

DeskArtes

3Data Expert 8.1

Quick Start Guide

Fourth Edition

Ismo Mäkelä: “3Data Expert 8.1: Quick Start Guide”.

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3Data Expert 8.1: Quick Start Guide

FOREWORD.....	4
LESSON 1 – FULLY AUTOMATIC STL FIXING	5
<i>Auto Repair process for STL files</i>	5
<i>Basic viewing commands</i>	11
<i>Selecting objects</i>	13
LESSON 2 - SPLITTING AND COMBINING STL.....	15
<i>Splitting the dino model</i>	15
<i>Creating the pins</i>	19
FURTHER READING	22

Foreword

The *3Data Expert 8.1: Quick Start Guide* document provides an introduction to the basic 3D model handling: triangle model repair and model splitting with 3Data Expert Software. The *Quick Start Guide* document and the geometry files for the examples are found in the *Tutorials* folder and its sub-folders in the 3Data Expert installation directory.

There are two simple lessons and it should not take more than 15 minutes to go through the examples.

The first lesson fixes an erroneous STL model for 3D Printing using the Auto Repair process available with 3Data Expert.

The second lesson describes methods to split and combine STL parts for 3D Printing. Large parts must be split and pins have to be added to be able to attach the manufactured parts correctly with 3Data Expert.

DeskArtes Expert Series software suite consists of several products: View Expert, Design Expert, 3Data Expert and Dimensions Expert. The View Expert is targeted for viewing, verifying, dimensioning and communicating 3D geometry information. The 3Data Expert is used for manipulation of 3D data, including surface triangulation, STL repair as well as coloring and modification, like offsetting and boolean operations. Dimensions Expert is a dedicated tool for STL repair and splitting for machines with a smaller build area. Design Expert is a tool for free form conceptual design.

Lesson 1 – Fully Automatic STL fixing

This lesson shows you how to fix an erroneous STL model for 3D Printing using the automatic tools with 3Data Expert. Before starting the lessons please make sure you have received and installed the software license from DeskArtes. If you do not have a license yet, it is very simple to request an evaluation license. First go to the *Help > About 3Data Expert* command dialog. There you can find the *Send E-mail* button (in green circle below). Press it and it will open your favorite email application to send the license request to DeskArtes.



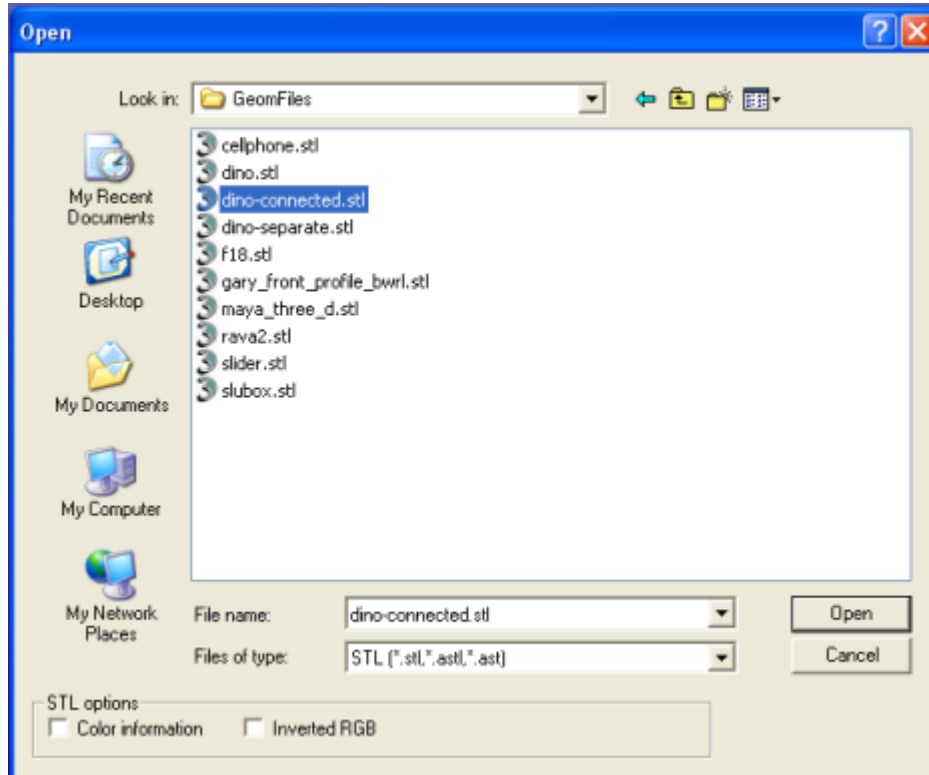
You will receive the 30 days evaluation license within 24 hours. When the license arrives, please Copy/Paste it into the appropriate field in the Help About dialog. Then press OK and restart the software.

Auto Repair process for STL files

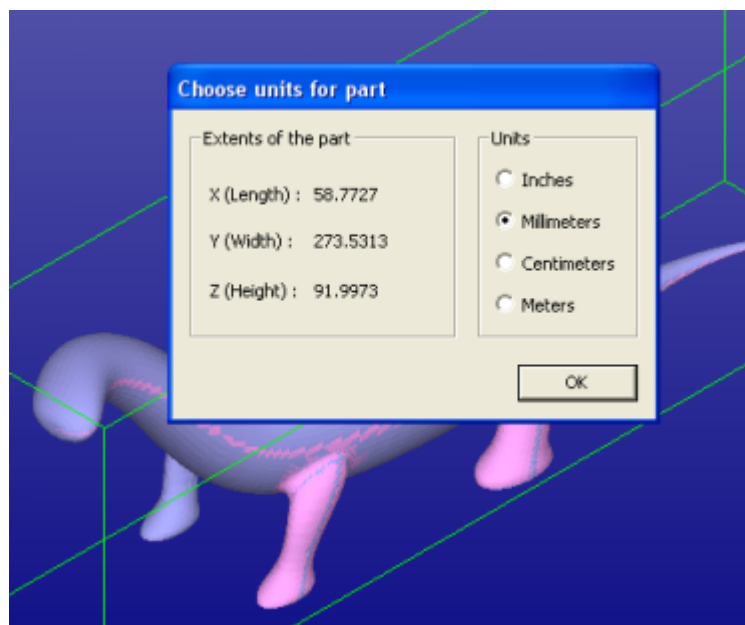
When inputting a triangulated model into 3Data Expert an automatic analysis and repair process is started. In normal everyday use you can verify and correct most of the models using the Auto Repair process.

