ZEdit Pro 1.0

Tutorial 4 – Cow

First Edition

DeskArtes: “ZEdit Pro 1.0: Tutorial 4 – Cow”

February 2008

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Chapter 1 – Foreword

The *ZEdit Pro 1.0 Tutorial 4 – Cow* tutorial introduces the second set of print preparation commands available with ZEdit Pro software. Through this sequence, you will learn how to repair the *COW.zpr* model by using the Auto Repair functionality and how to split the model into two pieces, which you will connect after the build. In the final step, you will output the split model for printing with Z Corporation color printers.

This tutorial is the fourth in a set of five tutorials, each of which covers different aspects of model repair, coloring, and print preparation. The following tutorials are available in the software distribution package:

- *Tutorial 1 – Lamp* introduces basic automatic repair and coloring. Estimated completion time is 60 minutes.
- *Tutorial 2 – Black Bass* covers more advanced repair, including joining surfaces and adding thickness. Estimated completion time is 30 minutes.
- *Tutorial 3 – Annie* addresses repair with hollowing and adding drain holes. Estimated completion time is 20 minutes.
- *Tutorial 4 – Cow* relates to splitting and connecting. Estimated completion time is 20 minutes.
- *Tutorial 5 – Explorer* involves repair with offsetting and joining surfaces. Estimated completion time is 20 minutes.

The tutorial documents and the geometry files for the tutorial examples are found in the *Tutorials* folder and its sub-folders (*Tutorial 1*, *Tutorial 2,* etc.) in the ZEdit Pro installation directory.

If you are using ZEdit Pro for the first time, going through the tutorials in the given order will help to familiarize you with the application. Tutorial 1 is especially helpful because it includes information on the basic use (auto repair, viewing, selecting, painting, and texturing) and different concepts (modes, windows, etc.) in the software.

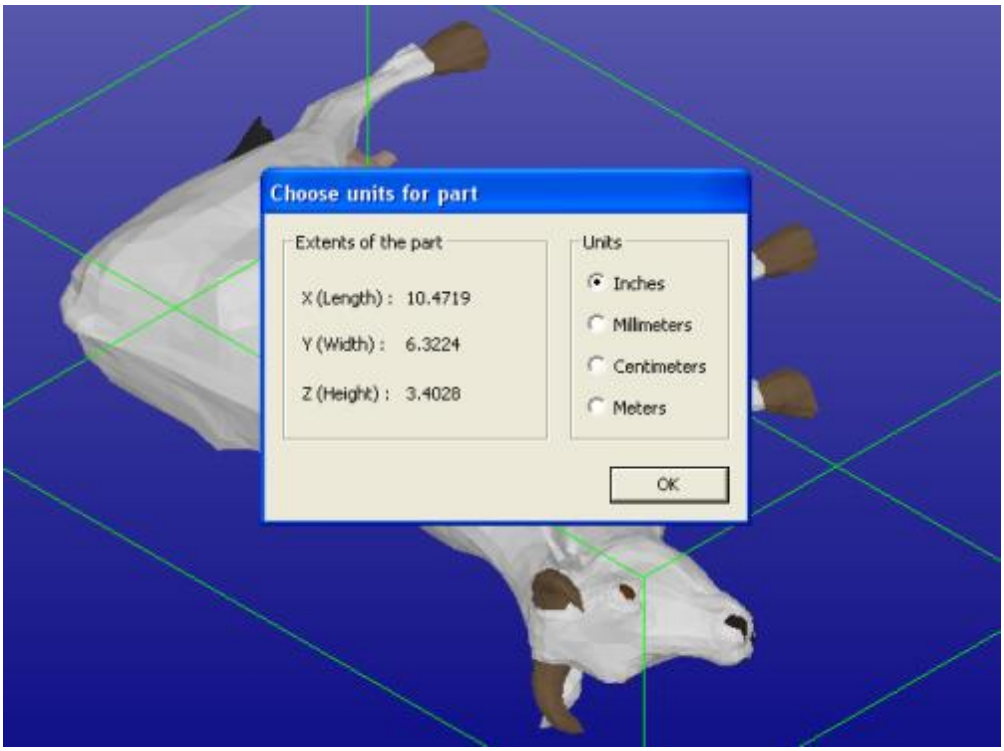
The **boldface** and *italics* used in this tutorial have designated meanings. A **boldfaced command** is a command or operation that alters the model or is otherwise necessary to reach results similar to the example. A statement in *italics* denotes the different parameters and their values; menu commands; mouse clicks; file names; Model Tree items; or any new terms introduced to the reader.

ZEdit Pro allows you to do full repair and advanced coloring for 3D models for 3D printing with Z Corporation color printers. The Import Package and 3Data Expert® software from DeskArtes (www.deskartes.com) provide additional model manipulation functionality, including surface input and triangulation, and Boolean operations. ZEdit Pro is part of the DeskArtes Expert Series software suite. Optional tools are available through DeskArtes.

Chapter 2 – Fixing the Cow model

In this example, you will go through the steps required to fix a *Cow* model with Auto Repair and split the model. You will then add connectors for accurate joining of the two halves after the build. The COW*.zpr* model is available in the ZPR format (.zpr) on the ZEdit Pro installation directory (*Tutorials/Tutorial 4 – The Cow* directory). After completing model repair and preparation, you will save and store the two halves in ZPR format for 3D color printing.

