

# **True Life Anatomy**

## **TLA Generator User Manual**

**Version 2.0.0.0**

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## Introduction

### Welcome to TLA Generator

Welcome to the TLA Generator, the world class 3-Dimensional Medical imaging visualization software from True Life Anatomy. TLA Generator brings 3D modeling and visualization of Scan data derived from CT and MRI scanners to your PC desktop system.

The TLA Generator Software imports CT or MRI scanned two-Dimensional slice data and creates 3D models which are saved as TLA files. TLA files contain both the 3D model created by the TLA Generator software as well as the CT slice data in a compressed form. The 3D Model can also be sent to the Clinician for viewing on another TLA program – TLA Viewer that requires less computing power. This 3D image data can also be transmitted by network or broadband connection.

True Life Anatomy, has created a product that can help Radiologists, Doctors, Researchers, Medical Educators and Training Institutions to quickly and easily develop 3D Models from 2D CT and MRI slice images. The aim has been to develop a system that is easy to use and offers more functionality and interactivity for education, training and in the future diagnosis within the 3D medical imaging arena.

This User reference contains detailed information about all the features and capabilities of TLA Generator. This manual should be used in conjunction with the PowerPoint™ and other demonstration as supplied with your installed version of TLA Generator, plus on line examples at <http://www.rubamas.com/case-studies.htm> and forum discussions.

There are extensive and detailed discussions, demonstrations and other information at <https://www.truelifeanatomy.com>

Log corrections to this document at <http://mantis.truelifeanatomy.com>

Thank you for selecting True Life Anatomy software for your anatomical imaging solutions.

**TLA GENERATOR DOES NOT HAVE FDA, CE OR TGA  
CERTIFICATION, AND SHOULD NOT BE USED FOR PATIENT  
CARE OR PRIMARY DIAGNOSIS.**

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## About True Life Anatomy Medical Imaging Tools

True Life Anatomy, an IT development company in Adelaide, Australia, has been working on software programs that can create a 3D model of bones and other anatomical structures from plain CT scan slice data and saved in such a way that it can be exported and easily viewed on a standard computer.

While there are a number of other programs that are utilized by Radiologists to create 3D images for their diagnostic work, the information and images for the requesting Clinician are generally provided only as 2D representations of the 3D model. This is done as screen image captures in the form of a series of representative views or possibly as a movie, which gives the impression of 3D interaction but in reality, is not. They are generally unable to save the data as a 3D model and provide it for the requesting Clinician to view and interact with in real time.

The unique feature of the True Life Anatomy software is that the scan data can be converted into a 3D model (using TLA Generator) and that model can be provided as a true 3D model that can be viewed, manipulated and modified in a PC environment using a "cut down" version of the program (TLA Viewer).

True Life Anatomy currently has the following range of products either available or under development to provide true 3D access of scan data for the Clinician:

**TLA Generator** – The TLA Generator Software imports CT or MRI scanned two Dimensional slice data and creates the 3D model which is saved as a .tla file which contains both the 3D model created by the TLA Generator software as well as the CT slice data in a compressed form. The 3D Model can also be sent to the Clinician for viewing on another TLA program – TLA Viewer that requires less computing power. This 3D image data can also be transmitted by network or broadband connection.

**TLA Viewer** – The TLA Viewer allows viewing of TLA files created by TLA Generator software. This program requires less hardware resources and is much less complicated than the TLA Generator. It is designed for the clinician to view and demonstrate the TLA 3D images in the teaching and research setting as well as an adjunct to existing imaging data in the clinical environment. The user interface is simple and does not demand significant computer skills.

**TLA Animator** – The TLA Animator software creates animation files by reading in .tla files and creating "movie" frames based on the transformation or manipulation of these files over time. The created animation files are saved as native .tla files or standard .avi files which can be distributed and viewed by either TLA Animator software or media players such as Windows Media Player.

**TLA VPOPS** – Virtual Pre-Operative Procedure Simulation or TLA VPOPS software is used to do virtual surgery and anatomical analysis. TLA files are used in conjunction with certain toolsets to provide physical rules and other diagnostic tests for virtual surgery simulation and motion replication. This application combines the interactive graphics environments of TLA Animator, with the segmentation capabilities of TLA Generator, plus creates a virtual environment to import and template in 3D prosthesis data.

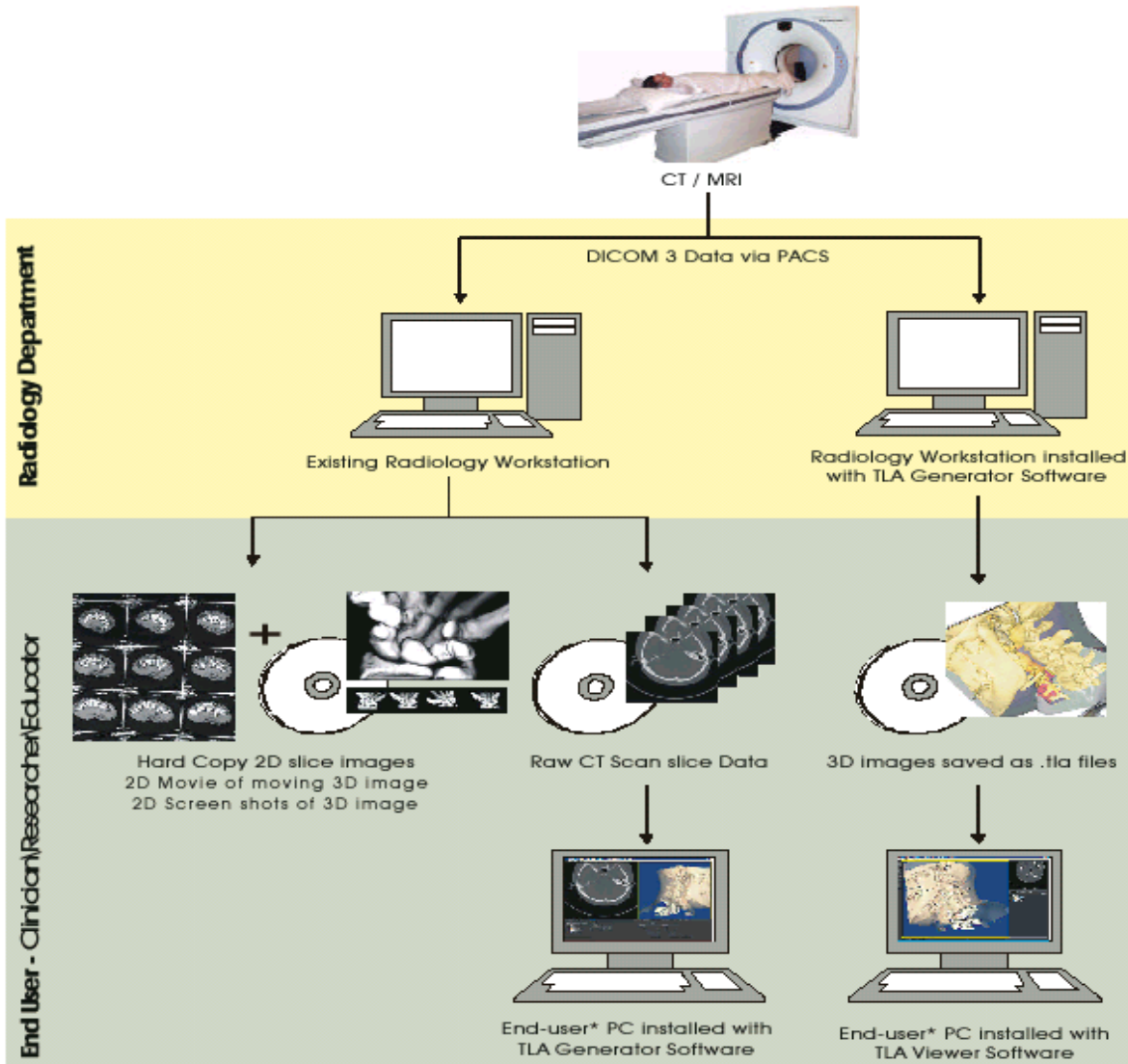
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## Patient Image Creation – RESEARCH ONLY

Current Radiological practice is generally that the images from a Patient's CT or MRI scan are provided for the ordering Clinician as 2D slices as well as snapshots of a possible 3D image reformation in digital or hard copy form.

Using the power of TLA Technology, as well as the usual hard copy films of the representative slices, this scan data can now be provided to the Clinician as a truly interactive 3D image. Using the TLA Generator Software on a networked CT or MRI workstation, the Radiology Service Provider creates the 3D image file from the imported Scan data and transmits them to the Clinician on CD (or other solid media format/device) or by network or broadband connection. The Radiologist could supply, or the Clinician may already have the TLA Viewer software on their computer to allow real time viewing and manipulation of the 3D model.

The viewing interaction in 3D allows the clinician to better understand the anatomical relationships of the affected area, to plan the appropriate intervention and demonstrate to the patient in a dynamic and clear fashion the proposed intervention or pathology.





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## System Requirements and Recommendations

S.No	Item	Minimum Requirements and Recommendations
1.	Supported Operating Systems	<ul style="list-style-type: none"> <li>Windows 2000 Professional Service Pack 1 or 2</li> <li>Windows NT 4.0 Workstation Service Pack 6a</li> <li>Windows 98 Second Edition</li> <li>Windows ME</li> <li>Windows XP Professional</li> <li>Windows 10+</li> </ul> <p>The TLA products will run in a MAC (Apple Macintosh) environment by using programs such as <a href="#">Parallels® Desktop 17 for Mac</a> and separate Window OS. See help files on line sites or in product folder for details.</p>
2.	Hardware Recommendations	<ul style="list-style-type: none"> <li>P4 2.2 GHz or higher</li> <li>1 GB RAM or higher, more memory generally improves responsiveness</li> <li>128 MB graphics card with open GL support</li> <li>3 GB or more free disk space on a single drive to accommodate the software and data.</li> </ul>
3.	Disk Space to Install (all software components)	<p>TLA Generator – 50 MB            Optional Software – 20 MB            All TLA application plus storage of files &gt; 500MB</p>
4.	Web Browsers on Windows	<ul style="list-style-type: none"> <li>Internet Explorer 5.01 Service Pack 2, 5.5 (no Service Pack), 5.5 Service Pack 1, or 6.0.</li> <li>Mozilla Firefox 100+</li> <li>Chrome 100+</li> </ul>
5.	TLA Documentation	<p>Adobe Acrobat Reader 4.x or higher to read the user manuals and online PDF files.</p>
6.	Language Support	<p>This release supports only English. All displays, menus, controls, wizards, reports, and user documentation are in US English.</p>

## Getting access to TLA Generator

The TLA Generator can be launched from a media card or can be installed on a host computer or network.

There are various different versions of the TLA Generator, including an application that can import volumetric scan data and create a surface rendered 3D model, and another that can only read and segment the created 3D model.

These different versions allow for different functionality needs of the imaging provider and treating clinician.

Access is restricted by linking to a specific solid media USB card, or by registering and installing the application on a specific computer or network.

Details on specific access and registration of application are available in the help links on the web sites <https://www.truelifeanatomy.com> and <https://www.rubamas.com>

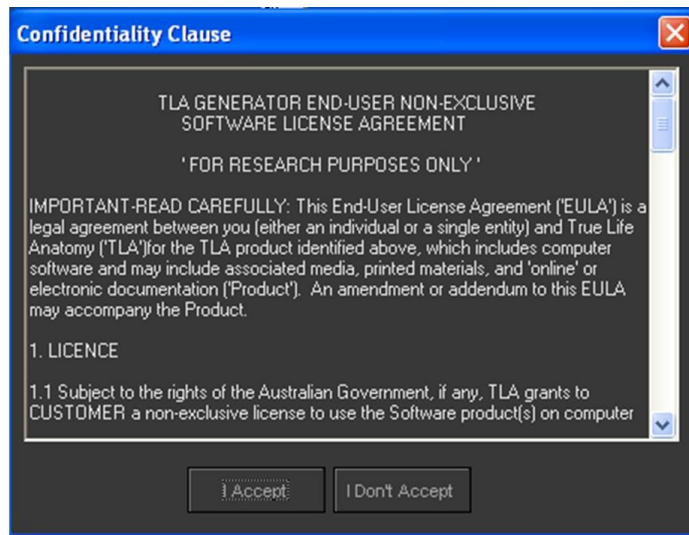
## Learning to use TLA Generator

### Starting TLA Generator

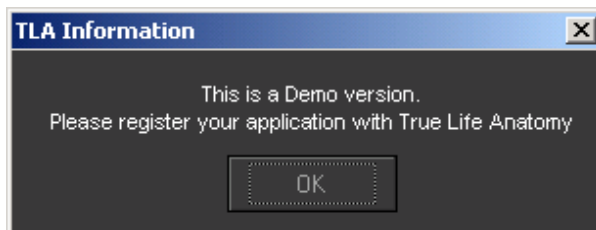
1. From the Start menu, select Programs → TLA → TLA Generator → TLA Generator  
- or -  
Double-click the TLA Generator icon on the desktop

2. Add a password if required.

3. The Confidentiality screen appears

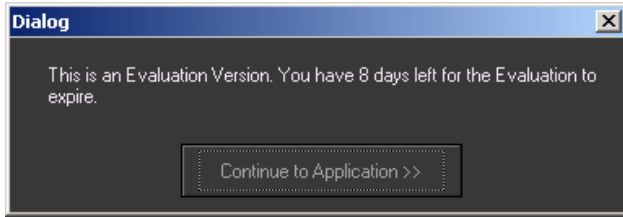


- Choose to accept or not accept the license agreement. If you do not accept the license agreement, exit the application by clicking "I Don't Accept".
  - If you accept the license agreement, the application allows the user to continue to open the software.
4. If you haven't registered the product, you will get the following message asking you to register the product, and advising how many further days on the trial version you have. By registering the software and sending the registration file to technical support, you will be sent an authorization application which will allow you to use the software past the initial grace \ demo period.