First open the *dino-connected.stl* file in the *Tutorials/GeomFiles* directory with the *File > Open* command. Make sure the *Files of type* is *STL*:

3Data Expert 8.1: Quick Start Guide



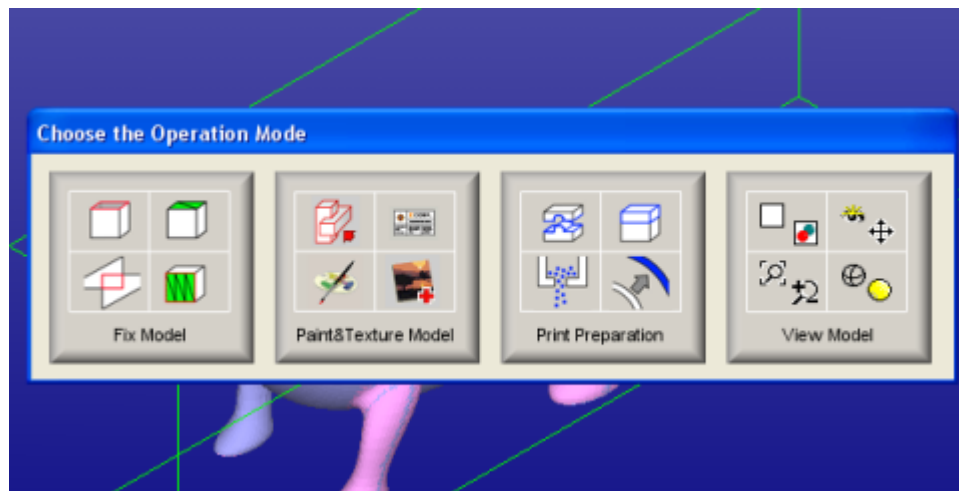
Press *Open* to bring the model into the software. You will be prompted for the units, accept the proposed units *Millimeters*:



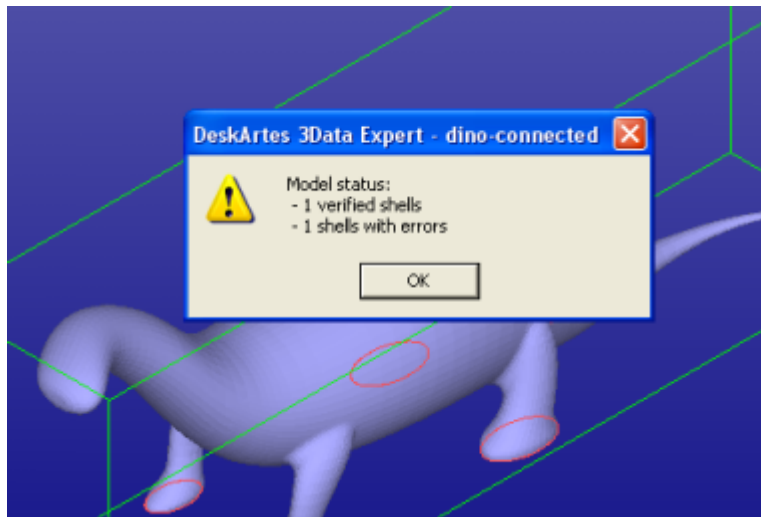
3Data Expert 8.1: Quick Start Guide

Press OK to continue and you will be prompted for the Operation Mode. 3Data Expert has three main operation modes: *Fix Model*, *Paint & Texture Model*, and *Print Preparation*, as well as a basic *View Model* mode. The different modes are used for different tasks:

- *Fix Model* takes you to automatic model verification and repair, and contains shortcuts to the main tools used for repair work;
- *Paint & Texture Model* displays the tools for painting and texturing. These tools check the model for errors and set it to “what you see is what you get” display color mode;
- *Print Preparation* shows tools for model manipulation, such as hollowing and splitting. These tools also check the model for errors;
- *View Mode* allows you to temporarily view the model and then return to Operation Mode selection.



The normal way to begin repairing a model is to start with the Fix Model mode. To start fixing **press the Fix Model button** in the Operation Mode dialog now. 3Data Expert will begin automatic model verification (*Fix Model > Verify Shells* command). The screen is erased and a progress bar appears. When the analysis is ready, a *Model status* message box is displayed