Please **input the *Cow* model (*File > Open*)** from the COW*.zpr* file. You should see the following result on your computer screen:

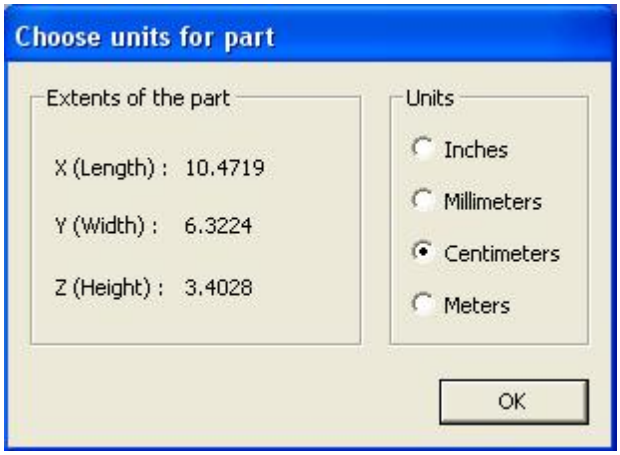


You can also start ZEdit Pro through the ZEdit Pro icon in the ZPrint software (or through the *Edit > Start ZEdit Pro* command). In this case, the model will automatically load to ZEdit Pro. The software will ascribe a temporary file name to the model instead of *Cow*.

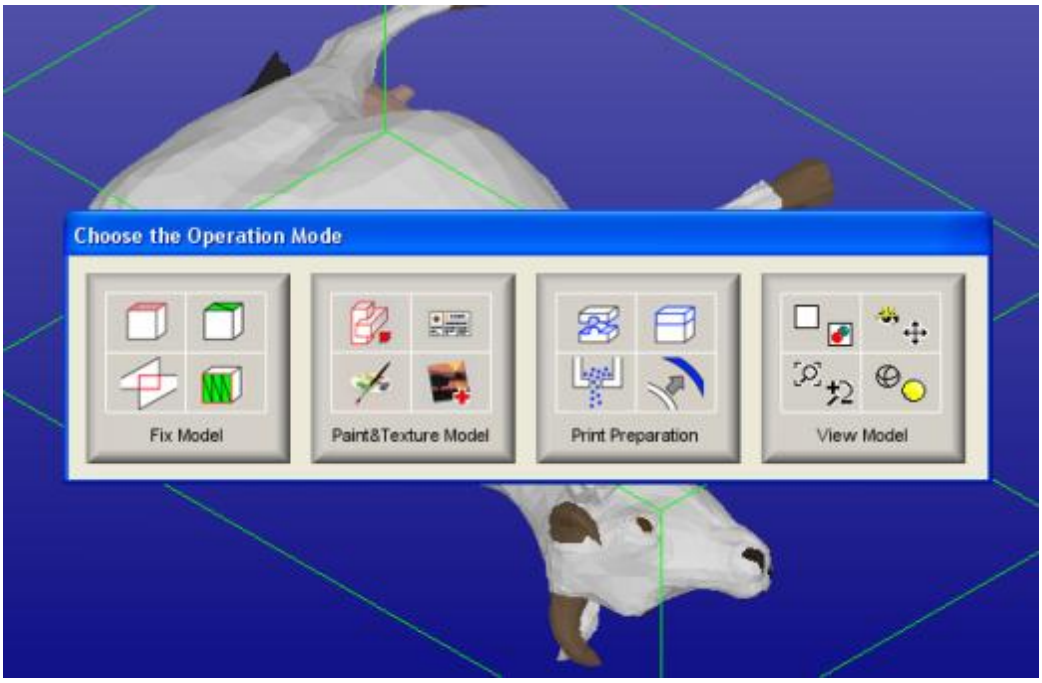
You will note that the Cow model comes with correct colors. ZPR files can store model colors and textures for maximum realism with 3D color printing.

The first ZEdit Pro dialog allows you to check and set the units for the inputted part. ZPR (.zpr) files include the unit information, but in this case, the units seem to produce a very large object. **You will change the units to centimeters**. This is a more realistic size, and it also fits into the 3D printer build volume nicely.

When you output the model into ZPR file at the end of the repair process, the new units will be stored in the file.



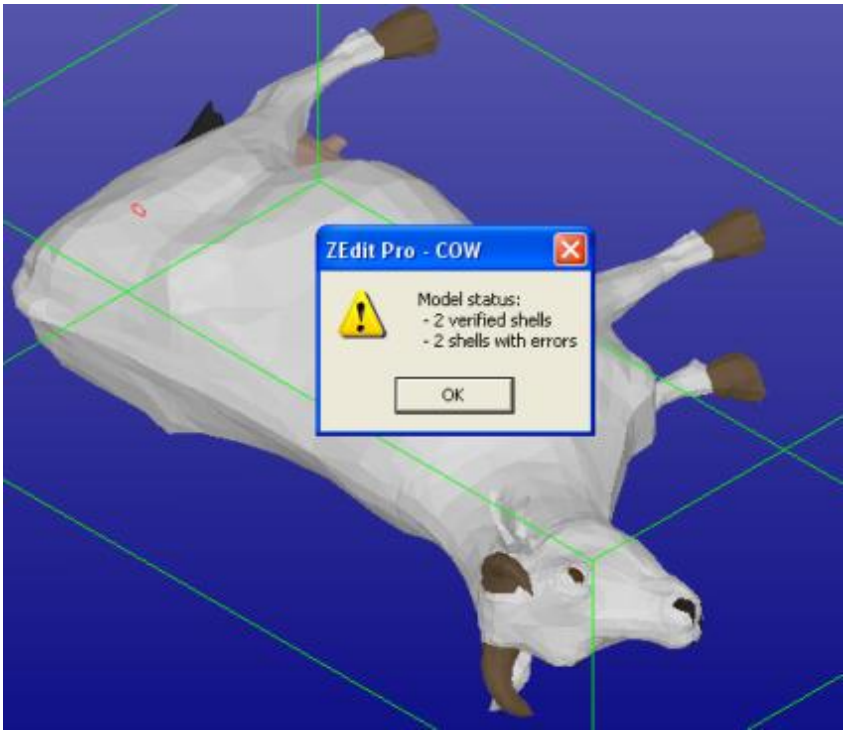
Press OK to continue. The *Operation Mode* window will appear:



ZEdit Pro has three main operation modes: *Fix Model*, *Paint & Texture Model,* and *Print Preparation* mode, as well as a temporary *View Model* mode. The different modes are used for different tasks, but in this instance you want to start with verify and repair to produce a solid geometry ready for splitting. We will select the Fix Model mode for model repair.

