each time the film format, film image or the Dental Planning scan protocol on the scanner are changed. Any time you change the page layout, header, or footer of the film, you must re-calibrate the dental application to get true size measurements. The calibration factor (DFOV) sets the size on film. After changing the factor, use a scale to measure the horizontal and vertical scales on the film to ensure true-size.

On systems filming through AMC-4 interface, set the film image to the Dental Planning film size and format.

NOTICE

Changing the calibration of the True Size filming is only available for users with administrative rights.

1. Open a Dental Planning study.

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2. Open the True Size tab in the Panoramics work stage.
3. Click **Use True Size Filming**.
4. Click the **Select Printer** arrow to view your printer choices. Select a printer.
5. Open the **Define Panoramics** tab. Draw a Panoramic curve center line.
6. In the Sections work stage, set up one of the cross section images to have both vertical and horizontal scales (from the right-click menu, click Show Horizontal Scale.)
7. Send the image to Film.

8. Open the Film application and print the image to the printer. The required film size for True Size filming is 14 x 17 inch film, using the 2 x 3 format.
9. Return to Dental Analysis > Panoramics. From the True Size tab, record the scale lengths from the Image Scale column (for example, vertical = 5 cm, horizontal = 2 cm).
10. On the printed film, using a calibrated ruler, measure the actual scale lengths (for example, vertical = 4.9 cm, horizontal = 2.1 cm).
11. Write the measured values in the table under the Ruler column.
12. Click **Calibrate**  and see that the value of DFOV has changed to a new value (DFOV is the calibration factor that sets the size on film).

Verify Calibration

Repeat basic calibration as above, starting by drawing a new Panoramic curve. After printing on film, the scales on the printed page should match your calibrated ruler. If not, repeat the rest of the calibration procedure until the measurements match. Repeat entire procedure for all printers.

Configure Printers that Support Dental Planning

1. Select **Define Printers** from the Select Printer options.
2. Choose a printer by clicking the **Selected** checkbox. Only select printers that support true-size.
3. After changing the size of the header/footer in filmview, you will be asked to re-calibrate the next time you open Dental Planning.
4. Type the value in the DFOV field and click **Calibrate.**

Displayed Field of View (DFOV)

Displayed Field of View (DFOV) is the length of the image shown in the axial viewport in mm.

DFOV is calculated as follows:

DFOV (after calibration) = DFOV (before calibration) × CorrectionFactor

The Correction Factor is calculated as follows:

- The user should print an image from the application and measure a vertical scale and a horizontal scale with a ruler, and type in the values into two text boxes.
- **Parameters**:
  - L_H= the real length of the horizontal scale (the one written on the image).
  - L_V= the real length of the vertical scale (the one written on the image).
  - ML_H= the measured length of the horizontal scale (the one measured with the ruler).
  - ML_V= the measured length of the vertical scale (the one measured with the ruler).
- **Correction Factor Calculation**:

$$F_H = \frac{ML_H}{L_H}$$

$$F_V = \frac{ML_V}{L_V}$$

$$Correction\ Factor = \frac{F_H + F_V}{2}$$

Dental Planning Workflow

The Dental Planning application opens in the Panoramics stage, in the default layout (Layout A).

- **Top left viewport.** Shows axial images of the study. Draw a curved line on this image to define the desired panoramic images. You can scroll through the images to find the optimum view.
- **Bottom left viewport.** Shows a volumetric image of the study. Use the Volume and Clipping Tools for editing this image.
- **Right viewport.** Shows the panoramic images produced from your curved line on the axial image.

Click **Layout** to change.

WARNING

One or more of the following image types may appear in this application: curved MPR, straightened MPR, volume images, and thick slab images. Measurements you make on such processed images can sometimes be misleading. When saving such images, make sure they are labeled properly. The volume image displays the anatomy according to the defined protocol. Do not use the volume image as the sole basis for a diagnosis.

Functions Tab

- **Define Panoramics.** Use this function to define the panoramic curve.
- **True Size.** Use this function to calibrate the image size for true-size.
- **Nerve Canal.** Use this function to highlight the nerve canals.