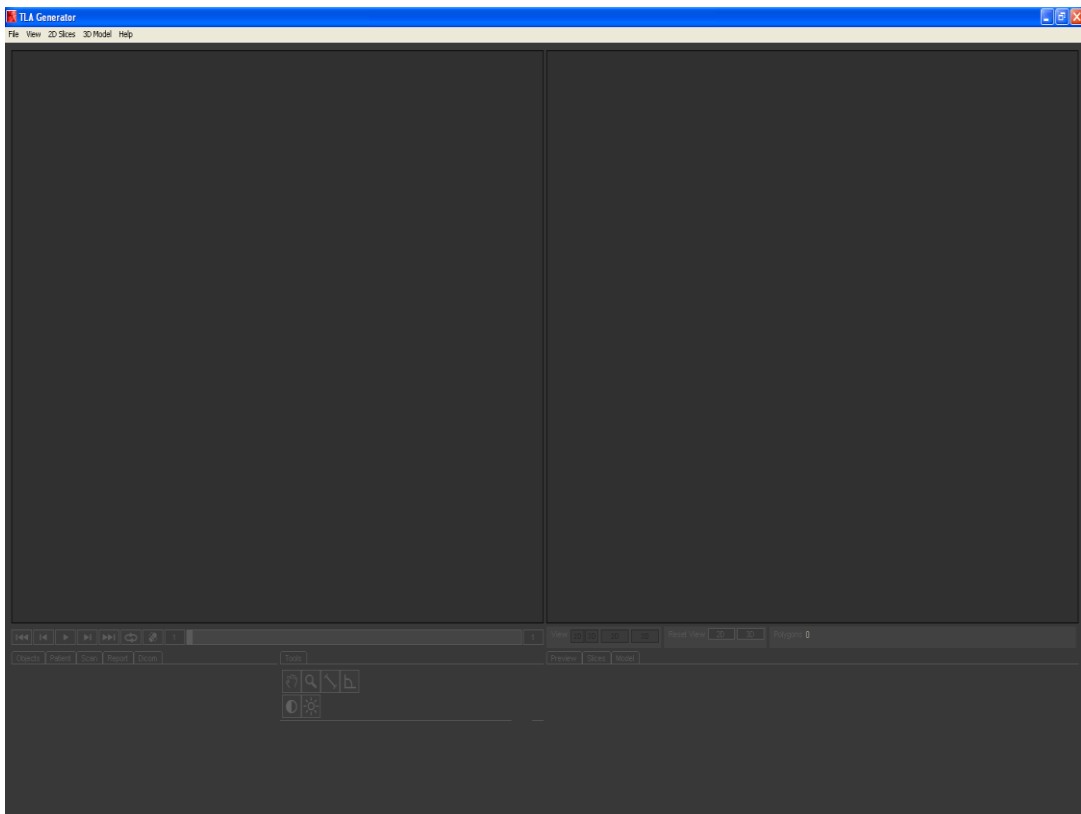
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5. On click of the OK button, another TLA Information dialog appears informing the number of days left for the user to register the product before it expires.



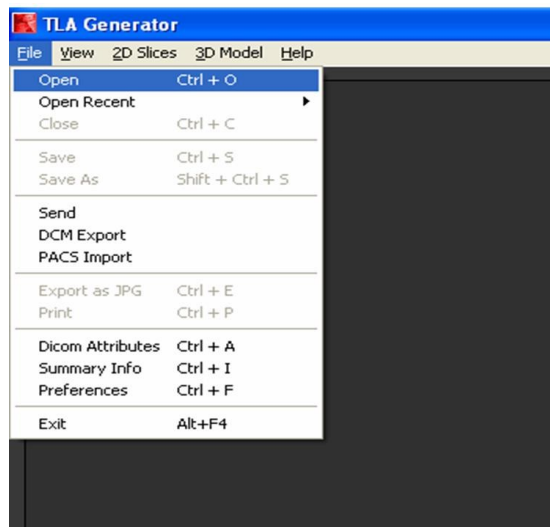
Click the button Continue to Application to start using the application.

Note - If the user has done a successful registration, step 3 and 4 doesn't appear and the TLA Generator Main window is displayed.



6. Click File → Open and choose a file.
7. Click File → Open Recent to open a previous file.
8. Other functions including DCM Export, PACS Import relate to functionality within a PACS environment, and may not have been installed with the version you have installed. Contact TLA ([info@truelieanatomy.com](mailto:info@truelieanatomy.com)) for more details.

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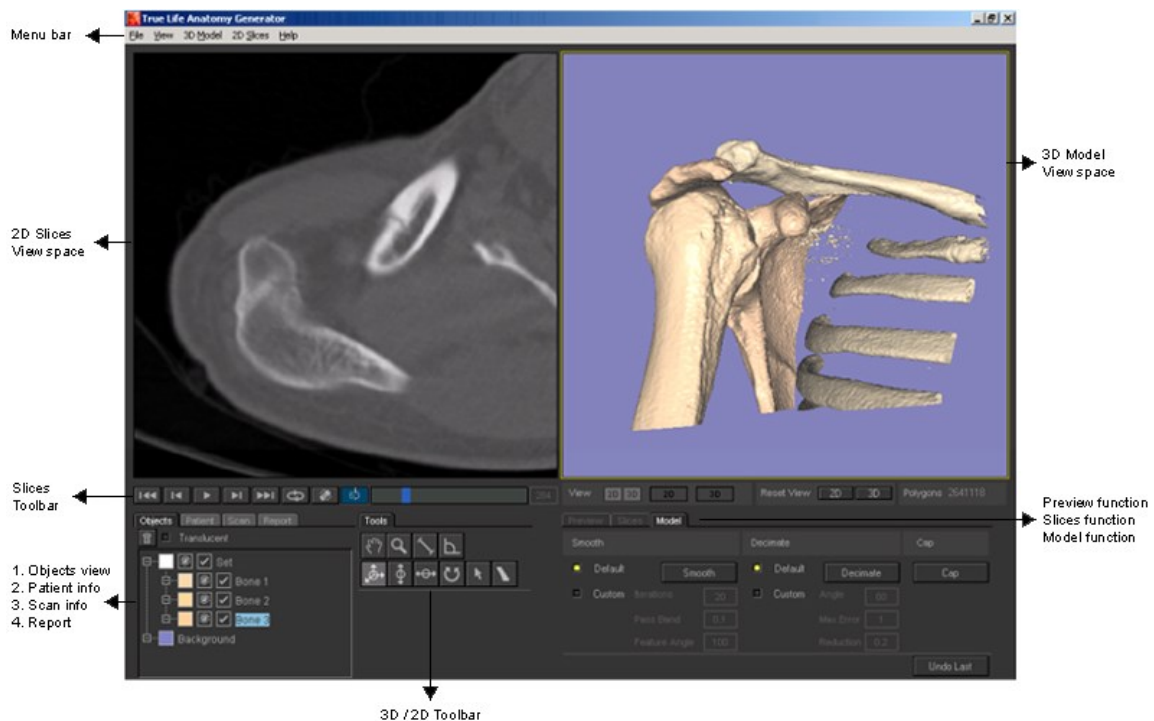
9. Dicom Attributes lists a summary of the dicom tags for the loaded slices.
10. Summary Info quantifies the contribution of the slice data and the 3D model to the memory use in RAM
11. Preferences allow you to select the segmentation colour, choose specular shading of the model and remove auto-segment.
12. Close and Exit are as for other programs
13. Export as JPG allows you to save the active window (either the 2D slice window, or 3D window as an image file to a selectable folder location.
14. Print allows you to send the image in the active window to an attached printer. This will allow printing of either the 3D model, or the 2D slice. Simply select the desired window and then select print.

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## The TLA Environment

When you start TLA Generator, the main window appears. It contains a Menu bar, Toolbars and different workspace like 3D View, 2D View, Preview function, Slices function, Model function, Objects view, Patient information, Scan information and Reports.

This diagram is of a completed model. This is the appearance if you open a previously created .tla file, or have completed a model creation. This is an indication of the complete GUI (Graphics User Interface), once a model has been created or imported.

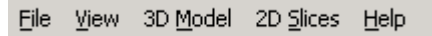


On the top of the window are the menus. Different functions can be done using the menus or with the help of toolbars or context menus. Context menus are available by right mouse clicking anywhere within a workspace window such as the 2D slice view or 3D model view windows. The Menu, toolbars and context menus are organized by function.

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## The Main Menu

The main menu, near the top of the window, is called the "menu bar".



Each word or group of words on a menu provides access to another menu of related functions. When you click on a word on the menu bar, a drop-down list appears, showing the menu associated with that word. For example, when you click on File, the File menu is displayed:

When you click on an item listed in the menu, you either perform the task described by that item, or go to another screen to perform the task there.

## Menus Available from the Main Menu








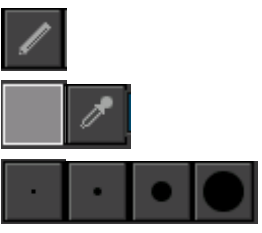

The following menus are available from the main menu

- **File menu:** contains functions related to opening, saving and closing TLA supported files, exporting and printing, and application settings options. You also use this menu to exit TLA Generator.
- **View menu:** contains functions related to pan, zoom, view and reset view.
- **3D Model menu:** contains functions related to tools that allow you to navigate and manipulate the 3 dimensional models.
- **2D Slices menu:** contains functions related to tools that allow you to navigate and manipulate the 2 dimensional slices.
- **Help menu:** contains online help for TLA Generator, including access to the tutorial and online website information. The "About" option on this menu is where your software version and contact details are displayed.

## The Toolbars













The toolbars give quick access to various options and functions.

### 2D View toolbar









Button	Menu Access	Description	Shortcut
	View → Pan	Tool to move or drag the 2D image	Space bar
	View → Zoom In / Out	Tool to Magnify in or out the 2D image	Ctrl + + Ctrl + -
	2D Slices → Measure Distance	Tool to measure the distance in millimeters between two points	D
	2D Slices → Measure Angle	Tool to measure the angle in degrees	A
	2D Slices → Contrast	Tool to manipulate the contrast of the 2D image	C
	2D Slices → Brightness	Tool to manipulate the brightness of the 2D image	B
	2D Slices → Splines → Create Splines Edit Splines Remove Splines	To manipulate the 2D image the Spline tools are used to apply new boundaries between bones as represented within the slice data image. Each level can be done separately, or applied to all below the current slice	
	2D Slices → Draw	To manipulate the 2D Image the Draw Tool allows you to draw onto the image different threshold levels or bone/tissue densities represented by varying shades of black to white. This allows you in effect to remove artifacts, add new objects or densities, and highlight features not isolated using threshold adjustment. The color picker tool also allows you to choose a threshold setting from within the image itself and re-apply it.	
	2D Slices → Fill	To manipulate the 2D image, The fill option is used to remove inner walls or boundaries caused by density values that fall outside of the initial bone density thresholds, thus causing the effect of cavities or holes within bones. The inner walls or cavity edges are removed and filled in with color that represents density within the required threshold to create solid bones without internal cavities. The fill tool can be applied to one slice or all slices.	








## 3D View toolbar

Button	Menu Access	Description	Shortcut
	View → Pan	Tool to move or drag the 3D model image	Space bar
	View → Zoom In / Out	Tool to magnify into or out of the 3D model image	Ctrl + + Ctrl + -
	3D Model → Measure Distance	Tool to measure the distance in millimeters between two points that reside on the 3D surface or perpendicular to your 2D view. 2 values are given	D
	3D Model → Measure Angle	Tool to measure the angle in degrees on a 2D plane perpendicular to your view	A
	3D Model → Rotate Free	Tool to freely rotate the 3D Model	F
	3D Model → Rotate X	Tool to rotate the 3D Model about the X-axis	X
	3D Model → Rotate Y	Tool to rotate the 3D Model about the Y-axis	Y
	3D Model → Rotate Z	Tool to rotate the 3D Model about the Z-axis	Z
	3D Model → Pick	Tool to pick an object in the 3D Model view workspace and make active to manipulate the same.	P
  	3D Model → Mark for Separation → Select Deselect	Tools used to mark and unmark polygons selected for separation into individual 3D objects.	Ctrl + M Ctrl + D

## Slices toolbar

Button	Menu Access	Description	Shortcut
	2D Slices → Go to First Slice	Tool to go to the first slice image in the sequence.	Home
	2D Slices → Previous slice	Tool to go to the previous slice image in the sequence.	Page Up
	2D Slices → Play / Stop	Tool to play the entire sequence of slice images sequentially. The button toggles from play to stop operations.	Enter
	2D Slices → Next slice	Tool to go to the Next slice image in the sequence.	Page Down
	2D Slices → Go to Last Slice	Tool to go to the last slice image in the sequence.	End
	2D Slices → Loop	Tool to loop or play once the entire slice image sequence. The button toggles from play once to loop operations.	\
	2D Slices → Show / Hide 2D Plane	Tool to Display or Hide the 2D plane in the 3D Model view workspace corresponding to the 2D Slice image location within the sequence and on the 3d model.	Alt + P
	2D Slices → Go to Slice Number	This is an editable field used to go to a 2D Slice image within the loaded sequence. Enter a valid sequence number and press enter to jump straight to this 2D Slice image. If the 2D plane is active, the location will also update within the 3D model view workspace to reflect the corresponding 2D slice location on the 3D model.	/

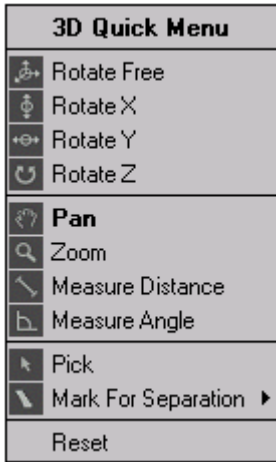
## View toolbar

Button	Menu Access	Description	Shortcut
	View → View 2D / 3D → Activate 2D Activate 3D	Tool to view both the 2D slice image view and 3D model view workspaces together with either 2D slice image or 3D Model as active.	
	View → View 2D	Tool to view only the 2D Slice image view workspace.	Ctrl + 2
	View → View 3D	Tool to view only the 3D Model image view workspace.	Ctrl + 3
	View → Reset 2D	Tool to reset the 2D slice image view workspace to the original starting view when first opened.	F2
	View → Reset 3D	Tool to reset the 3D Model Image view workspace to the original starting view when first opened.	F3

## The Context Menus

### 3D Quick Menu

On right clicking the mouse on a 3D Model image, the user has the facility to call up the following tools and functions quickly.