Fixing the Cow automatically

The normal way to start 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**.** ZEdit Pro will start 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 displays:



The message indicates that there are two verified shells, both with errors. The display shows red *Gap curves* in the tail indicating errors.

The model contains two shells. **Press the OK button** in the *Model status* dialog to see the model structure in the *Model Tree (*left-hand side of the screen*)*. The error shells have red icons in the Model Tree. The *Fix Model Tab* on the *Tools Window* (right-hand side of the screen) 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.

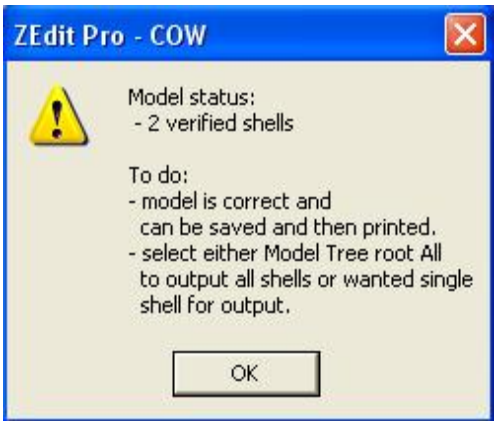
When the OK button is pressed, new windows appear and a request for Auto Repair is prompted:

Press Yes to run Auto Repair on the Cow model. Auto Repair is the best path to follow when repairing normal models. Auto Repair will attempt to fix all shells with errors in the Model Tree.

When the Auto Repair is started each shell is run through the repair command (*Fix Model* > *Repair Shells* command) using automatically calculated parameters. A progress bar appears, and then you receive the following message:

The model is correct and requires no further repair work. **After pressing the OK button**, the following dialog appears:

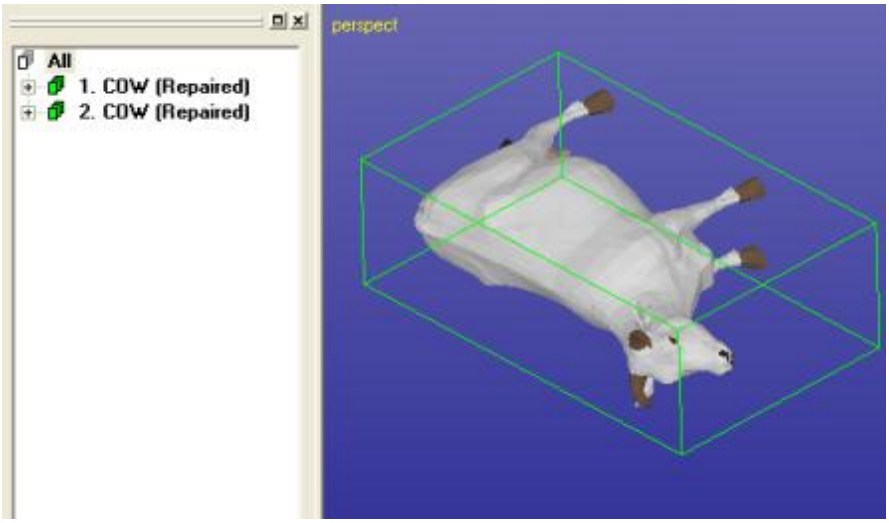
You are prompted for the *Repair color* mode. **Press No** because you already have a correct model and only wish to split it and create connectors. You will see the *Model status* window:



You may also see the short “Introduction to File Fixing” splash screen. The “Introduction to File Fixing” page includes a description of what file fixing is and where to find more help.

Press the OK button to close the *Model status* window after Auto Repair.

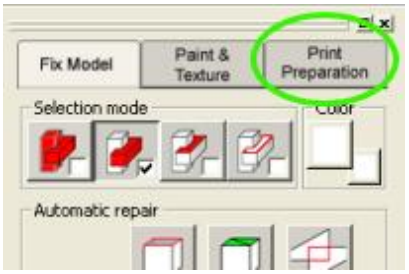
A *Tip Window* with useful tips on viewing and selection mechanisms may be displayed after Auto Repair (please see the *Tutorial 1 – Lamp* page 14 for details). You can just **Close** or **Minimize** the *Tip Window* and the “Introduction to File Fixing” page for later reference during the repair session. You can also permanently turn them off when you become more familiar with the use of the repair tools through the *Show Command Tips* and *Don't show the window after Auto Repair* settings in the dialogs. You can restart both windows through the Help menu.



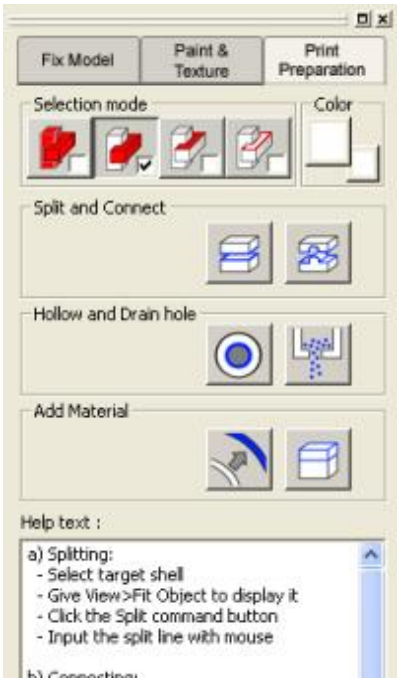
The model is now fixed and you can continue with splitting.