Key Images

Save groups of images that can be reviewed in any system supporting the defined standard. See **Instructions for Use** > **Directory** > **Key Image Notes** for more information.

Panoramics Work Stage

The Dental Planning application opens in the Panoramics stage.

WARNING

Measurements on Panoramic images are calculated along the curved plane, and should not be used as the sole basis for diagnosis. Objects in thick curved MPR images may appear distorted. Use caution when making measurements on MPR images. Cross sectional images might rotate around the centerline. Please note orientation annotations on images.

Set Plane

Scroll through the images in the axial slab viewport to find the best cross-section for dental planning. If the original (orthogonal) viewing plane does not form an ideal cross-section through the Maxilla or Mandible, adjust the plane as described:

1. Click **Rotate Plane**. Ensure the Define Panoramics tab is open and the sagittal and coronal images, in addition to the original axial image, are visible.

2. Click and drag to reposition the plane lines in the sagittal and/or coronal viewports. The slab viewport is updated as you move the line(s).
3. When done, click the **Accept** checkmark.

Define Panoramics

Draw one curve on the axial viewport, approximately following the tooth centers. When you finish, the application displays your curve, and also creates and displays additional curves (in parallel to your original curve). Up to six curves can be seen at one time in the right-side viewport. The Number and Spacing options of the curves can be changed at any time.

Draw a Panoramic Curve

1. Click **Draw Curve**.
2. Point the cursor in the axial image viewport and click where you want to start the curve.
3. Click as you move along the proposed curve (creating control points). A green line forms showing your progress.
4. Double-click on the end point of the curve to complete it.
   – Purple parallel lines appear on each side of the green line. These lines are numbered, and corresponding numbers are shown in the right-side panoramic images.
5. Verify that the panoramic images are in the desired plane.

Modify the Curve Shape

1. Select **Edit Control Points**.
2. To move a control point, drag it to the desired location.
3. To add a control point, click on the green curve where you want a new point.

Move the Curve

Select Move Curve. Point anywhere on the center curve, then click and drag the entire line to the desired location.

Delete the Curve

Click **Draw Curve**. Point the cursor in the axial image viewport and click where you want to start a new curve. The old curve disappears.

Define Nerve Canal

After you define the panoramics, you can choose to mark the nerve canals.

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NOTICE

There are separate Right and Left tools for marking the nerve canals. Be sure to match the tools with the corresponding nerve canals. The orientation labels are marked in the panoramic image.

1. Select the panoramic image that shows the nerve canals.
2. Click Mark Canal (Right or Left).
3. In the panoramic image, click as you move along the proposed canal (creating control points). A line forms showing your progress.
4. Move the cursor away from the line when complete.
5. Select the other Mark Canal tool and draw the line along the remaining canal.
6. To visually emphasize the marked canal, select it and change its thickness using Highlight Canal.

When you are satisfied with the Panoramics and Nerve Canal curves, you can begin the Sections work stage. Select the Continue arrow next to the Panoramics stage indicator.

NOTICE

You cannot access the Section work stage unless a curve has been defined. Curves cannot be added, deleted or changed in the Sections work stage.

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Sections Work Stage

The Sections work stage displays cross-section dental images of the patient. The images are regularly spaced along the panoramic curve of the Mandible or the Maxilla.