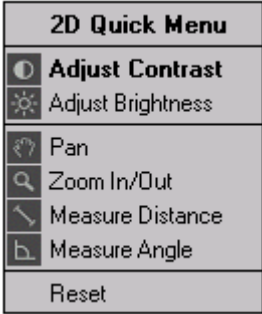
Rotate Free	–	Tool to freely rotate the 3D Model	
Rotate X	–	Tool to rotate the 3D Model about the X-axis	
Rotate Y	–	Tool to rotate the 3D Model about the Y-axis	
Rotate Z	–	Tool to rotate the 3D Model about the Z-axis	
Pan	–	Tool to move or drag a 3D Model	
Zoom	–	Tool to magnify in or out the 3D Model	
Measure Distance	–	Tool to measure the distance between two points on the 3D Model	
Measure Angle	–	Tool to measure the angle in degrees	
Pick	–	Tool to pick an object in the 3D Model view workspace and make active, to manipulate the same.	

Mark for Separation	→	Select	–	Tool used to mark polygons selected for separation into individual 3D objects.
		Deselect	–	Tool used to unmark polygons selected for separation into individual 3D objects.

Reset	–	Tool to reset the 3D model view workspace.		
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### 2D Quick Menu

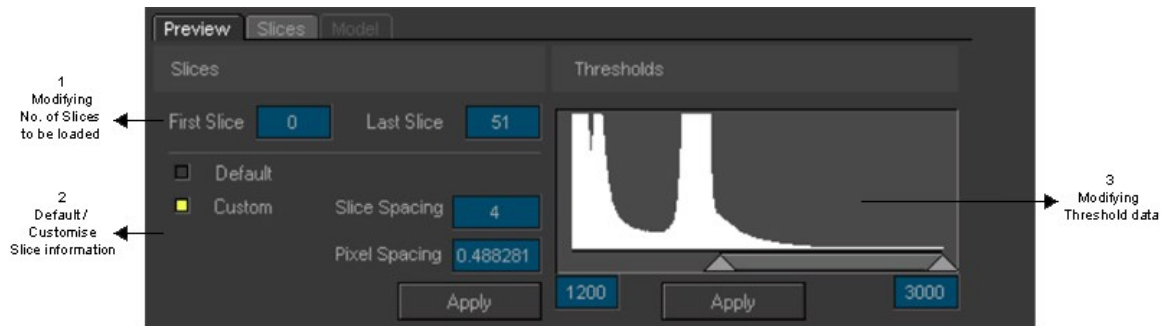
On right clicking the mouse on a 2D Slice image, the user has the facility to call up the following tools and functions quickly.



Adjust Contrast	–	Tool to manipulate the contrast of the 2D image
Measure Brightness	–	Tool to manipulate the brightness of the 2D image
Pan	–	Tool to move or drag a 2D image
Zoom	–	Tool to magnify in or out of the 2D image
Measure Distance	–	Tool to measure the distance between two points on the 2D image
Measure Angle	–	Tool to measure the angle in degrees
Reset	–	Tool to reset the 2D image workspace

There are three distinct functional windows on the TLA Generator interface – **Preview Window / Slices Window / Model Window**. These are selectable with the tabs just below the 3D window. On loading the scan data, the program automatically opens in the Slices Window. If a modification of the slice selection or pixel spacing is required, this can be achieved by selecting the Preview window.

## Preview Functional Screen



### 1. Modifying number of Slices to be loaded

After opening the DicomDir file which also contains information regarding the number of 2D slices and their sequence, the user defines the first slice and the last slice to be loaded from the entire sequence of 2D slices before creating a 3D model.

### 2. Default / Custom Slice information

**Default** – Keep the default slice information as defined by the DicomDir file.

**Custom** – Customise the spacing and pixel spacing of each 2D slice by entering the data in the edit field Slice Spacing and/or Pixel Spacing and click the apply button to take effect.

### 3. Modifying Threshold data

The Upper and Lower Thresholds can be adjusted to obtain the optimal surfaced image by checking the blue lines in the 2D View workspace and the preview 3D model in the 3D model view workspace.

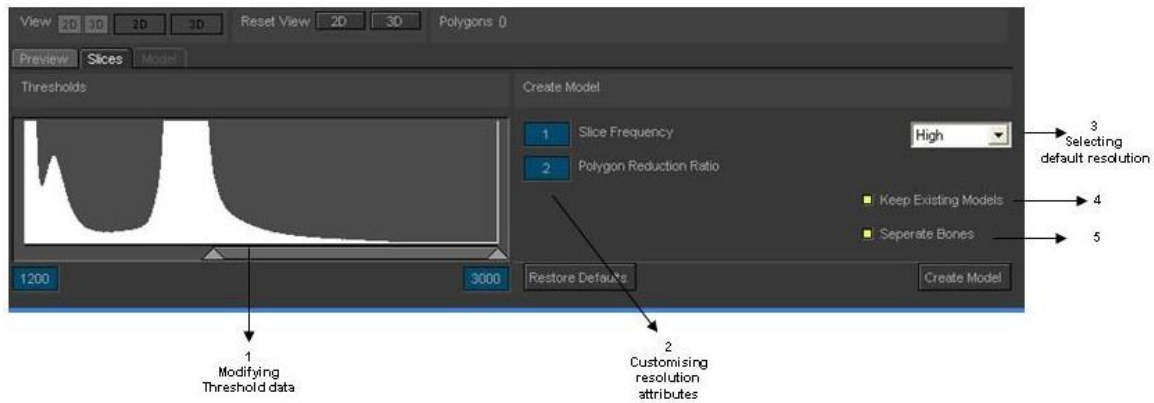
The adjustment could be done either by using the scrollbar or by entering values in the low and high threshold edit fields.

Once the best general threshold values have been identified click Apply. This saves the selected threshold to the Slice Functional Screen. Without clicking “Apply” to forwarded value is the default, i.e. 1200.

Note – Generally the value is defaulted to a low threshold of 1200 and a high threshold of 3000 which is the optimized surface of bones for most CT images.

## Slices Functional Screen

TLA Generator automatically opens in the Slice Functional screen after loading the scan data. This is where the main adjustment to the model creation is performed, but for most CT scans, the default setting will usually create an adequate model. This window can be reselected after creating an initial model without losing the original model as long as “Keep existing Models” is selected.



### 1. Modifying Threshold data in Thresholds Section

Before creating the model, the Upper and Lower Thresholds may need to be adjusted to obtain the optimal surfaced image by checking the blue lines in the 2D View workspace and the preview 3D model in the 3D model view workspace.

The adjustment could be done either by using the scrollbar or by entering values in the low and high threshold edit fields. It is generally better to only use the left-hand slider, although prostheses seem to be better images if the left-hand slider is set to zero. And the optimum threshold is selected with the right-hand slider.

Note – A little trial and error is worth while, however, the value is defaulted to a low threshold of 1200 and a high threshold of 3000 which is the optimized surface of bones for most CT images.

### 2. Customising Resolution attributes

- a. Slice frequency – selects every second or third slice as required to reduce model size
- b. Polygon Reduction Ratio – reduces the number of polygons created. Typically, too many polygons are created for appropriate visual quality, resulting in a larger model than is required. This allows a model to be much smaller. Where there are a lot of boundaries, such as spine, this can be set at 5, or even 10, but a little trial and error is needed.

### **3. Selecting Default Resolution in Create Model Section**

- a. Select "Low" from the drop-down box, to generate a low-resolution 3D model in comparison with the preview model - this uses every fifth slice, and reduces the polygon count by a third.
- b. Select "Medium" from the drop-down box to generate a medium resolution 3D model – this uses every second slice, and reduces the polygon count by a quarter.
- c. Select "High" from the drop-down box to generate a high-resolution 3D model – this loads every slice in accordance with the specified slice frequency and polygon reduction ratio.

### **4. Create Model**

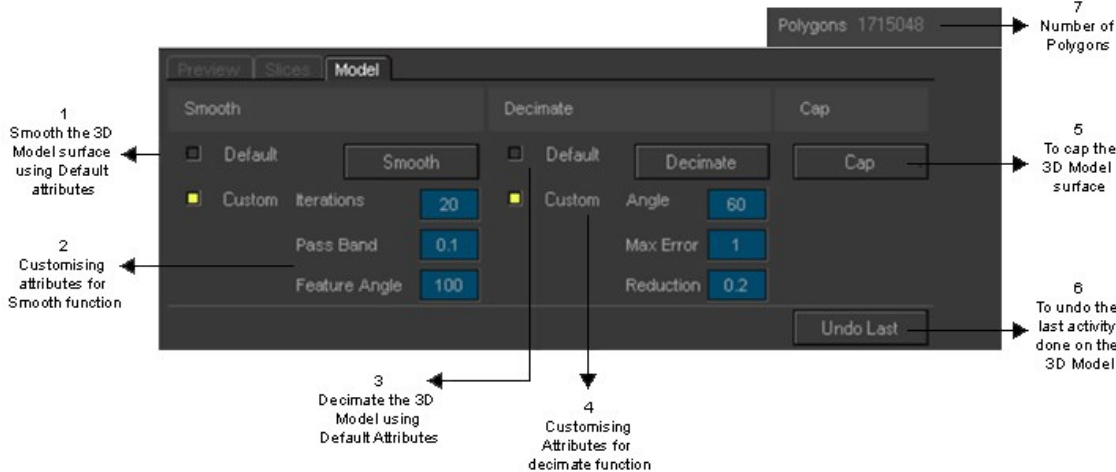
Click Create Model to start creating a 3D model based on the resolution and threshold settings.

### **5. Keep Existing Model**

- a. On selecting the checkbox "Keep Existing Models", a new 3D model is merged into the 3D model view workspace with any existing 3D models.
- b. On De-selecting the checkbox "Keep Existing Models", a new 3D model replaces any existing 3D models in the 3D model view workspace.



## Model Functional Screen



**1. Smooth function using Default attributes**

The user has the facility to create smoother models by accepting the default attributes – with 20 iterations, with pass band set to 0.1 and the feature angle set to 100.

**2. Smooth function using customized attributes**

The user has the facility to create smoother models by manipulating the iterations, Pass Band and the Feature angle. As the iterations increases, the model becomes smoother.

**3. Decimate function using Default attributes**

The user has the facility to reduce the size of the 3D model by minimizing the number of polygons based on which the model is created. Use the default attributes – angle set to 60, with 1 maximum error and 20 percent reduction.

**4. Decimate function using customized attributes**

The user has the facility to reduce the size of the model by manipulating the angle, increasing the maximum errors allowed or by reducing the reduction field stored as a percentage value. If the user sets 0.5 as the reduction value (recognized as 50% reduction), the model would result in a higher reduction, but the user needs to arrive at a correct value without manipulating the model heavily as higher reduction can result in too much loss of detail in the 3D model.

**5. Cap the 3D Model**

This function enables the user to cap or seal all the holes in the 3D model.

**6. Undo Last**

This function undoes the last activity done by the user initiated from within the Model functional screen.

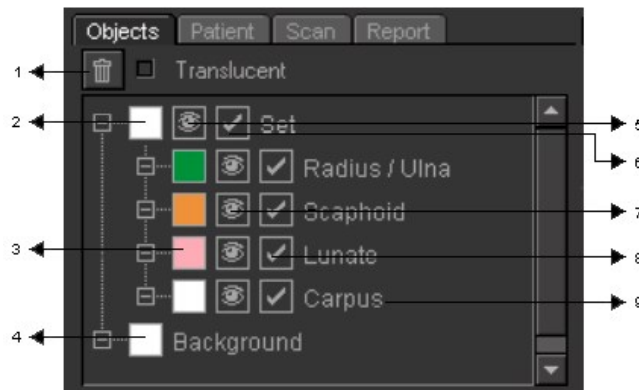
**7. Polygons**

Displays the number of polygons that make up the 3D model.

**8. Save, Send, DCM Export functions are not shown here, but described under Save TLA file.**

## TLA Object information

### Objects View



#### 1. Delete

Click this to delete the Set of objects that make up the 3D model. If a “child” object is selected only the selected object will be deleted. In the above image the “child” objects are the Radius/Ulna, Scaphoid, Lunate and Carpus. All can be selected individually as “child” objects. If none are selected then the whole Set is deleted.

#### 2. Colour of total set of objects

Click this to apply the common colour to all the objects that make up the Set.

#### 3. Colour of each object

Click this to apply the colour on the object in this row.

#### 4. Background Colour

Click this to apply the colour to the background in the 3D model view workspace.

#### 5. View all objects

Click this to enable / disable the view of all the objects.

#### 6. Manipulate all objects

Click this to enable / disable the manipulation of all 3D objects in the 3D model view workspace. This applies to separate, delete, smooth, decimate and cap functions.

#### 7. View each object

Click this to enable / disable the view of the selected objects.

#### 8. Manipulate each object

Click this to enable / disable the manipulation of the selected 3D objects in the 3D model view workspace. This applies to separate, delete, smooth, decimate and cap functions.

#### 9. Object name

Click this to rename the object.