Chapter 3 – Splitting and connecting

You will now split the Cow model and then add connectors to the split halves. These commands are available in the *Print Preparation mode*, which is entered by selecting the *Print Preparation Tab* from the Tools Window:

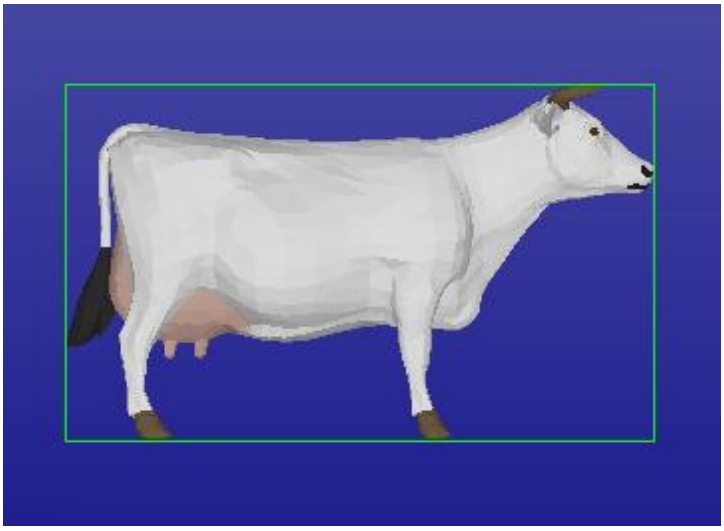


Pressing the Print Preparation Tab displays the shortcuts to Print Preparation commands. A short *Help text* is given for each command in the bottom of the Print Preparation Tab.



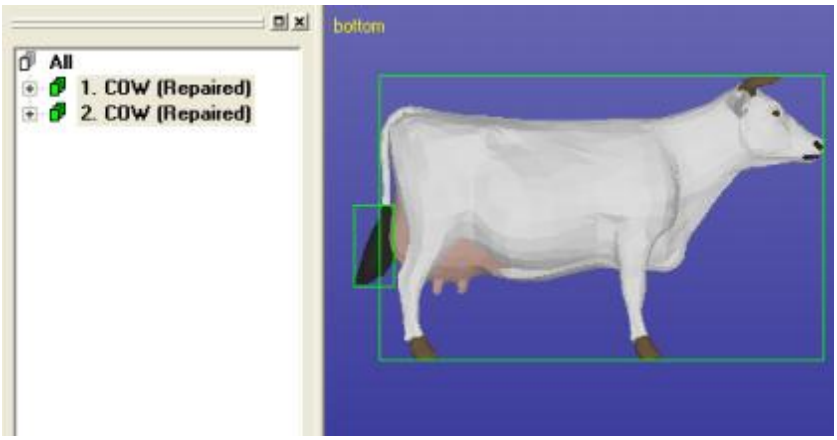
Selecting the splitting direction

First, you must establish the correct view for the model for defining the splitting plane correctly. The splitting plane is always created parallel to the line of sight. You want to split the cow at the middle of the longest extent into two pieces. Therefore, you will establish the view from the negative Z axis direction. **Press the X direction** **icon with the *right mouse button*** (RMB). The screen should look as follows:

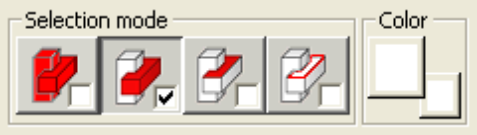


Selecting shells for splitting

You want to split the whole part at once so select both shells directly from the Model Tree with multiselection. First, **select shell *1. Cow (Repaired)* from the Model Tree with the left mouse button** (*LMB*). Then **press the *Ctrl* key and select shell *2. COW (Repaired)* with the *LMB***. The selections should look like the image that follows:



Selection can be done in several different ways. Using graphical multiselection with the *Shell selection level*

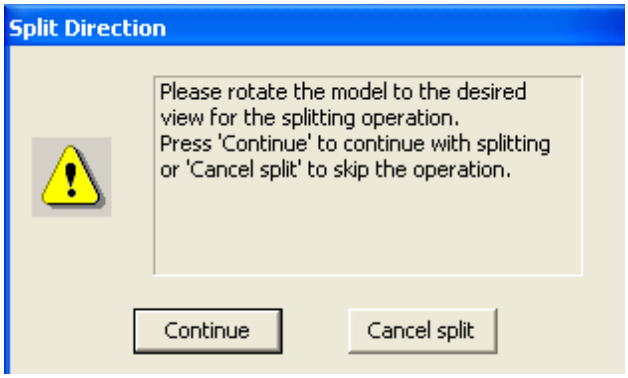


would yield the same result. Also, selecting the Model Tree root *All* would cause the two shells to be automatically selected prior to splitting (you would just get a few warning messages along the way).

Splitting the Cow

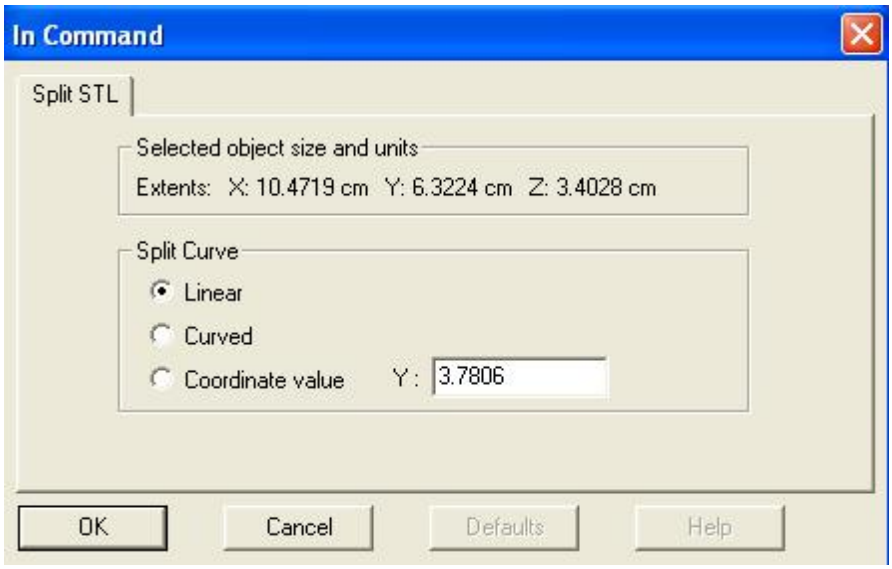
The hollowing is done by giving the command *Print Preparation* > *Split* or **pressing the**