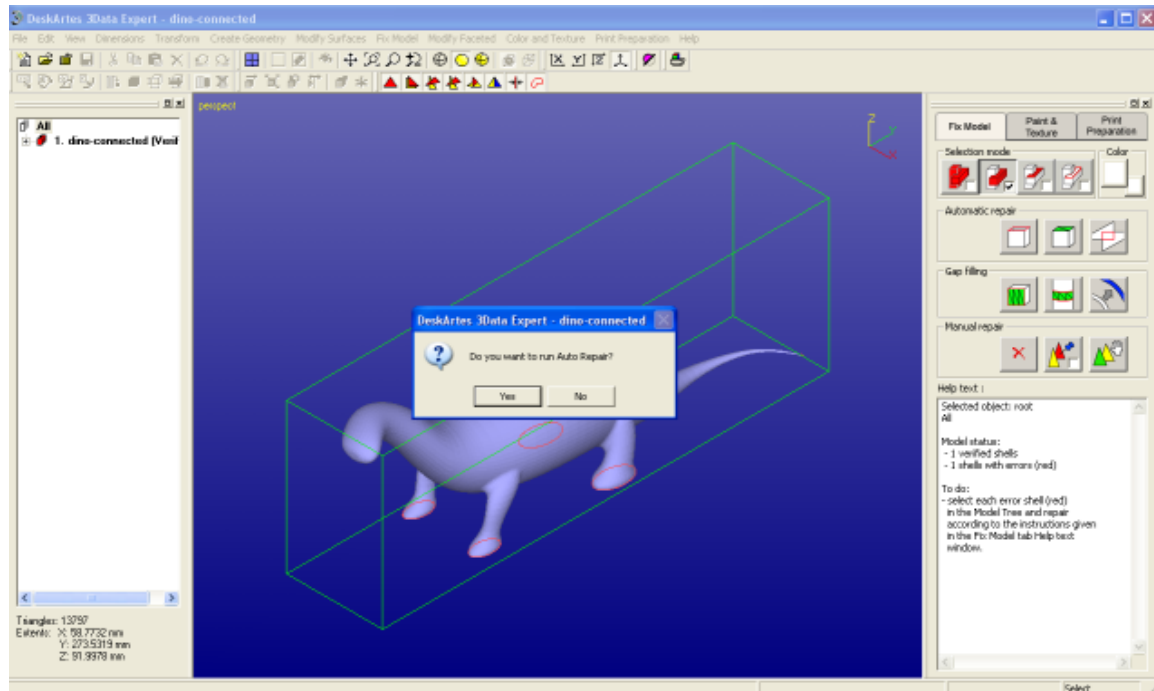


The message indicates that there is one verified shell, which also contains errors. The display shows red *Gap curves* through the surfaces. Gaps are an error type you must fix during the repair process.

The model is divided into separate shells during verification. In this case we only get one shell. **Press the OK button** in the *Model status* dialog to see the model structure in the *Model Tree* (on the left-hand side of the image that follows) as seen on the next page. The error shell has red icon (and the correct shells would have green icons) in the Model Tree.

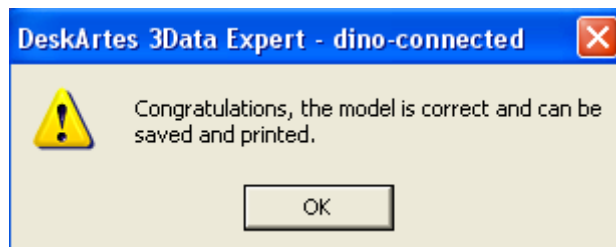
The *Fix Model Tab* on the *Tools Window* (on the right-hand side) provides shortcuts to the commands available for repair. The *Help text* window at the lower part of the Fix Model Tab also contains information for repair actions.

3Data Expert 8.1: Quick Start Guide

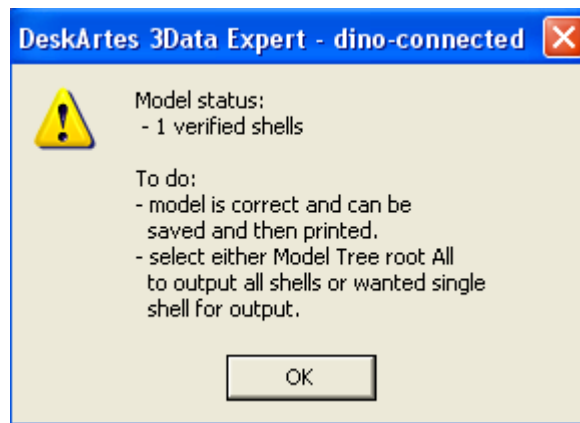


Auto Repair is the best path to follow when repairing everyday models so **press the OK button** to initiate Auto Repair. Auto Repair will attempt to fix all shells with errors in the Model Tree. When you only have one shell you should always try Auto Repair first.

When Auto Repair is started each shell is run through the automatic repair command (*Fix Model > Repair Shells* command) using automatically calculated parameters. For each shell, a progress bar shows the progress of the repair. After the Auto Repair process the following message is displayed:



You will now receive the final status report. **Press the OK button** to close the *Model status* window, containing the final status report, after Auto Repair.






A *Tip Window* with useful tips on viewing and selection mechanisms is also displayed after Auto Repair. After reading the tip you can **Close** the window:



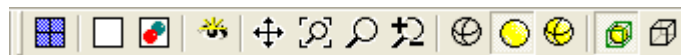
During the Auto Repair, 3Data Expert attempts to fill all gaps and remove non-manifold triangles (overlapping triangles, multi-edge triangles, duplicate triangles, triangles having less than three neighbors, etc.) from the model. To see more about triangle errors, please access the “Triangle errors” page in the Online Help chapter “Handling Faceted Models”. The *dino-connected.stl* model only has simple errors, like inverted triangles and gaps, which are all fully repaired during the Auto Repair process. You can now continue to save and print the model, as indicated by the status information in the Fix Model Tab Help Text window.