### Patient information

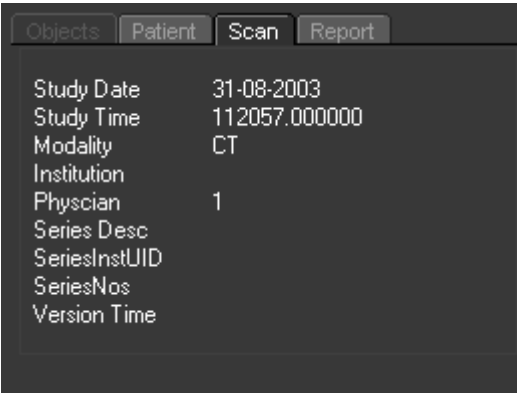


A screenshot of a software interface showing patient information. At the top, there are four tabs: 'Objects', 'Patient', 'Scan', and 'Report'. The 'Patient' tab is selected. Below the tabs, the following information is displayed:

Patient Name	
Patient Id	204848-1
Patient Sex	M
Date Of Birth	03-11-1958

The patient information – Name, Id, Sex and the Date of Birth are un-editable and they are automatically derived from scan information created at the time the patient was scanned.

### Scan Information

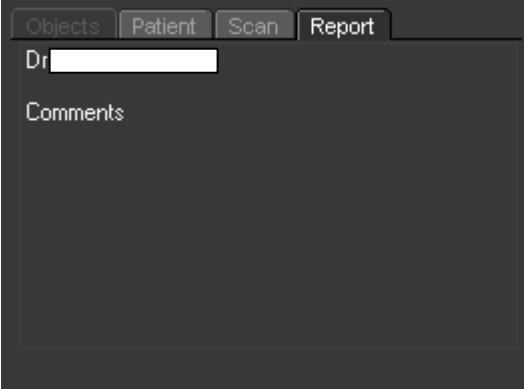


A screenshot of a software interface showing scan information. At the top, there are four tabs: 'Objects', 'Patient', 'Scan', and 'Report'. The 'Scan' tab is selected. Below the tabs, the following information is displayed:

Study Date	31-08-2003
Study Time	112057.000000
Modality	CT
Institution	
Physician	1
Series Desc	
SeriesInstUID	
SeriesNos	
Version Time	

The Scan information is un-editable and is automatically derived from scan information created at the time the patient was scanned.

### Report

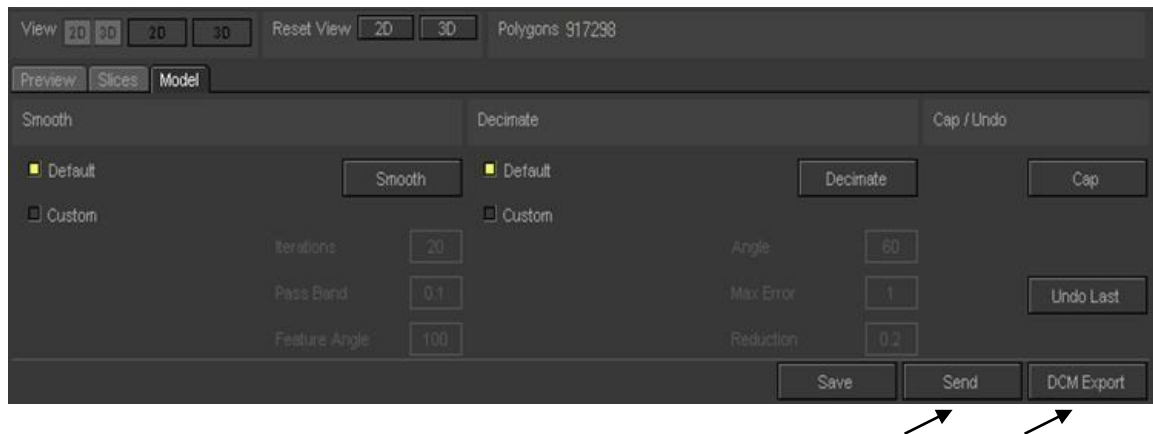


A screenshot of a software interface showing the report section. At the top, there are four tabs: 'Objects', 'Patient', 'Scan', and 'Report'. The 'Report' tab is selected. Below the tabs, there is a text input field labeled 'Dr' and a larger text area labeled 'Comments'.

The physician / radiology team can put in their comments in this area for further reference.

## Saving the TLA file

1. Once you have created a 3D model, or modified an existing model, to save the TLA model, click File → Save As, or Click the “Save” button on the bottom right-hand corner of the Model tool bar. Save the model in an appropriate folder on your computer.
2. When TLA Generator saves a file, it creates a new file containing the 3D model, compressed 2D slice images, patient and scan data plus a thumbnail snapshot of the 3D image. This is saved as a .tla file
3. Use the Save button to regularly save the model as you are working on it, or Save As to save it in under a separate file.



4. The Send button will open the model in the **TLA Animator** Virtual Surgery program if it is installed.
5. DCM Export converts the .tla file into a .dcm file and exports it to a PACS environment if this is installed.
6. The Model file must be saved before using the “Send” or “DCM Export” functions. Contact tla at [info@truelifeanatomy.com](mailto:info@truelifeanatomy.com) for more information on the Send and DCM Export functions.
7. If a .tla file is selected it will load in the **TLA Viewer** program if installed.

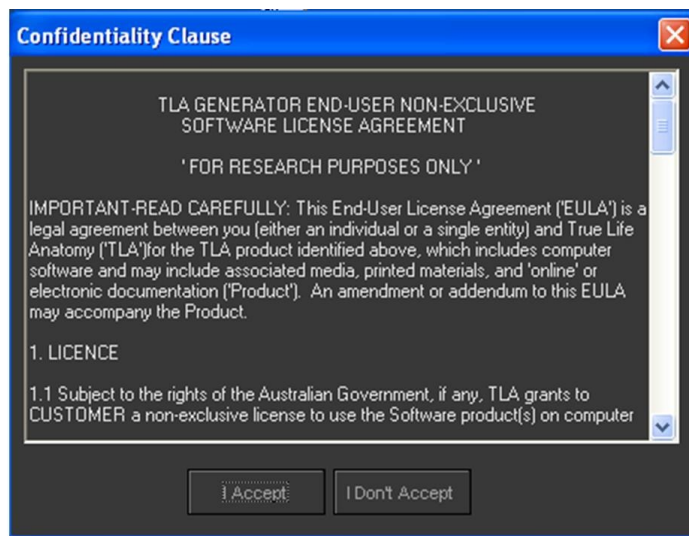
## Exiting TLA Generator

1. To close the opened file, click File → Close. If you made changes to the opened file and haven’t saved them, you are prompted to save these changes Confirm whether you want to save these changes
2. To exit from the application, click File → Exit. If you made changes to the opened file and haven’t saved them, you are prompted to save these changes.
3. Confirm whether you want to save these changes.

## Creating a new TLA File

### Starting TLA Generator

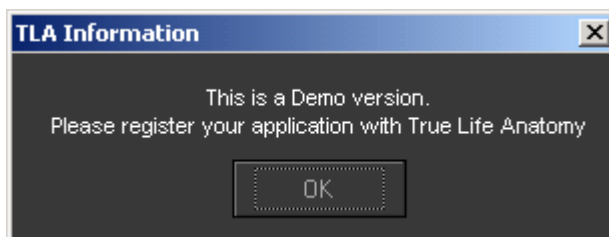
1. From the Start menu, select Programs → TLA → TLA Generator → TLA Generator  
- or -  
Double-click the TLA Generator icon on the desktop.
2. The Confidentiality screen appears.



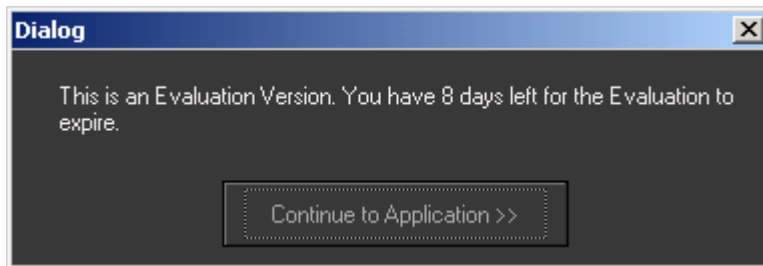
Choose to accept or not accept the license agreement. If you do not accept the license agreement, exit the application by clicking I Don't Accept.

If you accept the license agreement, the application allows the user to continue to use the software.

3. If you haven't registered the product, you will get the following message asking you to register the product. By registering the software and sending the registration file to technical support, you will be sent an authorization application which will allow you to use the software past the initial grace \ demo period.



4. On click of the OK button, another TLA Information dialog appears informing the number of days left for the user to register the product before it expires.



Click the button Continue to Application to start using the application.

Note - If the user has done a successful registration, step 3 and 4 doesn't appear and the TLA Generator Main menu is displayed.

2. Click File → Open and choose a file.
3. Click File → Open Recent to open a previous file.
4. For the creation of a new 3D model, TLA Generator can only load in data in DICOM format with an associated DICOM dir.

## What is a DICOM file?

DICOM standard is the format used to import and share scan data. Digital imaging and communications in medicine (DICOM) was created to aid the distribution of reviewing of medical images such as CT scans, MRIs and ultrasounds. It allows for different manufacturers machines and work stations to share digital data. It is a standard developed by the American College of Radiology and the National Equipment Manufacturers Association to define the connectivity and communication protocols of medical imaging devices and comprises a number of parts, Part 10 of which deals with the distribution of specific image data.

A patient's CT scan or MRI scan data contains multiple DICOM (.dcm) files that correspond to each slice. Each CT scan slice corresponds to a single DICOM file and each slice contains:

- A. Header (which stores patient and scan data) and
- B. The scan data – the scanned image data can be compressed using formats such as JPEG, or uncompressed as BMP.

Specific programs are required to read DICOM image data. More details on "links" page at [www.truelifeanatomy.com](http://www.truelifeanatomy.com)

## What is a DICOM (Dir)?

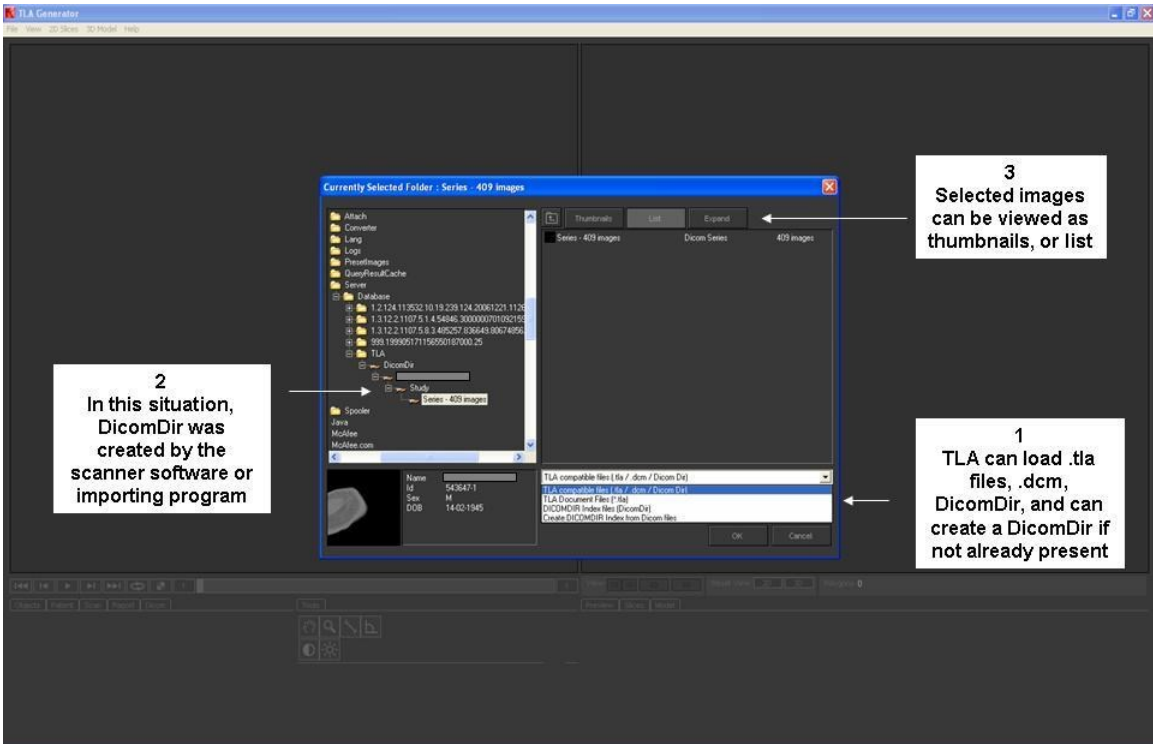
Due to the large number of DICOM files that are often within a data set, reading the data is easier if there is an attached directory file (DICOM Dir). Most (but not all) CT scanner and MRI scanner work stations will create and then export a DICOM Dir file with the DICOM image data set. Many graphics programs require the DICOM Dir file to assist in loading the data set and TLA Generator and TLA Viewer are no exception. The TLA software however can create its own DICOM Dir if the data set does not contain this information.

For more details go to TLA Generator [FAQ pages](#)

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### Opening a DICOM file

1. Click File → Open or use the shortcut key Ctrl + O
2. Use the following File types to choose a DICOM DIR file
  - All TLA valid formats
  - DICOM DIR Index Files



1. TLA Generator can load .tla files and .dcm file (set of 2 or more), but needs a DicomDir to load the dicom files.
2. Dicom Dir is commonly created by the third-party importing program or CT scanner software.
3. Series if CT images can be expanded and seen as a list or thumbnails.