Split button in the Print Preparation Tab. Immediately after the command is given the user is prompted to set the correct viewing direction for splitting:



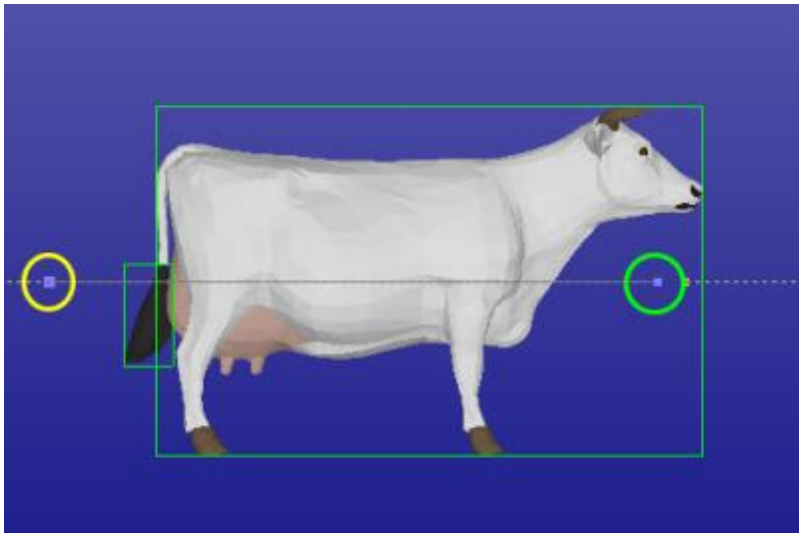
Splitting is done with a plane along the line of sight and the user can rotate the model correctly at this stage. Once the curve for split plane is given, model rotation is no longer possible. You may rotate the view now but in the end make sure that the view is from the -Z axis direction by **pressing the** **icon with the RMB**. Then **press Continue** to define the splitting plane.

After the **Continue** button is pressed the following Split STL parameter dialog appears:



There are three different splitting possibilities: *Linear* to draw a linear split polyline, *Curved* to draw a smoothly shaped split curve, and *Coordinate value* to split the model at the given exact coordinate level. We will use the first selection, *Linear,* to define a split visually to the desired location.

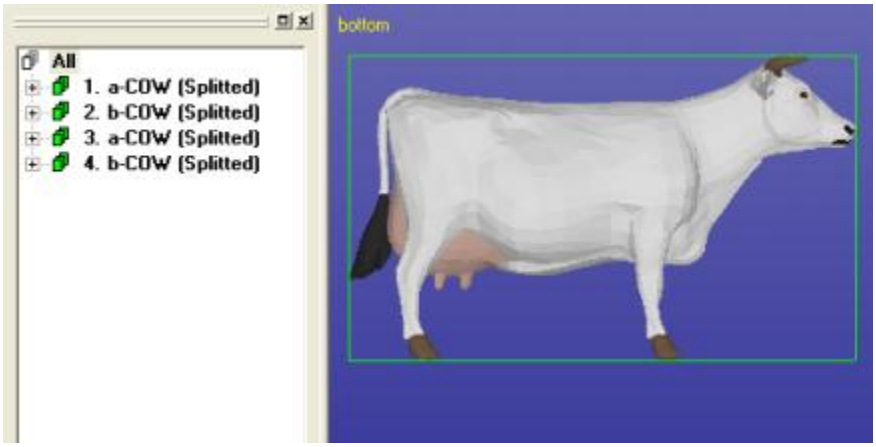
Now **press OK** to start inputting the splitting polyline. Then input two points as shown in the image that follows:



First, click with the *left mouse button (LMB)* more or less at the location inside the **yellow** circle. **Then move the mouse on the other side of the Cow** and **then press again with the *LMB*** on the location marked with the **green** circle. Make sure the dotted snap line goes through both points you input to ensure that

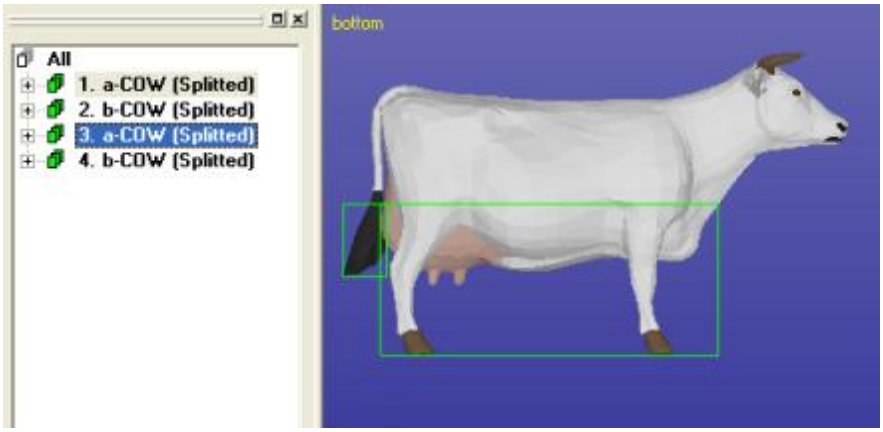
the split line will be parallel to the XZ plane (i.e., perpendicular to Y axis). You can press the ***ESC key*** to cancel the last point added or the ***Q*-key** to quit. When ready **press the *right mouse button (RMB)*** to perform the split.