Basic viewing commands

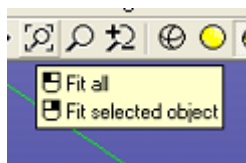
You have just fixed your first model with 3Data Expert. Now try the following commands to become familiar with viewing operations. Note that the commands below do not alter the model's true 3D coordinates. They only alter the eye-point location:

- **Rotate** the model on the screen by pressing the *middle mouse (MMB)* and moving the cursor. *Left mouse button (LMB)* rotation is also available most of the time except when working with painting, texturing, curve editing, and transformations.
- **Rotate** the model around a selected surface point by pressing the *right mouse button (RMB)* and moving the cursor. A blue cross indicating the rotation middle point appears on the part surface if the cursor is on top of the model when the *RMB* is pressed.
- **Pan** the model by dragging with the *MMB* (or *LMB* most of the time) while pressing the *Shift* key down.
- **Pan with rubberband** by dragging with *RMB* while pressing the *Shift* key down.
- **Zoom in/out** by rotating the *mouse wheel*.
- **Zoom in/out with MMB** (or *LMB*) while pressing the *Ctrl* key
- **Zoom to box** with *RMB* while pressing the *Ctrl* key
- **Hide all** by pressing the  icon with *LMB* (or *F5*)
- **Show all** by pressing the  icon (or *F6*)
- **Fit the model** by pressing the  icon (or *F7*).

The main viewing command icons reside in the Viewing Toolbar:

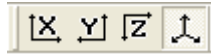



Try them out now. The tooltips provide a short description of each icon (let the cursor remain on top of the icon for a couple of seconds to see the tooltip). Please note that some icons will perform slightly different operations when pressed with *RMB* or *LMB* as seen in the tooltip image:



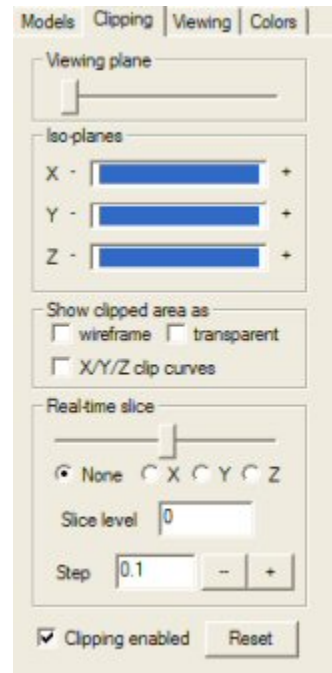
3Data Expert 8.1: Quick Start Guide

Also, the Viewing Planes toolbar allows you to select any projection direction as the viewing direction (try both *LMB* and *RMB* clicks):



Try also Clipping functionality through the Clipping Tab to look inside the model. The Clipping Tab is opened with the  icon. The clipped area can be displayed with different ways, like with wireframe or transparent.

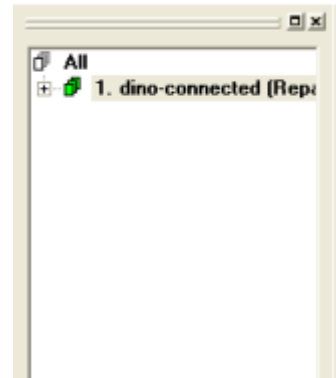
Clipping also enables to extract real time slice information on the model. *Real time slices* can be copied to the Model Tree for internal model dimensioning with the *Edit/ > Save Clip curves* command.



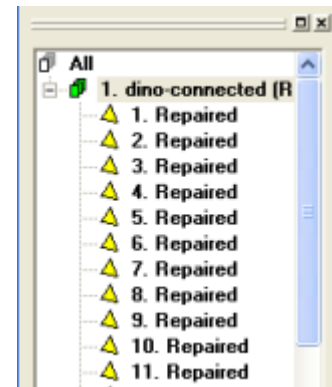
Selecting objects

On the left hand side of the 3Data Expert window you can see the Model Tree tab.

This tab tells you the current contents of the program database. With this file you can see one *shell* (aka node, group) 1. *dino-connected (Repaired)*. The node 1. includes the correct dino model, as indicated by the green icon with the shell. The *(Repaired)* text describes the last command run on the surfaces, which in this case is repair.

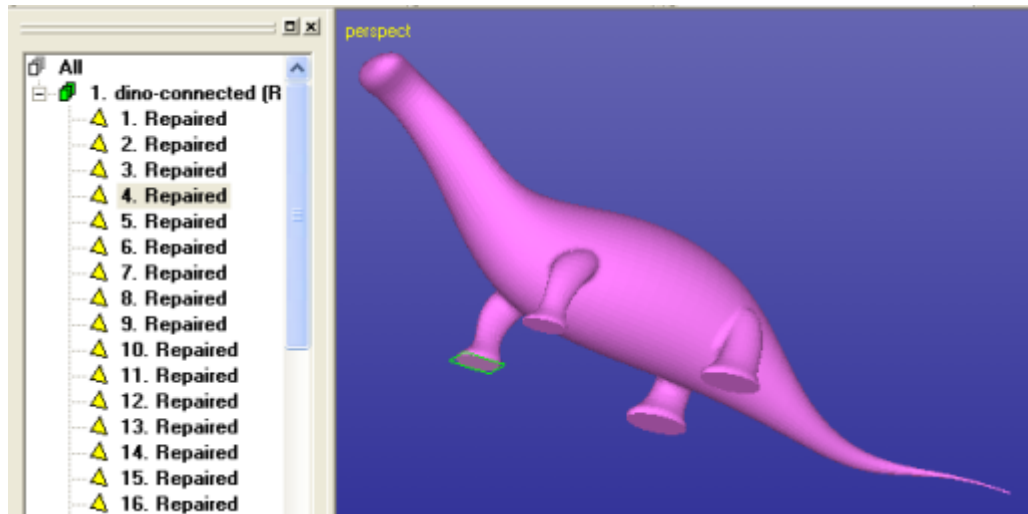


If you click the *+icon* at the shell 1. it will open and display the separate triangle surfaces the *dino* model is made of. During the repair process the model is subdivided into separate surfaces along sharp edges. Triangle surfaces are indicated by a yellow triangle icon and the operation name during which the surface was generated, i.e. 1. *Repaired* for the first and biggest triangle surface in the model and so forth.