3. Search the file using list or thumbnails option.
  - The list option will display the folder / file name, type of the file and the size of the file.
  - The thumbnails will display the folder / file as appropriate images with their name

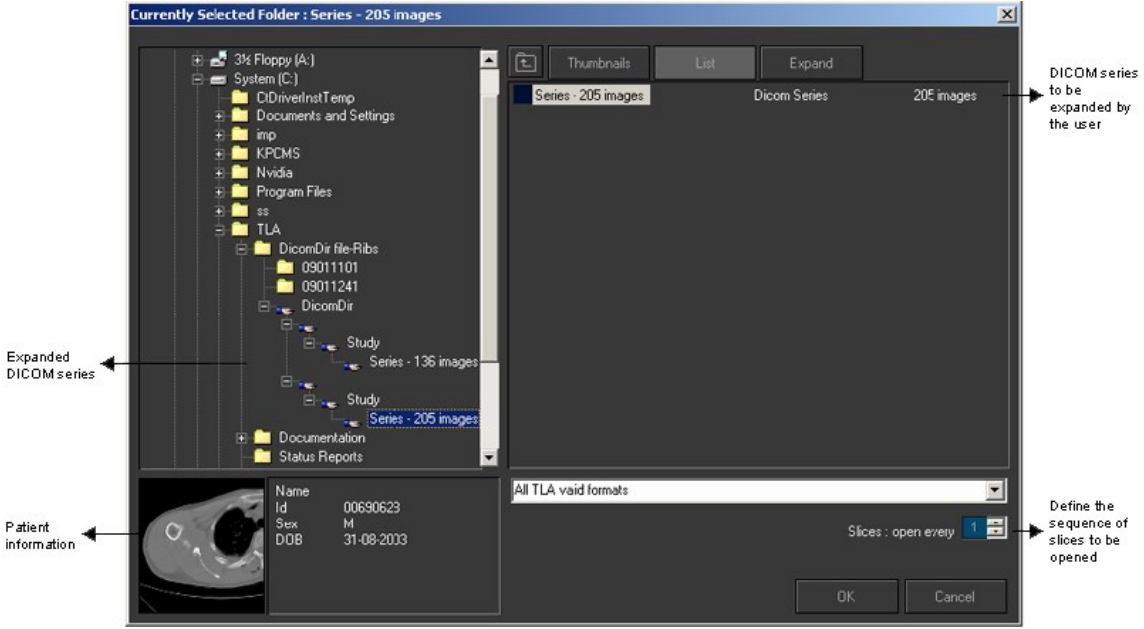
Note - Use the up button to search the parent folder for the appropriate file



4. On selecting a DICOM Dir file, different series associated with the DICOM DIR file are automatically displayed in the left-hand side. From the right-hand side, the user can manually expand the DICOM DIR file by double clicking with the right mouse button on the series name.


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5. Select a DICOM series and in the bottom right-hand side, choose the number of slices to be opened by entering the number in the "Slices: open every" field.  
 Note – The user has the facility to choose the number of slices from 1 to 10 only.
6. The patient information associated with the DICOM series is displayed in the bottom left-hand side.



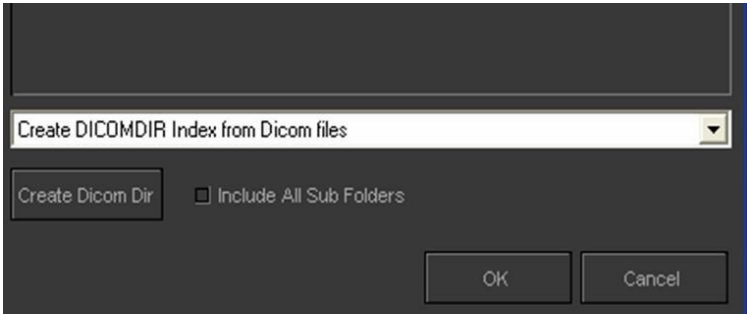
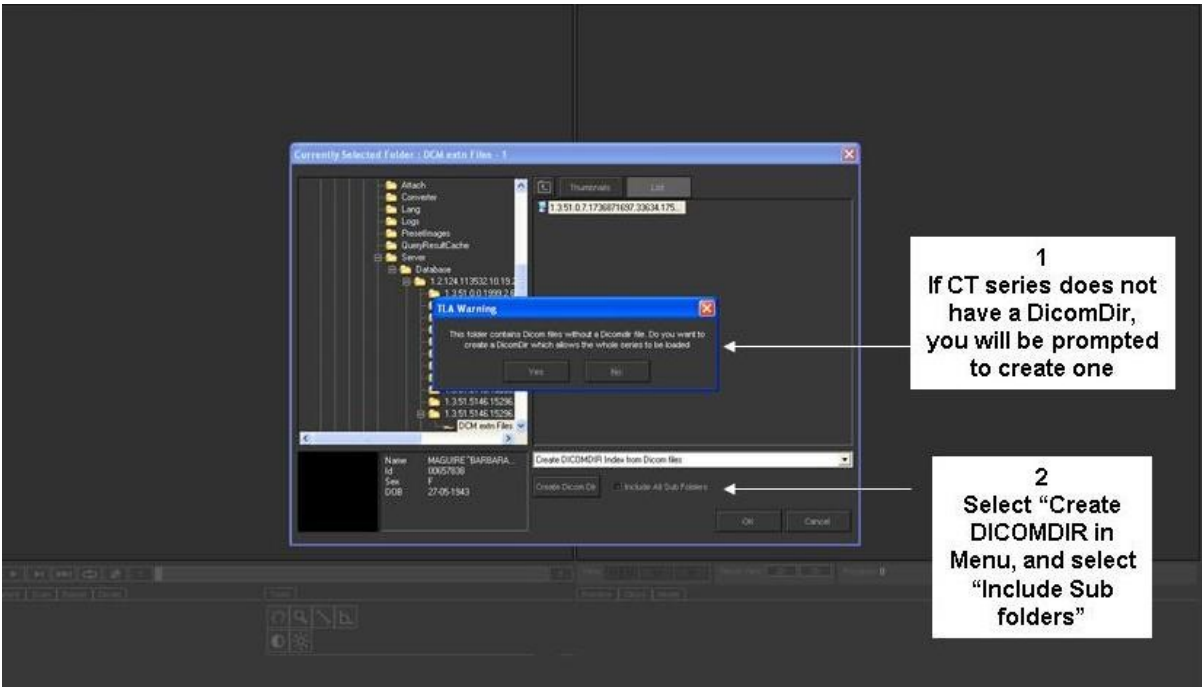
7. Once the required DICOM data set is identified and selected, click OK and the data will be loaded and a Preview model created.

**Creating a DICOM DIR file**

1. Click File → Open or use the shortcut key Ctrl + O
2. Use the following File types to create a DICOM DIR file
  - a. RAW DICOM file
3. Search the folder of DICOM files using the list or thumbnails option.
  - a. The list option will display the folder / file name, type of the file and the size of the file.
  - b. The thumbnails will display the folder / file as appropriate images with their name.
4. Note - Use the up button to search for the appropriate parent folder 
5. On identifying the folder, click the update button which creates the dynamic DICOM DIR file for files in this location. The Include All Sub folder check box is set if the user needs to go through all the sub folders to search for the DICOM file and create different series. Make sure you do not start too high up the tree with this action, as all Subfolders will be included, which can include a large amount in image data.



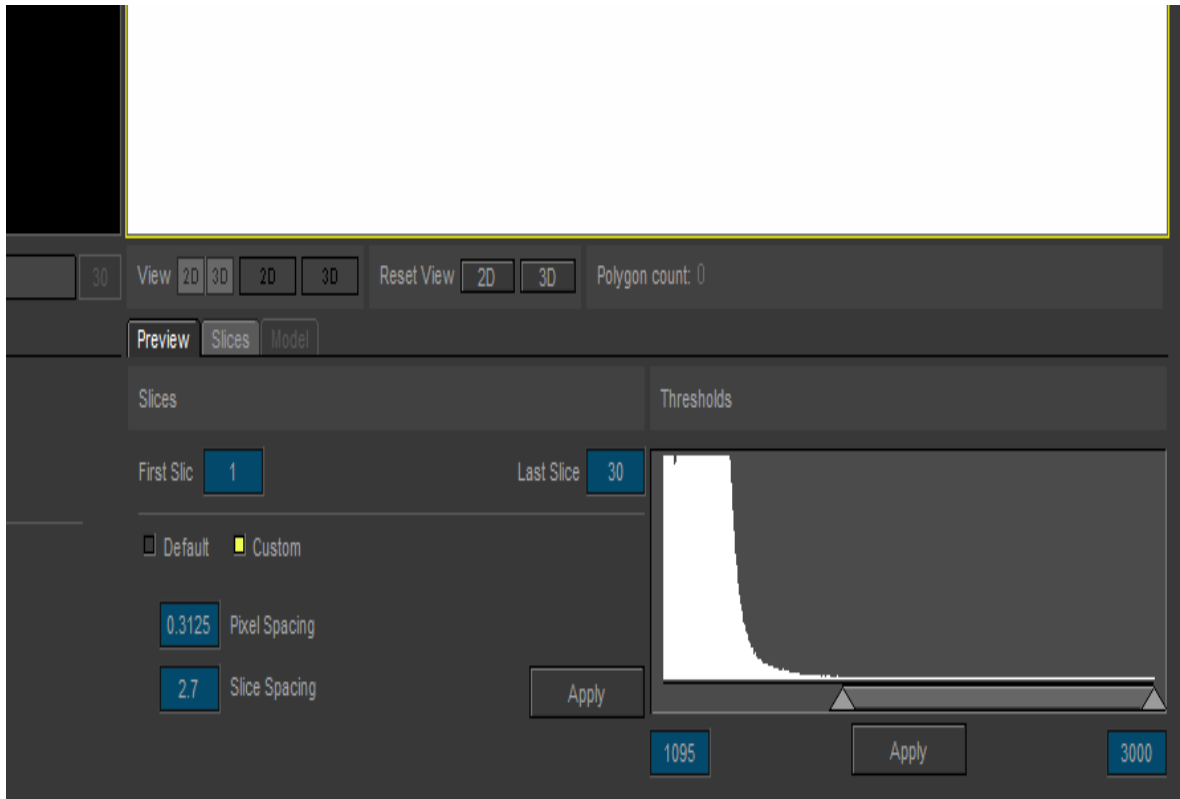
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Note – This dynamic DICOM DIR file is created only once residing in RAM and therefore it cannot be saved.

6. Once the DICOM Dir is created select the required series and proceed to load the data as detailed under “Opening a DICOM file”
7. Large volumetric data sets can challenge some computer memory resources. Exceeding memory capacity may cause the application to crash, unloading, or when saving the model.  
**Restricting the number of slices to 100, usually avoids such issues.**
8. In large slice data sets, the target region can be selected using Shift + Up or Down arrow, and then select every 2<sup>nd</sup> or 3<sup>rd</sup> slice loaded to restrict the data demand but still cover the desired region.
9. If exported from the scanning device using usual Dicom Tag format, the TLA Generator program is able to capture critical spatial scan details from the Dicom header viz: Pixel Spacing and Slice Spacing.

10. Slice Spacing (not Slice Thickness) is required to create a 3D model, and the program can usually automatically adjust for alternate (every second) or other non-consecutive slice loading.
11. If the Dicom details are not recorded using Dicom Tags that TLA Generator recognizes, a preview model will not appear.
12. These critical spatial details can be identified and inserted manually using the Custom tab in the Preview window.



13. Pixel Spacing (0028,0030) and Slice Spacing (0018,0088) are usually recorded in the Dicom Header.
14. If Slice spacing (not slice Thickness) is not recorded in the Dicom header it may need to be identified from the Dicom Reader Slice GUI, and recorded manually, making allowance for non-consecutive slice selection.
15. Always click Apply after each change or selection.
16. Once the Preview model appears, click Apply and then select the Slices Tab to create the 3D model or perform other slice manipulation or selection as detailed below.

## Preview the 3D Model or manipulate the 2D slice data set

**On loading the scan data, the program automatically opens in the Slices Window.** If a modification of the slice selection or pixel spacing is required, this can be achieved by selecting the Preview window. This is usually not required, but gives the flexibility if the preview model looks distorted.

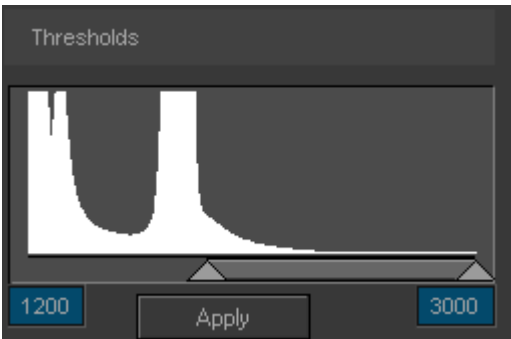
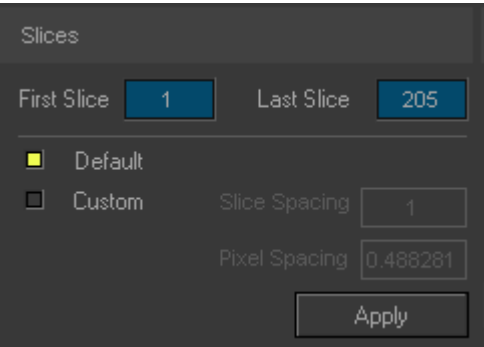
### Manipulating the slices in the Preview Window

1. Click to enter the first starting slice from the total slices.
2. Click to enter the last slice.  
Example - From a list of 205 slices the user can manipulate the starting slice as 5 and the last slice as 100.

Tip – On some occasions the first slice of a sequence may not actually belong to the current series being loaded. If the first slice doesn't belong to this series, then set your first slice to start slice from 2 or 3 to have a clean 3D model.