After the *RMB* is pressed, you will see the progress bar appear and disappear a couple of times. When ready, the split result is available in the Model Tree:



The Model Tree shells now have *a*- and *b*- prefixes added to their names. The prefixes denote the results either above or below the split line. The *a*- prefix normally indicates the halves on the larger coordinate values along the vertical coordinate axis of the display, and the *b*- prefix indicated the parts with the smaller coordinate values (if the split is done with a vertical line, the same larger vs. smaller values approach applies regarding the horizontal coordinate axis).

The split results are also grouped according to the prefixes. Now **select the *1. a-COW (Splitted)*** shell. Then **give the command *Edit > Groups > Select Group***, and all shells belonging to the same group are automatically added to multiselection:



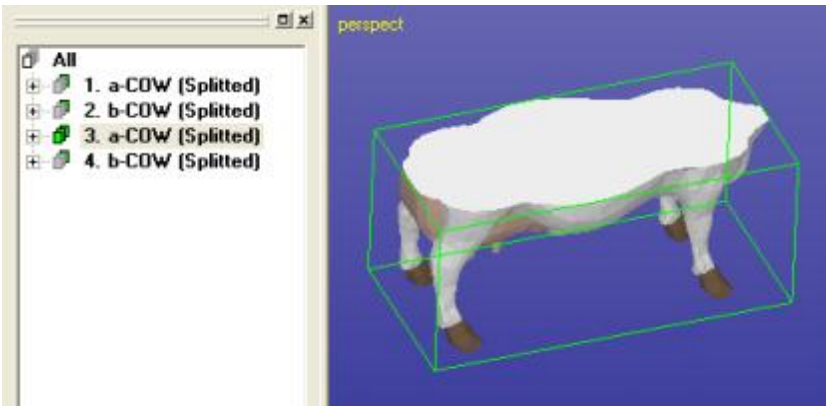
This is an efficient way to select split halves of multiple shells for outputting into separate files or to move them to different location. You can also use the Model Tree RMB button menu *Groups* command to select the group.

In this example, you only used two points to generate a planar split surface. The number of points is not limited to two, and the user can generate a split line with any complexity as long as the split line does not intersect itself and the split will start and end outside the model to be split (or make a closed loop). If these constraints are not met, results are unpredictable (most likely no split is done).

Creating the connectors

The purpose of the connectors is to help position the halves accurately with respect to each other after the build. This will help to build even parts that do not fit into the 3D printer build volume in one piece or to speed up building time with lower builds.

First, select the lower part of the Cow main body (*3. a-COW (Splitted)* shell) from the screen or from the Model Tree. **Use the View > Fit object command** (+ *RMB*) to fit it on the screen and rotate the view with middle mouse button (MMB) to see the split surface properly:

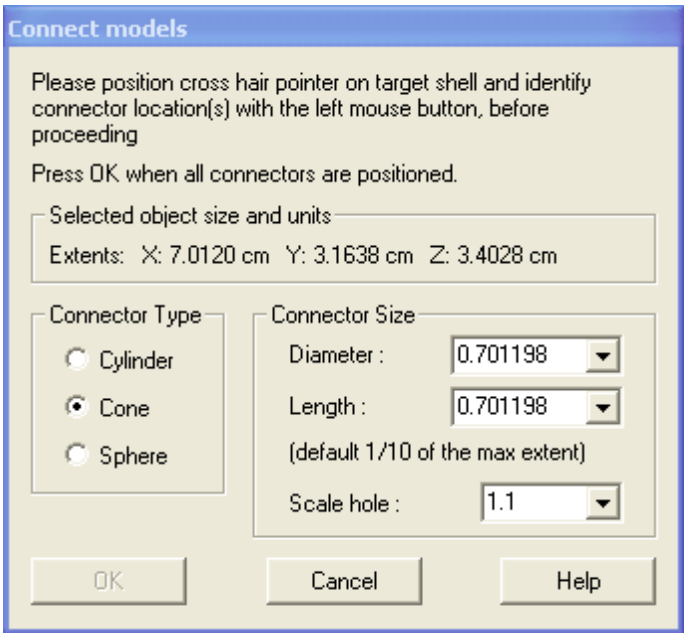


The newly generated split surface is *white* in color. If the color is different, check the *Foreground* color setting in the Print Preparation Tab *Color* group:

The Foreground color is used when generating split surfaces as well as other new geometries, like connectors.

To start creating the connectors give the command *Print Preparation* > *Connect* or **press the Connect**

button in the Print Preparation Tab. A *Connect model* dialog with Help text and parameters appears:

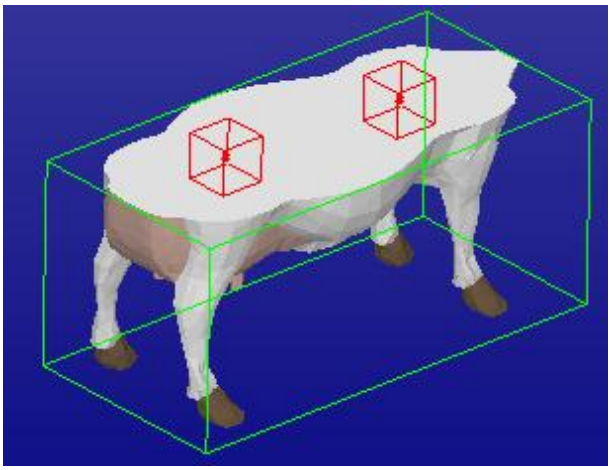


The *Connector size* is set automatically according to the maximum extents of the selected object. The *Diameter* and the *Length* is set to *1/10* of the maximum extent of the Cow model (*7.012 cm*). The values may be changed at will but keep in mind that the diameter should allow you to create strong enough connectors or connectors that do not exceed the size of the target object split surface. You can use either *Cylinder*, *Cone,* or *Sphere* shaped connectors. The hole for the connector should be scaled slightly larger than the actual connector for the parts to fit together easily. The default value for *Scale hole* is *1.1* units.