You can select objects at different levels either directly from the Model Tree with LBM click or graphically from the display area. For example, the surface 4 selected from the Model Tree corresponds to the sole of the front right leg of the *dino* model. This is indicated with highlight and green bounding box around the selected surface in the display area:

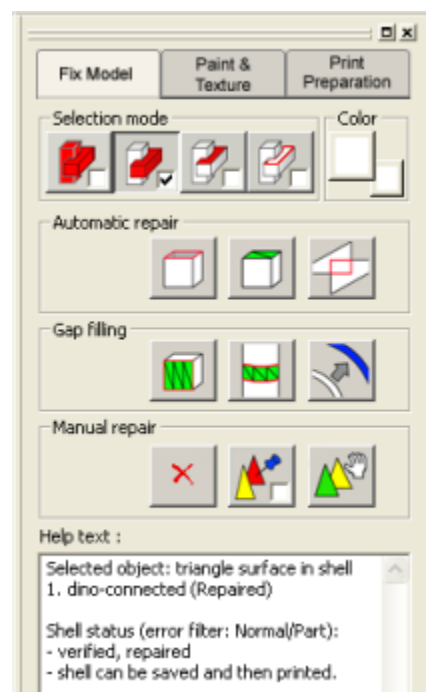
3Data Expert 8.1: Quick Start Guide



Different objects can be selected also graphically from the display area with LMB. On the right hand side of the screen you can see the Tools Window which includes the *Selection mode* icons.

The *Selection mode* icons allow you to set the graphical selection level to *All*, *Shell*, *Surface* or *Gaps*. The default mode is shown in the image right and it is the *Shell* level. If you now click on the dino model on the screen with the LMB the shell *1. dino-connected (Repaired)* will be selected in the Model Tree.

Generally, the Tools Window contains handy shortcuts to the available commands in the selected Operation Mode as well as *Help text* window for the selected object or for the command in progress.



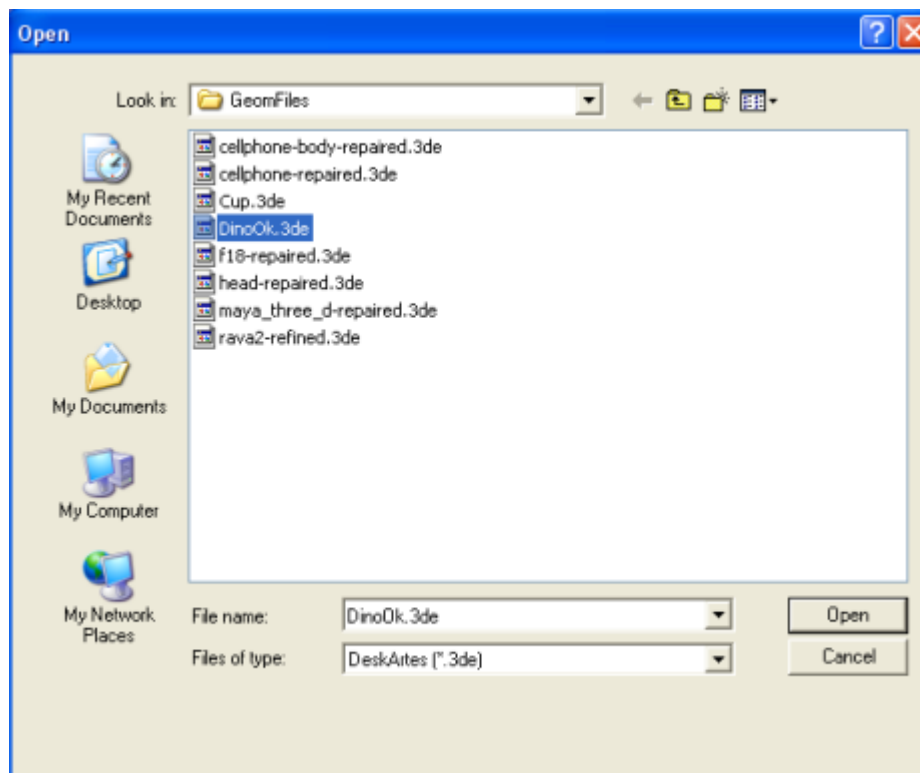
With 3Data Expert you normally should select an object and then run the desired command to it, as seen in the next lesson.

Lesson 2 - Splitting and Combining STL

One of the most common tasks with 3D Printing is to split a large model into smaller pieces to fit into the build area. This lesson shows you how to split large STL models for 3D printing and Rapid Prototyping. Building a very tall part is more expensive than building two shorter parts simultaneously. Also, the building area may not be large enough for a very big part. Correct joining of the split parts is ensured by adding guiding pins to the models.

Splitting the *dino* model

Start by inputting the DeskArtes geometry file *DinoOk.3de* in the *Tutorials/GeomFiles* directory. **Give the *File > Open* command.** During the input you are prompted if the previous *dino-connected* model should be stored into .3de (DeskArtes proprietary format) file. You should press *No* when prompted for it and continue to the file Open window. Set the correct *File of type (.3de)* and **select the *DinoOk.3de*** file for input.