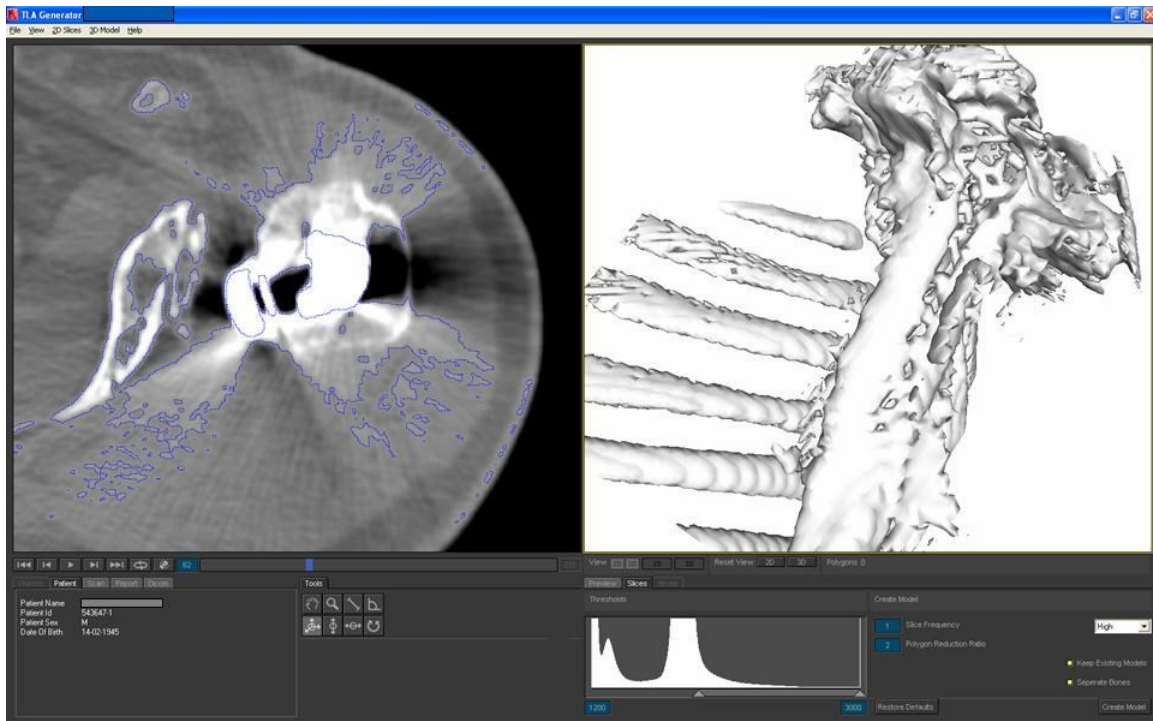
3. Accept the default settings of the slice and pixel spacing.
4. Click Custom check box to vary the slice spacing and pixel spacing. By default, these values are derived from the DICOM series. The values are determined by the original settings used to create the scanned images.
5. Click Apply button to save the changes.

Tip – If the preview 3D model is not in shape, that is if it looks abnormal, then check the slice spacing. Generally, it should be in the range of 0.5 to 1. On some occasions the Slice Spacing may be less accurate due to inconsistent data and so manually setting this value can give you a better result.



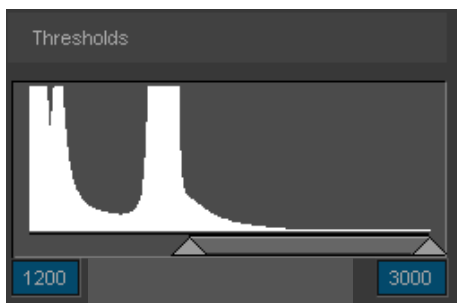
## Manipulating threshold in the Slices Window

The threshold can be manipulated in the Preview or the Slices window. These instructions work for either the Preview Window, or the Slices Window. The scan data will automatically load in the Slices Window.









1. Try changing the minimum and maximum threshold range to get a good 3D Preview model.
2. As the user manipulates the threshold, the changes are reflected in the 3D preview model.
3. If in the Preview Window, Click Apply, if you are happy with the 3D Preview model. This saves and passes on the values to the Slices window where the model creation is actioned when you are ready to generate your 3D model.

Tip – Generally the threshold range for a bone is from 1200 to 3000. This is set as default. Varying the threshold range from this can give you outer skin, soft-tissue or other internal surfaces.




## Manipulating the 2D Slice data

The following tools enable the user to navigate through the 2D Slices.

Name	Toolbar	Menu Access	Description	Shortcut
Pan		View → Pan	Tool to move or drag the 2D image	Space bar
Zoom		View → Zoom In / Out	Tool to Magnify in or out the 2D image	Ctrl + +
Measure Distance		2D Slices → Measure Distance	Tool to measure the distance in millimeters between two points	D
Measure Angle		2D Slices → Measure Angle	Tool to measure the angle in degrees	A
Adjust Contrast		2D Slices → Contrast	Tool to manipulate the contrast of the 2D image	C
Adjust Brightness		2D Slices → Brightness	Tool to manipulate the brightness of the 2D image	B

The following tools manipulate the 2D slice image.

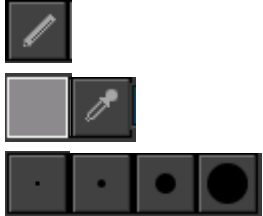
Splines		2D Slices → Splines → Create Splines Edit Splines Remove Splines	To manipulate the 2D image the Spline tools are used to apply new boundaries between bones as represented within the slice data image. Each level can be done separately, or applied to all below the current slice	
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The Splines tool creates boundaries and spaces between bones which then alters the 3D model respectively.

When boundaries are created or re-defined by using such tools as the Splines tools, the re-definition or enhancement of boundaries between bone densities and soft tissues allows for much cleaner separation of bones.


When boundaries are not clearly defined by the software automatically or by using the threshold data applied, the user may use these tools such as the spine tools to "assist" the software to obtain clean bone definitions and separation by manual creation of these boundaries.

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Draw		2D Slices → Draw	To manipulate the 2D Image the Draw Tool allows slice data to be modified, to remove artefact, add new object, highlight feature not isolated on threshold adjustment by first picking the colour and then applying the colour
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The Draw tool applies the selected threshold by painting this onto the 2D image. These threshold values are later used when creating surfaces. Boundaries are created or re-defined by using such tools as the Draw tools. The re-definition or enhancement of boundaries between bone densities and soft tissues allows for much cleaner separation of bones and surface creation. When boundaries are not clearly defined by the software automatically or by using the threshold data applied, but obvious to the user, the user may use these tools such as the Draw tools to "assist" the software in obtaining clean bone definitions and separation by manual creation of these boundaries or thresholds.

Tip – The draw tool can be used to remove unwanted pieces of noise by simply painting over the noise on the 2D image with a common threshold setting that can either be outside of the threshold setting or simply "welding" the noise into one to be later separated or deleted as a whole object.

Fill		2D Slices → Fill	To manipulate the 2D image, the fill option is used to fill an area with a common threshold value. This value is set to a density not common with bones. This is used to remove inner "walls" within bones thus causing multiple surfaces within a bone. The fill tool can be applied to one slice or all slices.
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The fill tool is used to remove inner walls or boundaries causing the effect of cavities or holes within bones. The inner walls or cavity edges are removed and filled in with threshold values that do not represent bone density and so removing internal surfaces and "walls" that may not be required to the user. This also reduces the size of the model due to reduced number of polygons created and also allows for a cleaner model to be generated, thus ensuring cleaner separation when using separate tools.

## Working with Frames

Button	Menu Access	Description	Shortcut
	2D Slices → Go to First Slice	Tool to go to the first slice image in the sequence.	Home
	2D Slices → Previous slice	Tool to go to the previous slice image in the sequence.	Page Up
	2D Slices → Play / Stop	Tool to play the entire sequence of slice images sequentially. The button toggles from play to stop operations.	Enter
	2D Slices → Next slice	Tool to go to the Next slice image in the sequence.	Page Down
	2D Slices → Go to Last Slice	Tool to go to the last slice image in the sequence.	End
	2D Slices → Loop	Tool to loop or play once the entire slice image sequence. The button toggles from play once to loop operations.	\
	2D Slices → Show / Hide 2D Plane	Tool to Display or Hide the 2D plane in the 3D Model view workspace corresponding to the 2D Slice image location within the sequence and on the 3d model.	Alt + P
	2D Slices → Go to Slice Number	This is an editable field used to go to a 2D Slice image within the loaded sequence. Enter a valid sequence number and press enter to jump straight to this 2DSlice image. If the 2D plane is active, the location will also update within the 3D model view workspace to reflect the corresponding 2Dslice location on the 3D model.	/

## Viewing and navigating the 3D Model

The following tools enable the user to navigate through the 3D preview model.

Name	Toolbar	Menu Access	Description	Shortcut
Pan		View → Pan	Tool to move or drag the 3D model image	Space bar
Zoom		View → Zoom In / Out	Tool to magnify into or out of the 3D model image	Ctrl + + Ctrl + -
Measure Distance		3D Model → Measure Distance	Tool to measure the distance in millimeters between two points that reside on the 3D surface or perpendicular to your 2D view. 2 values are given	D
Measure Angle		3D Model → Measure Angle	Tool to measure the angle in degrees on a 2D plane perpendicular to your view	A
Rotate free		3D Model → Rotate Free	Tool to freely rotate the 3D Model	F
X-Axis rotation		3D Model → Rotate X	Tool to rotate the 3D Model about the X-axis	X
Y-Axis rotation		3D Model → Rotate Y	Tool to rotate the 3D Model about the Y-axis	Y
Z-Axis rotation		3D Model → Rotate Z	Tool to rotate the 3D Model about the Z-axis	Z



**Patient information**

Objects	Patient	Scan	Report
Patient Name			
Patient Id	204848-1		
Patient Sex	M		
Date Of Birth	03-11-1958		

The patient information – Name, Id, Sex and the Date of Birth are un-editable and they are automatically derived from scan information created at the time the patient was scanned.

**Scan Information**

Objects	Patient	Scan	Report
Study Date	31-08-2003		
Study Time	112057.000000		
Modality	CT		
Institution			
Physician	1		
Series Desc			
SeriesInstUID			
SeriesNos			
Version Time			

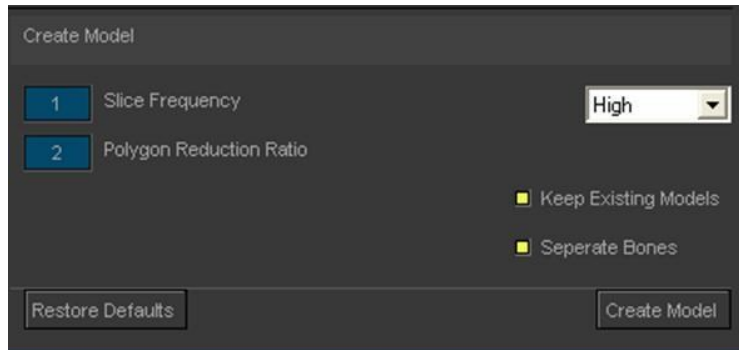
The Scan information is un-editable and is automatically derived from scan information created at the time the patient was scanned.

**Report**

Objects	Patient	Scan	Report
Dr.	<input type="text"/>		
Comments	<input type="text"/>		

The physician / radiology team can put in their comments in this area for further reference.

## Model creation






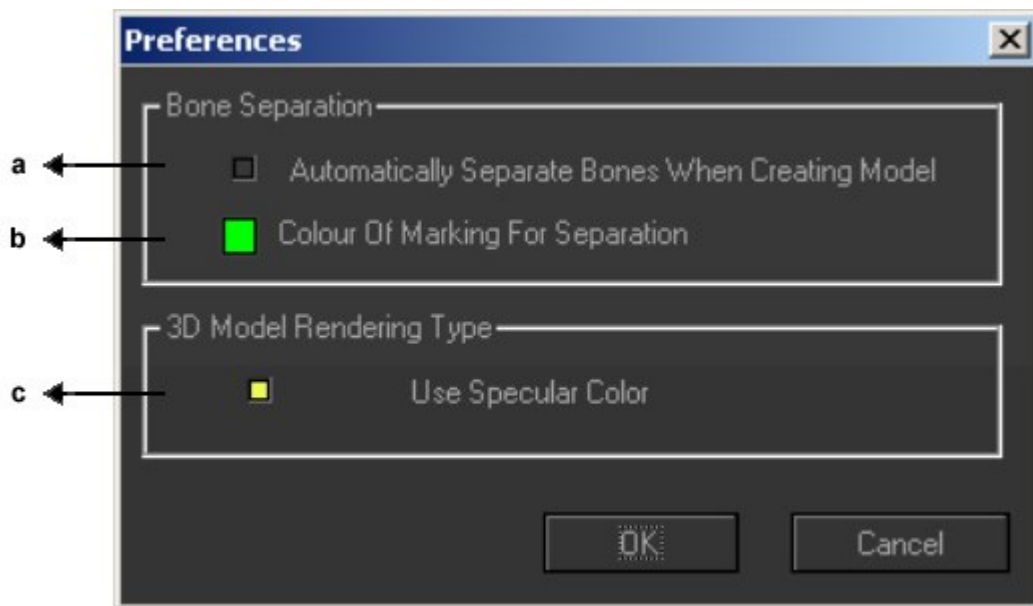
1. Choose the default resolution of the model to be created. The user has the facility to choose from the default settings varying between Low, Medium and High.
2. Choose custom to manipulate the Polygon Reduction Ratio and the Slice frequency.  
The Polygon Reduction Ratio values are used to reduce the number of polygons used to generate your model. A higher value here will generate a less dense model with less definition but smaller file size.  
Slice Frequency relates to the number of slices to be used, in other words a value of 2 would mean use every 2<sup>nd</sup> slice for generating the model as opposed to a value of 1 which uses every slice.  
Increasing the Slice Frequency or Slice Shrink Ratio decreases the overall size and definition of your model.
3. Choose to keep the checkbox "Keep Existing model" checked so that all the previous models created are available and they are not deleted.
4. Choose to keep the checkbox "Keep Existing model" un-checked so that all the previous models created earlier are deleted.
5. Click create model for the 3D Model to be created.