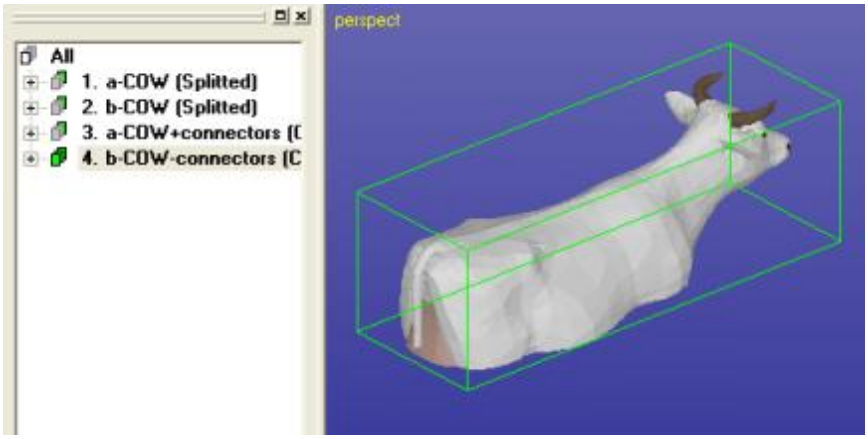
Note: The connector *Length* is actually the size of the primitive used to create the connector. The connector primitive (cylinder, cone, or sphere) is deleted from the other part and added to the selected part. This means that the primitive is divided

on both sides of the splitting surface. The actual length of the connector remaining on top of the surface will be *Length/2*, so is the hole depth *Length/2.0.*

Before pressing OK, you must select the positions for the connectors. With the Cow model, it is sufficient to make two connectors to fix the position of the split halves after the build. **Click with the left mouse button** (*LMB*) twice in the middle of the split surface area to locate the connectors. Please see the appropriate location of the connectors with a red box in the image that follows:

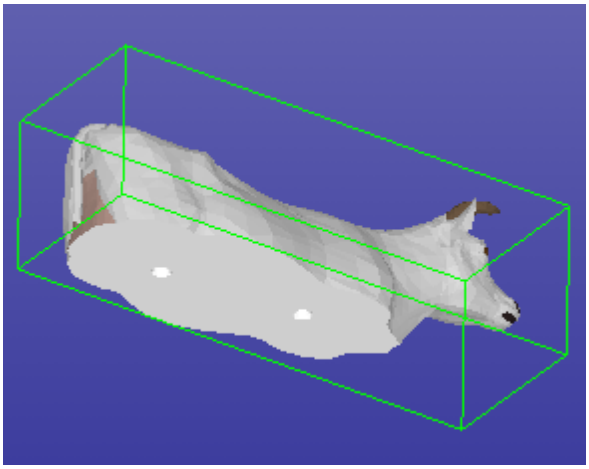


You can rotate the view with the *middle mouse button* (*MMB*) to find the correct location for the connector positions. These viewing shortcuts are available: *pan – Ctrl + RMB, zoom – mouse wheel, rotate – MMB*. You can also remove incorrectly selected connector locations by clicking the red box with the *LMB* again. **Make sure your location is more or less as shown in the image above and press OK**. A progress bar will appear and soon you will see the result:

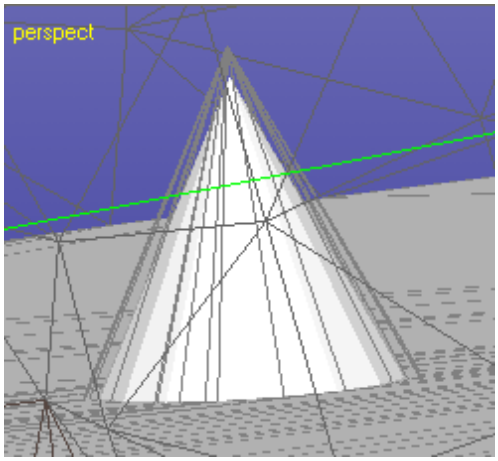


The Connect command automatically finds the shell where the selected shell must be connected. The one with the added connector will be renamed with a *+connector (Connected)* suffix and the half with subtracted connector will be renamed with a *-connectors (Connected)* suffix.

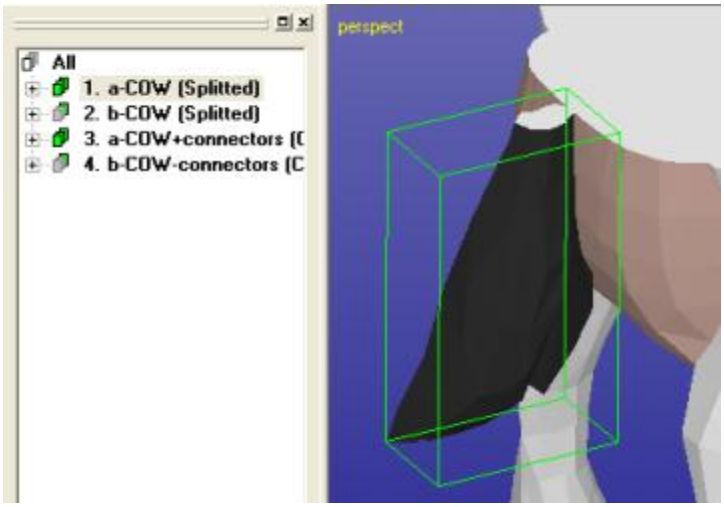
If you rotate the view, you can see that the *Cones* are deleted from the upper part of the Cow:



This will enable fully accurate positioning of the two halves after the build. If you take a closer look at one of the connectors using both shaded and wireframe views (+ RMB on shell) for the different halves you will see that the hole is slightly bigger (scaled 1.1 or 10% bigger) than the connector.