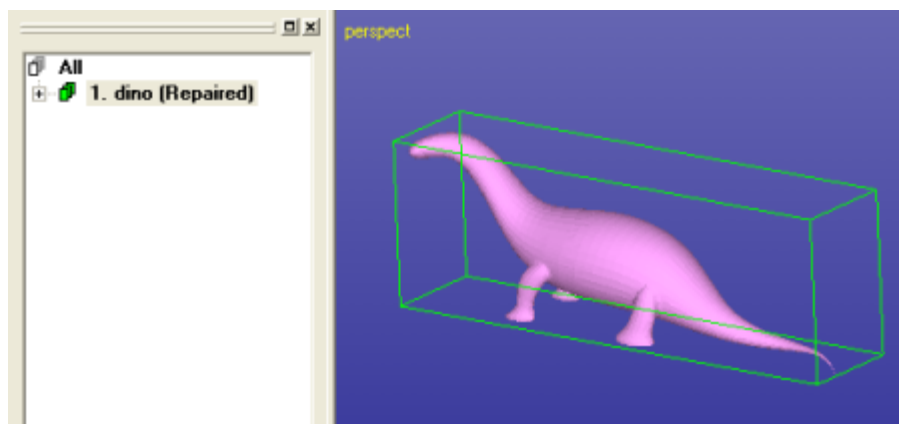


3Data Expert 8.1: Quick Start Guide

The file includes a correct triangulation for the familiar *dino* model. You should accept the proposed units and **go directly to the *Print Preparation* mode** by pressing the

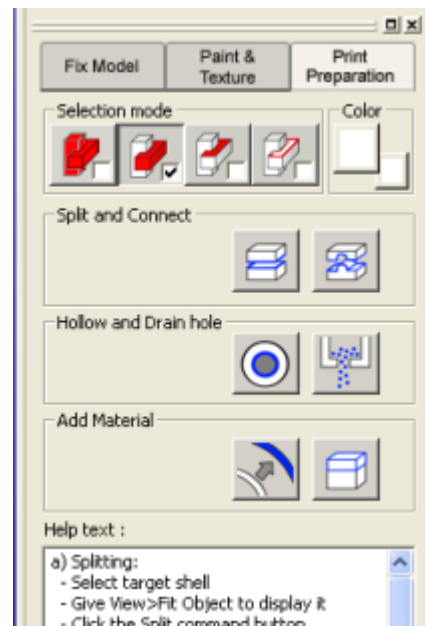



button in the Operation Mode Window. You should see the following dino model:

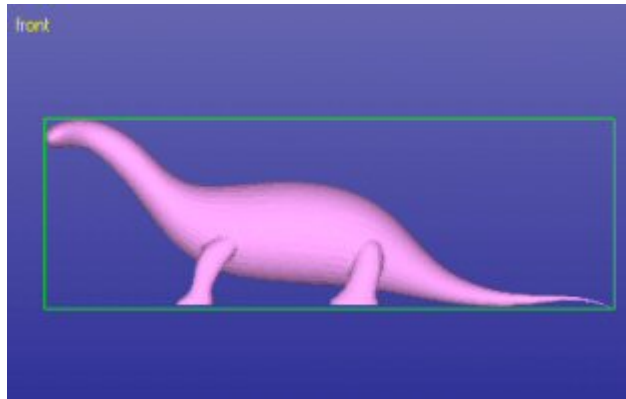


with the Print Preparation Tab on the right hand side of the screen.

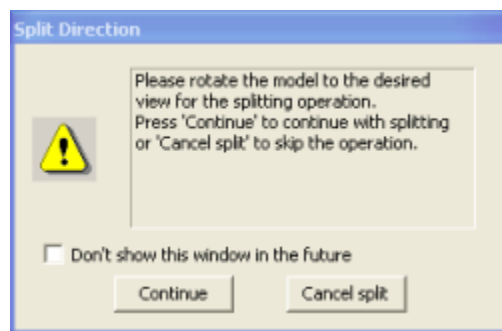
The Print Preparation Tab gives shortcuts to the mostly used print preparation commands, like split, connect, hollow, offset and drain hole. The Help Text provides context sensitive help to the commands.



Select node 1. dino (Repaired) by clicking it with the LBM in the Model Tree. Before the splitting we must take a correct view to the model because the splitting plane is generated by extruding a user defined split polygon away from the viewer. With 3D Printing the correct way normally is to split the model perpendicular to the z-axis to make the part lower. Thus, **take a view from the x-axis direction with View > Ortho View > Front (+X)** ( + LMB).



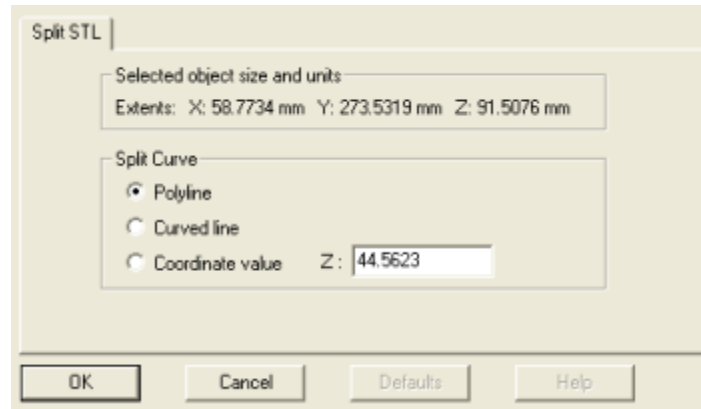
The splitting is started with command Print Preparation > Split. The system prompts you to take the correct view direction if no yet set:



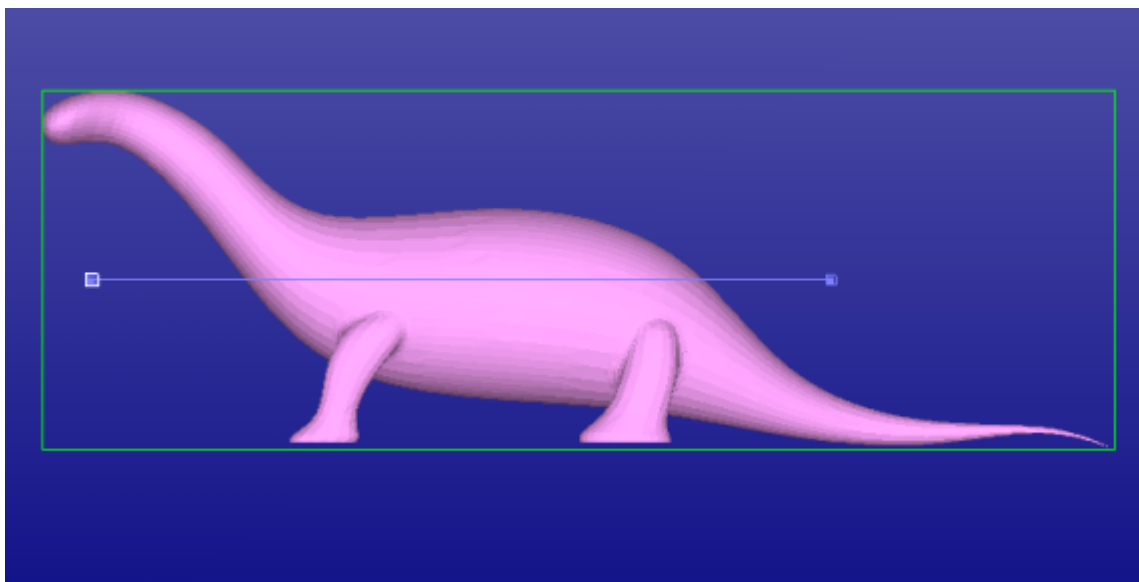
When the view is correct you can **press Continue** or Cancel to quit. You may hide this window permanently if necessary by ticking the “*Don't show this window in the future*”.

The system asks you if you wish to use a *Polyline (linear)*, *Curved* split line or *Coordinate value*, **select Polyline**. After **pressing OK** that the system goes into the curve edit mode where you can define the shape of the splitting surface.

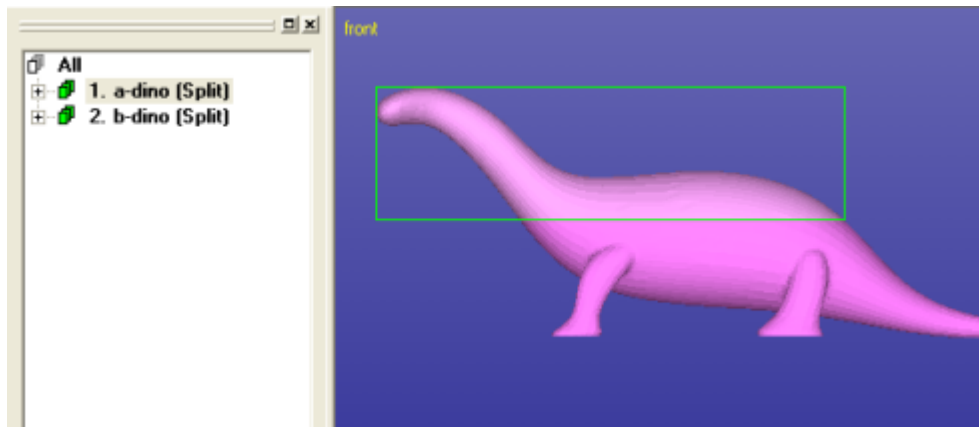
3Data Expert 8.1: Quick Start Guide



Now you can draw the shape for the splitting surface. **Draw a horizontal line by giving two points with the LMB clearly outside of the *dino* model as seen in the image below:**




The curve editing is finished by **pressing the *RMB*** or *ESC* key. When finished the model is split along the plane defined with the polyline. After a while the result is available in the Model Tree. You can select the upper part with LMB click on the shell *1. a-dino (Split)* to highlight it.



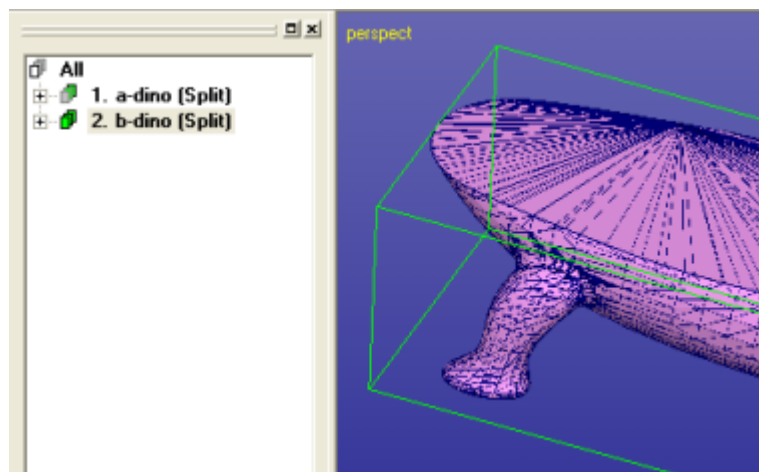
The two halves are named with *a*- and *b*- prefixes to distinguish between the shells above the split line and below the split line.

Creating the pins

The separate parts of the model could now be positioned and stored into .stl files for 3D Printing. However, the precise joining of the ready parts would be difficult or impossible. To be able to position the parts accurately we shall add pins in the models to connect them together after finishing the build.