## Working with the TLA Model

(Model needs to be enabled for manipulation – see page 26, point 8. Selected object can be disabled to prevent manipulation)

### Using Separate function

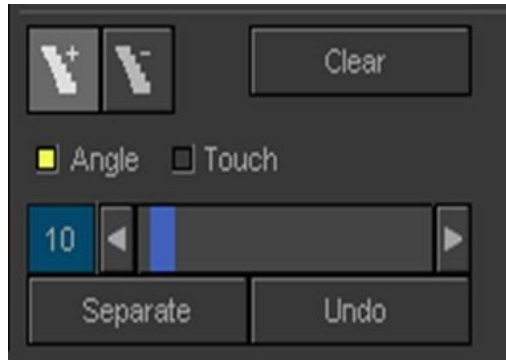
1. Click the Separate tool - .
2. The Select tool -  and the Deselect tool -  appears. These tools can be initiated also from the menu 3D Model → Mark for Separation → Select / Deselect
3. From the menu click File → Preferences and set the preferences you need to use whilst using separation tools.



- a. Click this checkbox as a preference to automatically separate the whole 3D model into multiple bones grouped together. The polygons which fall under the defined angle which is set within the separation tools, groups together and forms separate groups of polygons or bones.
- b. Set this option to define the colour of the selected group of polygons or bones while separating.
- c. Set this option to increase the specular (shows reflection) color which provides a prominent shine or polished look to the bones.

Tip: Making your 3D model with a shiny surface can help in highlighting certain surface deformations existing in your model.

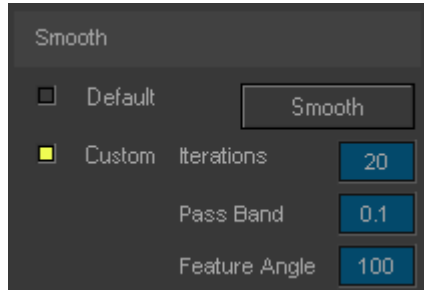
4. The polygons can be selected to create a separate object within the model by using the **Angle** selection tool, or the **Touch** tool.
5. On clicking the select tool, set the angle of the polygons either by entering the value into the editable field or by using the slider bar varying from 0 to 360 degrees.



6. Select either Angle or Touch and then move the cursor onto the 3D model and click on the region of selection to mark polygons to be separated from the bigger model. All the continuous regions which have similar polygon angles are painted with the colour specified in the preferences and marked for separation. You can continue to add to your selection by clicking on multiple places of interest which need to be grouped as a single bone. This requires some patience and trial and error.
7. Polygons can also be selected using the touch tool. This selected concentric rings of contiguous polygons with the spread dependent on the number in the slider selected. Both tools can be used sequentially and repeatedly in the same separation action. Polygons can be similarly removed from the selection using the De-select tool and then using the Angle and Tool functions.
8. If you are happy with the selection, then click the Separate button.
9. If you are not happy with the last done selection, click Undo button
10. If you are not happy with any of the previous selections click clear. This clears all of your selections totally and resets your model with no polygons marked for separation.
11. To deselect the previously selected regions, use the Deselect tool to unmark polygons. These polygons or regions should change back to their original colour indicating they are no longer marked for separation.
12. Only one object can be segmented at one time, and if you touch another, the previous selection work may be lost. This can sometimes be retrieved by clicking Undo.

13. A separate object is thus created in the Object tree, which can be renamed or recolored.

## Using the Smooth function



1. Smooth function using Default attributes  
The user has the facility to create smoother models by accepting the default attributes – with 20 iterations, with pass band set to 0.1 and the feature angle set to 100.
2. Smooth function using customized attributes  
The user has the facility to create smoother models by manipulating the iterations, Pass Band and the Feature angle. As the iterations increases, the model becomes smoother.

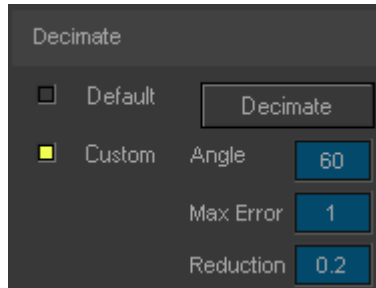
Iterations indicates how many times to run the "smoothing" algorithm. The higher the value, the smoother the result.

Pass Band is used to determine how much to smooth. The range is between 0 – 2. Smaller values result in smoother results.

Feature Angle is used to determine whether an edge is a feature or not. Polygon normals between an edge whose angles are less than the feature angle will result in this edge been treated as a feature of the model and will try to incorporate this in the final smoothed result.

3. Use the Undo button to undo the last smooth function initiated by the user. As this is a 3D function, only the very last function can be undone.

## Using the Decimate function



### 1. Decimate function using Default attributes

The user has the facility to reduce the size of the 3D model by minimizing the number of polygons based on which the model is created. Use the default attributes – angle set to 60, with 1 maximum error and 20 percent reduction.

### 2. Decimate function using customized attributes.

The user has the facility to reduce the size of the model by manipulating the angle, increasing the maximum error allowed or by the reduction percent. If the user sets 0.5 as the reduction value, the model would get a higher reduction or be reduced in size by 50 percent, but the user needs to arrive at a correct value without manipulating the model heavily.

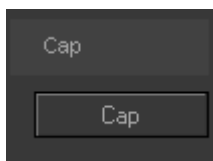
**Angle:** Polygons will be decimated if the angle between the normals is smaller than the "Decimator" angle.

**Max Error:** This value is used to determine how aggressively to decimate. Smaller value will result in a greater resemblance to the original object. Greater values mean more polygons removed and so may result in an unrecognizable result.

**Reduction:** This value is the target proportion of polygons to remove. Range is 0 -1 where a value of 0.2 results in 20 percent reduction.

### 3. Use the Undo button to undo the last decimate function initiated by the user.

## Using the Cap function



This function enables the user to cap all the holes in the 3D model. Use the Undo button to undo the last cap function initiated by the user. Capping is whereby a surface is created to cover up or remove a hole or cavity on the 3D model. Cavities or holes can be created due to the result of separation of polygons.

**Tip –** Use this tool to improve the aesthetics of your final 3D model.

## Saving the TLA file

1. When the user is happy with the 3D Model and the 2D slices, you can save the 3D model along with the 2D slices as a TLA file either by clicking File → Save or File → Save As.
2. Save the file in a specific directory / folder.
3. Further use of Save function will save the latest modifications.  
Tip: A TLA file can only be saved after a 3D model has been generated.

TLA files contain the following properties and information.

2D images	–	The sequence of 2d scans used to generate a 3d model. These are compressed into smaller files to reduce the overall TLA file size.
3D model	–	A 3-Dimensional representation derived from the 2D scan data.
Patient Data	–	Details of the patient such as date of birth, name, sex, patient-id.
Patient Report	–	A detailed report that is created by the user generating this file.
Scan Data	–	Details such as date and time of scan, institution, physician, modality etc.

## Exporting the TLA / DICOM file

1. When the user is happy with the 3D Model, set the 3D model as the active window and click File → Export as JPG.
2. Save the file in a specific directory / folder.
3. The 3D model as displayed in the window is saved as a jpeg format.
4. When the user is happy with the 2D slice image, set the 2D Slice image as the active window and click File → Export as JPG.
5. Save the file in a specific directory / folder.
6. The 2D slice image as displayed in the window is saved as a jpeg format.

Tip – 3D models and 2D images can be saved out as a snapshot window in JPG file format. This raster file or 2D image snapshot can then be used for input into your own report documents or other applications that support the JPG file format.

### Printing the TLA / DICOM file

1. When the user is happy with the 3D Model, set the 3D model as the active window and click File → Print.
2. Ensure the printer is attached to the machine.
3. Click OK and the 3D model is printed as displayed in the window
4. When the user is happy with the 2D Slice image, set the 2D Slice image as the active window and click File → Print.
5. Ensure the printer is attached on the machine.
6. Click OK and the 2D Slice image is printed as displayed in the window

Tip: When printing either a 2D image workspace window or 3D model workspace window the relevant Patient Info, Scan Info, and Report info is also printed.












## Viewing and modifying TLA File

### Opening a TLA file

1. Click File → Open
2. Choose a TLA file
3. Click OK
4. When the TLA file is opened, the 2D images contained in the file are loaded into the left workspace window and the 3D models contained in the file are loaded into the right workspace window.

### Viewing and navigating the 3D Model




The following tools enable the user to navigate through the 3D preview model.

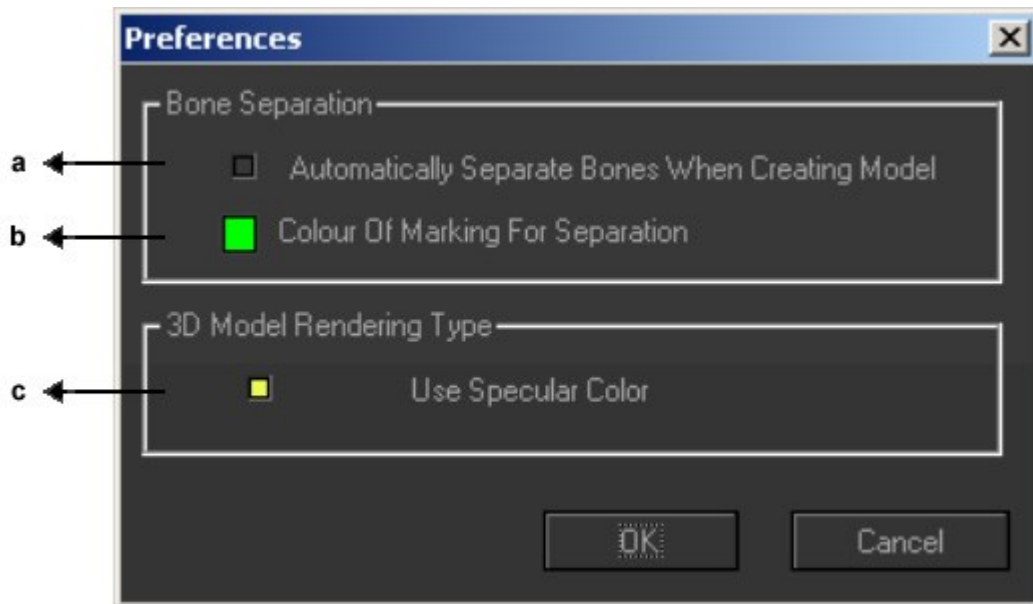
Name	Toolbar	Menu Access	Description	Shortcut
Pan		View → Pan	Tool to move or drag the 3D model image	Space bar
Zoom		View → Zoom In / Out	Tool to magnify into or out of the 3D model image	Ctrl + + Ctrl + -
Measure Distance		3D Model → Measure Distance	Tool to measure the distance in millimeters between two points that reside on the 3D surface or perpendicular to your 2D view. 2 values are given	D
Measure Angle		3D Model → Measure Angle	Tool to measure the angle in degrees on a 2D plane perpendicular to your view	A
Rotate free		3D Model → Rotate Free	Tool to freely rotate the 3D Model	F
X-Axis rotation		3D Model → Rotate X	Tool to rotate the 3D Model about the X-axis	X
Y-Axis rotation		3D Model → Rotate Y	Tool to rotate the 3D Model about the Y-axis	Y
Z-Axis rotation		3D Model → Rotate Z	Tool to rotate the 3D Model about the Z-axis	Z
Pick		3D Model → Pick	Pick an object in the 3D Model to manipulate.	P

## Modifying the TLA Model

*(Model needs to be enabled for manipulation – see page 26, point 8. Selected object can be disabled to prevent manipulation)*

## Using Separate function

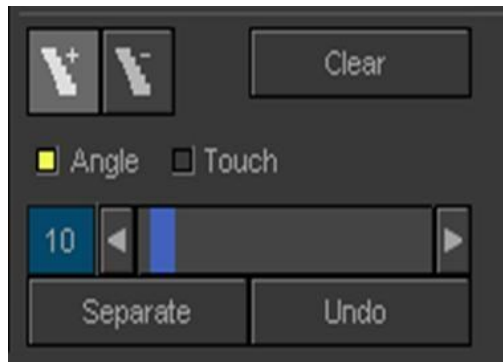
1. Click the Separate tool - .
2. The Select tool -  and the Deselect tool -  appears. These tools can be initiated also from the menu 3D Model → Mark for Separation → Select / Deselect.
3. From the menu click File → Preferences and set the preferences you need to use whilst using separation tools.



- a. Click this checkbox as a preference to automatically separate the whole 3D model into multiple bones grouped together. The polygons which fall under the defined angle which is set within the separation tools, groups together and forms separate groups of polygons or bones.
- d. Set this option to define the colour of the selected group of polygons or bones while separating.
- e. Set this option to increase the specular color that provides a prominent shine or polished look to the bones.

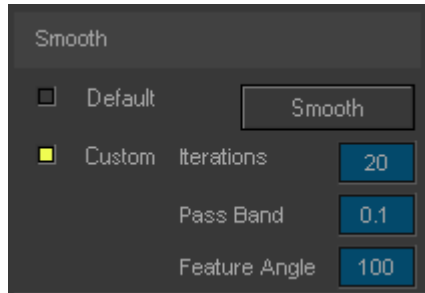
Tip: Sometimes making your 3D model with a shiny surface can help in highlighting certain surface deformations existing in your 3Dmodel.

5. The polygons can be selected to create a separate model by using the **Angle** selection tool, or the **Touch** tool.
6. On clicking the select tool, set the angle of the polygons either by entering the value into the editable field or by using the slider bar varying from 0 to 360 degrees.