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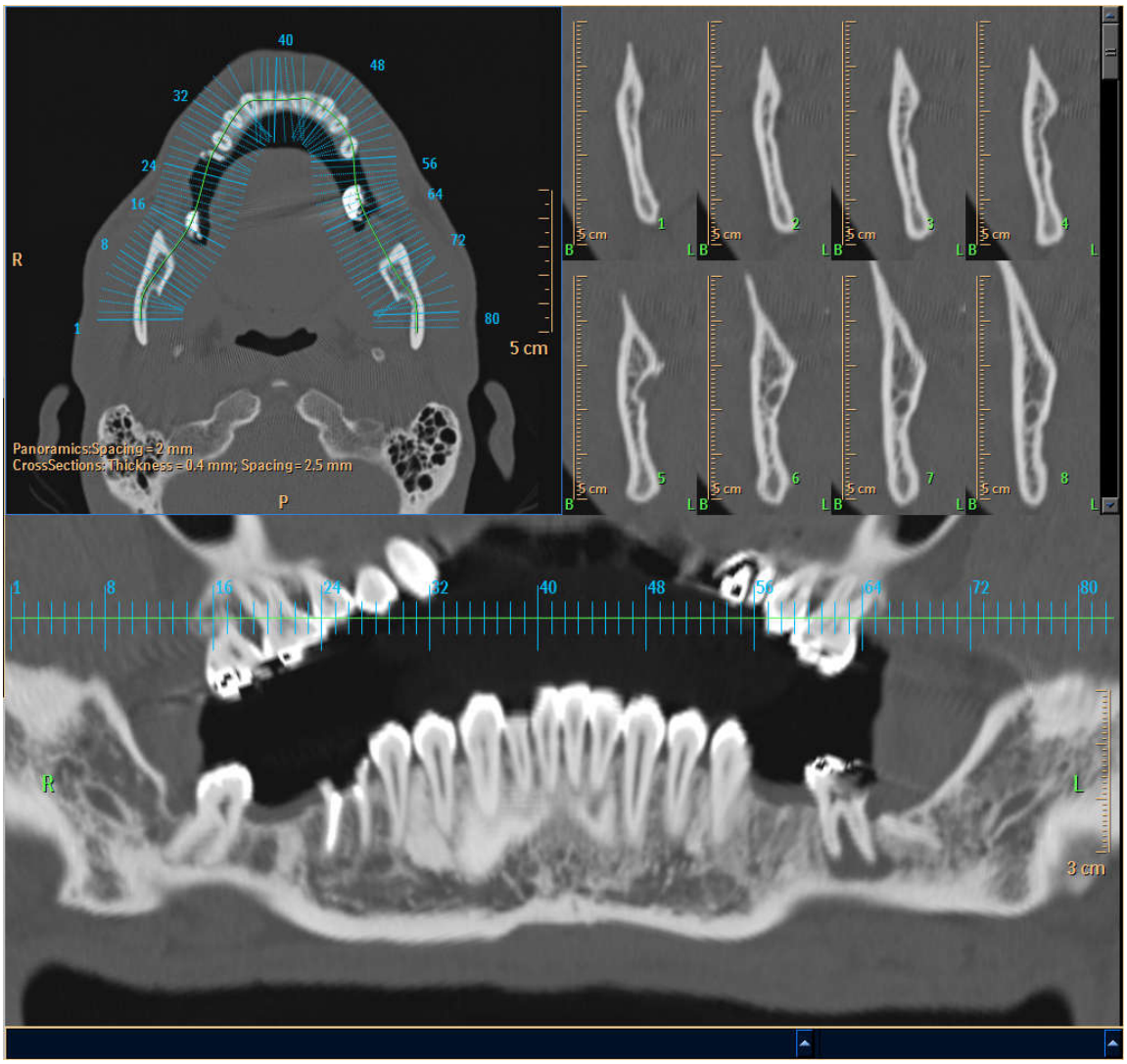

- **Top left viewport.** Shows an axial image, overlaid with a diagram of cross-sectional cuts along the panoramic curve.
- **Top right viewport.** Shows the section images. The slice number displays on the right edge of each image, and can be turned off and on with Show slices on section. The cross section images are labeled B and L, identifying the Buccal and Lingual sides of the teeth. Measurement scales on the images are for true-size measuring of dental features.
- **Bottom viewport.** Shows a coronal image, displayed as a flattened view along the green panoramic curve line that you created in the Define stage.

Click Layout to select a different layout than the one shown.

Viewport Options

You can change the following display characteristics:

Long Sections. The length of the sections displayed in the top right viewport (on = 5 cm, off = 3 cm)

Show Section Lines. Turns section lines on and off in the top left and bottom viewports

Edit Sections

Use the Add Sections function to add additional cross-sectional images to the defined curve. If there is enough space on the curve, a new set of section lines is created to the right of the last set, with the same number of cuts and the same spacing between lines. If there is not enough space for a new set, a notice displays.