First we will locate the necessary primitives (sphere, cone, cylinder) which will connect the two parts together. We need a nice view to point the pins on the screen to start with. Here we are also using the shaded+wireframe view mode available with the  icon.

Rotate the model, erase the screen and display the lower part of the dino, shell 2. *b-dino (Split)*. Zoom in to the front end of the model to be able to accurately position the connectors with the next command.

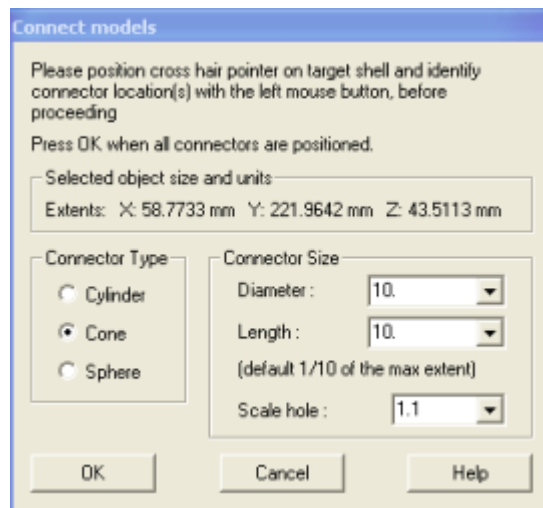


3Data Expert 8.1: Quick Start Guide

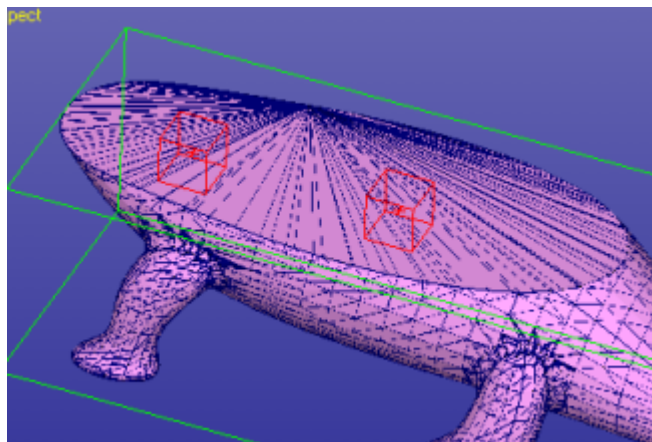
The pins are now **created with the *Print Preparation > Connect* command** or using the Print Preparation Tab shortcut



After the command is given, it is possible to give the *shape* and the *size* for the pin to be created. Set *Diameter* and *Length* both to 10.0, as seen below:



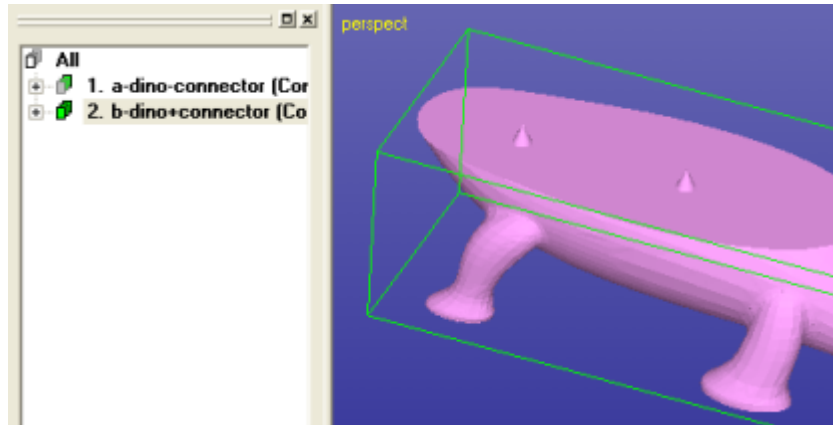
The pins are positioned with LMB clicks on the display area on top of the dino model. Give two locations, the positions for the pins should look similar to the image below when ready. Note that you can use the MMB zoom and MMB rotation to change the view point when locating the connectors.



3Data Expert 8.1: Quick Start Guide

If a connector location is not correct you can remove it by clicking on the red indicator box again. Then reposition with another LMB click on the correct location.

When ready **Press OK to generate the connectors.** After a while you will see the connectors added to the selected shell:



Corresponding holes are automatically created to the *a-dino-connector* shell. You should move the shells apart from each other with the Transform menu commands prior to outputting the model for 3D Printing.

You can save both files into the same STL file by selecting the Model Tree root *All*. Anyhow, you normally want to build and position the parts separately in the 3D Printer. For that select each shell separately and **output** it to a proper STL file with **File > Save As** command.

Further Reading

This *Quick Start Guide* should give you the skills to verify and repair models with simple errors for 3D Printing. Model splitting for build with systems with smaller build areas when compared to the part size is also presented.

This *Quick Start Guide* is the first in a set of tutorials covering different aspects of model repair, coloring and print preparation. The tutorials are available in the software distribution package through the *Help > Tutorial Documents* menu:

- *3Data Expert: Tutorial 1 – Working with 3D Models* introduces basic triangulation, automatic repair and model manipulation for STL files. Estimated completion time is 2-3 hours.
- *3Data Expert: Tutorial 2 – Working with Colors* introduces basic automatic repair and coloring for Z Corporation 3D Color Printer users. Estimated completion time is 60 minutes.
- *STL and VRML repair examples* gives more advanced model repair examples to master the use of 3Data Expert repair functions. Estimated completion time is 4 hours.

More information and other STL manipulation tools can be found in the Handling Faceted Models section of the On-line Help pages. These pages contain information on verifying, repairing, splitting, offsetting, hollowing and draft checking for tooling applications.