7. Select either Angle or Touch, and then move the cursor onto the 3D model and click on the region of selection to mark polygons to be separated from the bigger model. All the continuous regions which have similar polygon angles are painted with the colour specified in the preferences and marked for separation. You can continue to add to your selection by clicking on multiple places of interest which need to be grouped as a single bone. This requires some patience and trial and error.
8. Polygons can also be selected using the touch tool. This selected concentric rings of contiguous polygons with the spread dependent on the number in the slider selected. Both tools can be used sequentially and repeatedly in the same separation action. Polygons can be similarly removed from the selection using the De-select tool and then using the Angle and Tool functions.
9. If you are happy with the selection, then click the Separate button.
10. If you are not happy with the last done selection, click Undo button.
11. If you are not happy with any of the previous selections click clear. This clears all of your selections totally and resets your model with no polygons marked for separation.
12. To deselect the previously selected regions, use the Deselect tool to unmark polygons. These polygons or regions should change back to their original colour indicating they are no longer marked for separation.
13. Only one object can be segmented at one time, and if you touch another, the previous selection work may be lost. This can sometimes be retrieved by clicking Undo.
14. A separate object is thus created in the Object tree, which can be renamed or recolored

## Using the Smooth function



### 15. Smooth function using Default attributes

The user has the facility to create smoother models by accepting the default attributes – with 20 iterations, with pass band set to 0.1 and the feature angle set to 100.

### 16. Smooth function using customized attributes

The user has the facility to create smoother models by manipulating the iterations, Pass Band and the Feature angle. As the iterations increases, the model becomes smoother.

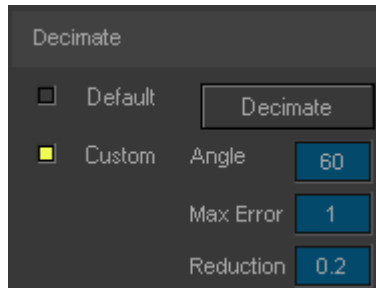
Iterations indicates how many times to run the "smoothing" algorithm. The higher the value, the smoother the result.

Pass Band is used to determine how much to smooth. The range is between 0 – 2. Smaller values result in smoother results.

Feature Angle is used to determine whether an edge is a feature or not. Polygon normals between an edge whose angles are less than the feature angle will result in this edge been treated as a feature of the model and will try to incorporate this in the final smoothed result.

### 17. Use the Undo button to undo the last smooth function initiated by the user.

## Using the Decimate function



### 1. Decimate function using Default attributes

The user has the facility to reduce the size of the 3D model by minimizing the number of polygons based on which the model is created. Use the default attributes – angle set to 60, with 1 maximum error and 20 percent reduction.

### 2. Decimate function using customized attributes.

The user has the facility to reduce the size of the model by manipulating the angle, increasing the maximum error allowed or by the reduction percent. If the user sets 0.5 as the reduction value, the model would get a higher reduction or be reduced in size by 50 percent, but the user needs to arrive at a correct value without manipulating the model heavily.

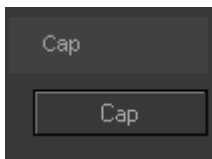
**Angle:** Polygons will be decimated if the angle between the normals is smaller than the "Decimator" angle.

**Max Error:** This value is used to determine how aggressively to decimate. Smaller value will result in a greater resemblance to the original object. Greater values mean more polygons removed and so may result in an unrecognizable result.

**Reduction:** This value is the target proportion of polygons to remove. Range is 0 -1 where a value of 0.2 results in 20 percent reduction.

### 3. Use the Undo button to undo the last 3D model function initiated by the user.

## Using the Cap function



This function enables the user to cap all the holes in the 3D model. Use the Undo button to undo the last cap function initiated by the user. Capping is whereby a surface is created to cover up or remove a hole or cavity on the 3D model. Cavities or holes can be created due to the result of separation of polygons.

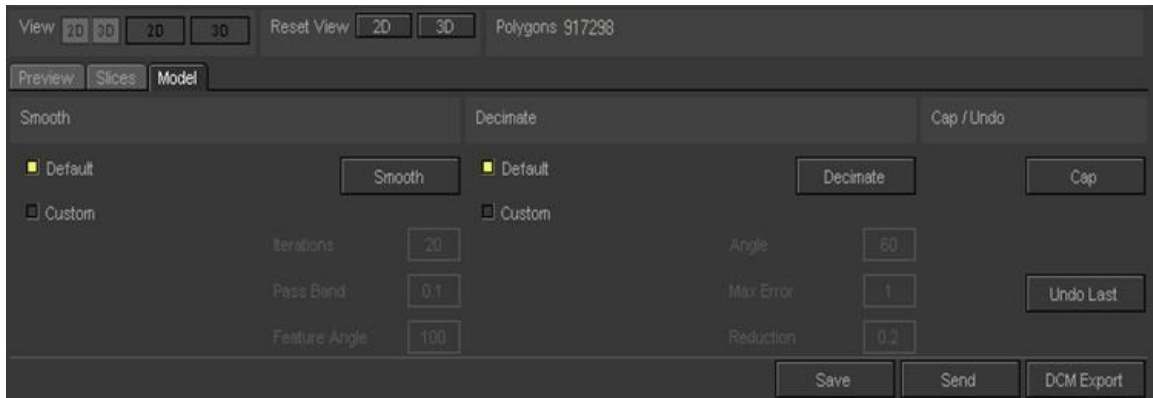
**Tip:** Use this tool to improve the aesthetics of your final 3D model.

## Saving the TLA file

1. When the user is happy with the 3D Model and the 2D slices, to save the TLA model, click File → Save As, or Click the “Save” button on the bottom right-hand corner of the Model tool bar. Save the model in an appropriate folder on your computer
2. Save the file in a specific directory / folder
3. Use the Save button to regularly save the model as you are working on it, or Save As to save it in under a separate file. Further use of Save function will save the latest modifications.  
 Tip: A TLA file can only be saved after a 3d model has been generated
4. When TLA Generator saves a file, it creates a new file containing the 3D model, compressed 2D slice images, patient and scan data plus a thumbnail snapshot of the 3D image. This is saved as a .tla file

TLA files contain the following properties and information

2D images	–	The sequence of 2d scans used to generate a 3d model. These are compressed into smaller files to reduce the overall TLA file size.
3D model	–	A 3Dimensional representation derived from the 2D scan data
Patient Data	–	Details of the patient such as date of birth, name, sex, patient-id
Patient Report	–	A detailed report that is created by the user generating this file
Scan Data	–	Details such as date and time of scan, institution, physician, modality etc.



8. The Send button will open the model in the **TLA Animator** Virtual Surgery program if it is installed.
9. DCM Export converts the .tla file into a .dcm file and exports it to a PACS environment if this is installed.
10. The Model file must be saved before using the “Send” or “DCM Export” functions. Contact tla at [info@truelifeanatomy.com](mailto:info@truelifeanatomy.com) for more information on the Send and DCM Export functions.
11. If a .tla file is selected it will load in the **TLA Viewer** program if installed.

### **Exporting the TLA / DICOM file**

1. When the user is happy with the 3D Model, set the 3D model as the active window and click File → Export as JPG.
2. Save the file in a specific directory / folder
3. The 3D model as displayed in the window is saved as a jpeg format.
4. When the user is happy with the 2D slice image, set the 2D Slice image as the active window and click File → Export as JPG.
5. Save the file in a specific directory / folder
6. The 2D slice image as displayed in the window is saved as a jpeg format

Tip: 3D models and 2D images can be saved out as a snapshot window in JPG file format. This raster file or 2D image snapshot can then be used for input into your own report documents or other applications that support the JPG file format.







### **Printing the TLA / DICOM file**

1. When the user is happy with the 3D Model, set the 3D model as the active window and click File → Print.
2. Ensure the printer is attached to the machine.
3. Click OK and the 3D model is printed as displayed in the window.
4. When the user is happy with the 2D Slice image, set the 2D Slice image as the active window and click File → Print.
5. Ensure the printer is attached to the machine.
6. Click OK and the 2D Slice image is printed as displayed in the window

Tip: When printing either a 2D image workspace window or 3D model workspace window the relevant Patient Info, Scan Info, and Report info is also printed.

## Viewing and Navigating 2D Slices

The following tools enable the user to navigate through the 2D Slices.







Name	Toolbar	Menu Access	Description	Short cut
Pan		View → Pan	Move or drag the 2D image by moving the mouse.	Space bar
Zoom		View → Zoom In / Out	Magnify in or out the 2D image by moving the mouse.	Ctrl + +
Measure Distance		2D Slices → Measure Distance	Measure the distance in millimeters between two points by placing the mouse pointer on two locations.	D
Measure Angle		2D Slices → Measure Angle	Measure the angle in degrees by identifying the base by placing the mouse pointer in two locations and then identify angle drawn to the base.	A
Adjust Contrast		2D Slices → Contrast	Change the view of the 2D slice by adjusting the contrast by moving the mouse.	C
Adjust Brightness		2D Slices → Brightness	Change the view of the 2D slice by adjusting the brightness by moving the mouse.	B




## Viewing and modifying DICOM File

### Manipulating the 2D Slice data

The following tools enable the user to navigate through the 2D Slices.

Name	Toolbar	Menu Access	Description	Short cut
Pan		View → Pan	Tool to move or drag the 2D image	Space bar
Zoom		View → Zoom In / Out	Tool to Magnify in or out the 2D image	Ctrl + +
Measure Distance		2D Slices → Measure Distance	Tool to measure the distance in millimeters between two points	D
Measure Angle		2D Slices → Measure Angle	Tool to measure the angle in degrees	A
Adjust Contrast		2D Slices → Contrast	Tool to manipulate the contrast of the 2D image	C
Adjust Brightness		2D Slices → Brightness	Tool to manipulate the brightness of the 2D image	B

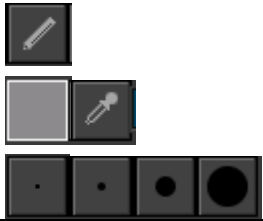
The following tools manipulate the 2D slice image.

Splines		2D Slices → Splines → Create Splines Edit Splines Remove Splines	To manipulate the 2D image the Spline tools are used to apply new boundaries between bones as represented within the slice data image. Each level can be done separately, or applied to all below the current slice	
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The Splines tool creates boundaries and spaces between bones which then alters the 3D model respectively.


When boundaries are created or re-defined by using such tools as the Spine tools, the re-definition or enhancement of boundaries between bone densities and soft tissues allows for much cleaner separation of bones. When boundaries are not clearly defined by the software automatically or by using the threshold data applied, but obvious to the user, the user may use these tools such as the Splines tools to "assist" the software in obtaining clean bone definitions and separation by manual creation of these boundaries.

# TRUE LIFE ANATOMY

Draw		2D Slices → Draw	To manipulate the 2D Image the Draw Tool allows slice data to be modified, to remove artefact, add new object, highlight feature not isolated on threshold adjustment by first picking the colour and then applying the colour
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The Draw tool applies the selected threshold by painting this onto the 2D image. These threshold values are later used when creating surfaces. Boundaries are created or re-defined by using such tools as the Draw tools. The re-definition or enhancement of boundaries between bone densities and soft tissues allows for much cleaner separation of bones and surface creation. When boundaries are not clearly defined by the software automatically or by using the threshold data applied, but obvious to the user, the user may use these tools such as the Draw tools to "assist" the software in obtaining clean bone definitions and separation by manual creation of these boundaries or thresholds.

Tip: The draw tool can be used to remove unwanted pieces of noise by simply painting over the noise on the 2D image with a common threshold setting that can either be outside of the threshold setting or simply "welding" the noise into one to be later separated or deleted as a whole object.

Fill		2D Slices → Fill	To manipulate the 2D image, the fill option is used to fill an area with a common threshold value. This value is set to a density not common with bones. This is used to remove inner "walls" within bones thus causing multiple surfaces within a bone. The fill tool can be applied to one slice or all slices.
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The fill tool is used to remove inner walls or boundaries causing the effect of cavities or holes within bones. The inner walls or cavity edges are removed and filled in with threshold values that do not represent bone density and so removing internal surfaces and "walls" that may not be required to the user. This also reduces the size of the model due to reduced number of polygons created and also allows for a cleaner model to be generated, thus ensuring cleaner separation when using separate tools.

## Exporting the DICOM file

1. When the user is happy with the 3D Model, set the 3D model as the active window and click File → Export as JPG.
2. Save the file in a specific directory / folder
3. The 3D model as displayed in the window is saved as a jpeg format.
4. When the user is happy with the 2D slice image, set the 2D Slice image as the active window and click File → Export as JPG.
5. Save the file in a specific directory / folder
6. The 2D slice image as displayed in the window is saved as a jpeg format

Tip: 3D models and 2D images can be saved out as a snapshot window in JPG file format. This raster file or 2D image snapshot can then be used for input into your own report documents or other applications that support the JPG file format.

## Printing the DICOM file

1. When the user is happy with the 3D Model, set the 3D model as the active window and click File → Print.
2. Ensure the printer is attached to the machine.
3. Click OK and the 3D model is printed as displayed in the window
4. When the user is happy with the 2D Slice image, set the 2D Slice image as the active window and click File → Print.
5. Ensure the printer is attached to the machine.
6. Click OK and the 2D Slice image is printed as displayed in the window

Tip: When printing either a 2D image workspace window or 3D model workspace window the relevant Patient Info, Scan Info, and Report info is also printed.

## Service and Support

**Check web site for current telephone numbers:**

**<http://www.truelifeanatomy.com>**

### **Contacting TLA Technical Support**

Email – [support@truelifeanatomy.com](mailto:support@truelifeanatomy.com)

### **Contacting TLA Licensing Technical Support**

Email – <mailto:support@truelifeanatomy.com>

### **Clinical issues**

[clinical@truelifeanatomy.com](mailto:clinical@truelifeanatomy.com)

RuBaMAS is the shop front for TLA software.

Go to [www.rubamas.com](http://www.rubamas.com) for examples, samples and instructions.