1. Click **Add Sections**.
2. Click on the image.
3. You can change the parameters of cross section image sets using functions in the Cross Sections tab:
   - **Set Number.** The number of sets to display.
   - **Spacing.** The distance between section lines (mm).
   - **No. Sections.** The number of sections displayed on the panoramic curve.
4. Select **Change Angles**.
5. Drag the round handle(s) in either the upper left (axial) or lower (panoramic) viewports and swivel to the optimum position. The cross-sections display in the upper right viewport.
   - Restore the original perpendicular angles by selecting **Reset Angles**.

Sections Results

After you complete any cross section operations, you can view the cross-section images in the top right viewport. Use the slider bar along the right edge of the viewport to scroll through the images.

Viewing Cross Section Results in Pair Mode and Moving CS (Cross Section) Continuously

Clicking **Enter Pair Mode** causes the viewing capabilities to be changed. Instead of viewing all cross sections, the viewable cross sections are reduced to eight.

Clicking **Move CS Continuously** (while in the Enter Pair mode), moves the eight-section set to the right, adjacent to its existing location on the curve. Each click moves the set to the next adjacent location.

Presets: Setting up Results for Film or Print

A Preset is a saved specification of how images are arranged for filming or printing (the film layout and the image list, respectively). Presets are not active in the Enter Pairs Mode. You can use a Preset or you can create your own. The following images are available for arranging into user's Presets:

- some or all cross-section images (you select);
- the axial image with cross-section lines;

- the axial image with the panoramic curves;
- the panoramic images; or
- the volume image.

1. Click **Define Presets** to open the Presets definition dialog box.

2. Select the **Preset** name/number to edit, or **New** to add a preset (if New, then type a name or number).
3. Select the **View** (**Film Layout** or **Image List**).

   You can **Save**, **Delete**, or **Reset** at any time. Reset deletes the entire preset content.
4. Right click to access basic editing functions.

Default Presets

You can replace the default preset in a selected preset window (shown with a yellow frame) by clicking in the preset window you want to change, then clicking the appropriate preset button (for example, Volume Image). When you have finished editing or adding presets, click the Save and Close button to save your edits and close the Define Preset dialog box, or click Cancel to close the dialog box without saving any changes.

Save, Report, and Film Dental Results

There are two modes for printing the results:

- **True-size filming.** Images are output to a film printer (zoom is not available)
- **Regular printing.** Images are output to a paper printer

WARNING

Calibrate the film printer for true size filming before producing films. For true size images, use only the special Dental Planning film format (2 x 3 with a film size of 14 x 17 inches). Any time you change the page layout, header, or footer of the film, you must re-calibrate the dental application to get true size measurements. The calibration factor (DFOV) sets the size on film. After changing the factor, use a scale to measure the horizontal and vertical scales on the film to ensure true-size.

Save Pairs

1. From the Common Tools area, click **Save Pair** as. The Save Pair As dialog box opens. Ensure that the Pair mode button is selected in the **Cross Section** tab.
2. Type a name for the pair, or accept the suggested name.
3. Select a format for the saved pair.

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4. Select a location to save the Pairs from the Local Devices.
5. Click **OK** to save the Pairs file.

Send Pair to Report

1. From the Common Tools area, click **Send pair to report**. The report is loaded and the Select Existing Report dialog box opens. Ensure that the Pair mode button is selected in the Cross Section tab.
2. From the Select Existing Report dialog box, you can select an existing report or create a new one:
   - Select a report from the list, then click **OK**. The Pair images are sent to the existing report.
   - You can click **Create new report**. A message displays while the new report is created.
3. To view the (existing or new) Report, click the **Report** button on the workflow bar.

Send Pair to Film

1. From the Common Tools area, click **Film** images.
2. Go to the Film application.
3. Follow the instructions for printing given in the **Calibration** section.

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