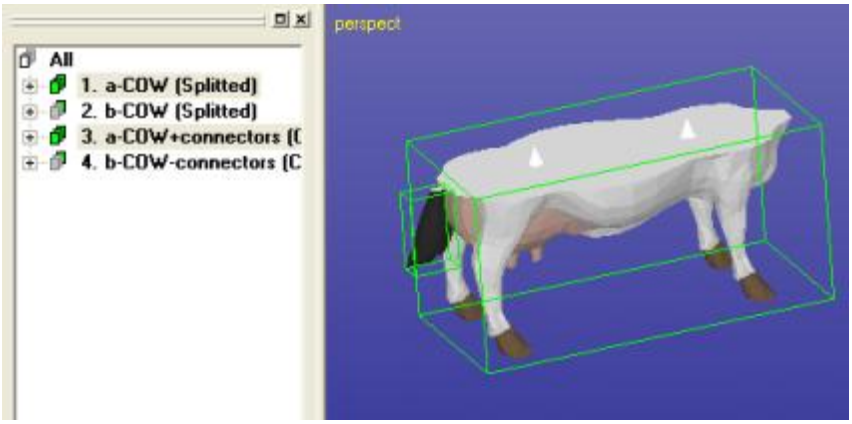
You might wonder what will happen to the tail and especially to the tip of the tail during the part building. The tip of the tail *1. a-COW (Splitted)* is a shell which is intersecting with the lower part of the Cow body *3. a-COW+connectors (Connected)* shell, as shown in the next image:



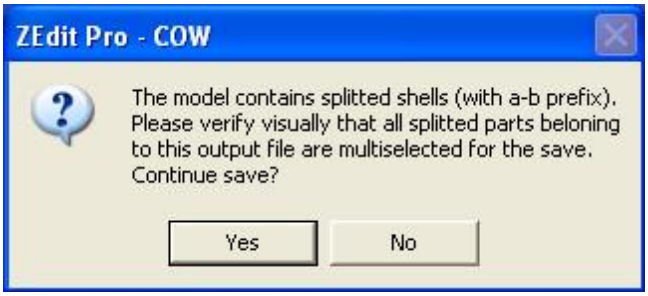
At the end you will output the lower a-part into one file that will cause the two intersecting shells to be built as one part, eliminating the need for extra connectors (unless additional robustness is required).

Saving the files

When saving the file to the ZPR format with the *File > Save As* command, you must save the two halves into separate files to allow them to be build separately. We can use the grouping to select the different groups (upper vs. lower half) into different output files. **Select 1. a-COW (Splitted) shell** and **give the *Edit > Groups > Select Group* command**. Your selection should now contain the following a-items:

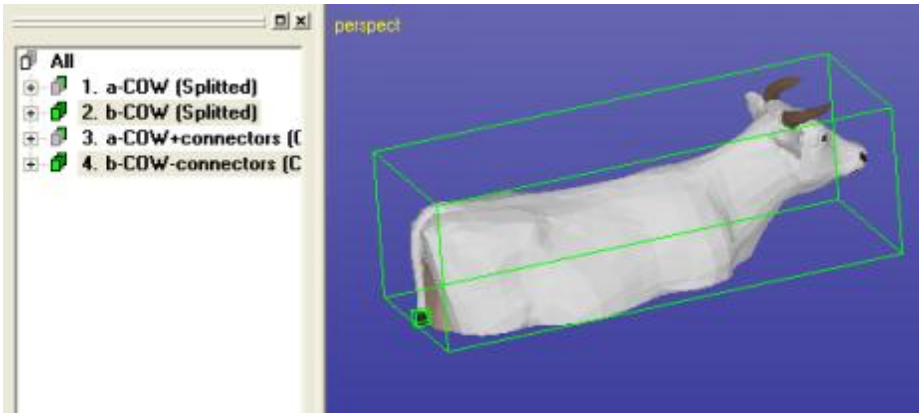


If so, **give the *File > Save As* command** and give the file name *COW-lower.zpr*. You will see the warning dialog:



Press Yes to accept the save because you have already used the *Select Group* command to make a correct multiselection.

Repeat the same selection mechanism for the upper b-group:



Then save the file *COW-upper.zpr*. (The two final output files are found in the distribution package with *-orig.zpr* suffixes).

You must not transfer the full model data back to ZPrint software if you began manipulating from the model in ZPrint unless you move the groups to different locations. The two halves will be handled as one model and cannot be separated in ZPrint anymore. Of course, if you place the two halves in different locations they can be built as one set in the printer. Then you can use the *File > Return to ZPrint* icon to transfer the data back directly.

Chapter 4 – Conclusions

Congratulations for reaching the end of this tutorial! The process and commands you have just learned will help you to split a model and create connectors between the two halves.

We recommend that you to continue on to *Tutorial 5 – Explorer* to learn more about the ZEdit Pro software and its more advanced model fixing capabilities.

ZEdit Pro is part of the DeskArtes Expert Series software suite. To learn more about the capabilities of other Expert Series software for 3D data fixing, coloring, preparation, or 3D model generation, please visit www.deskartes.com:

- 3Data Expert for full model repair and manipulation, including 2D Dimensioning; triangle reduction and refining; support generation; model slicing; etc.
- Import Package for importing native surface models from Pro/ENGINEER®, Unigraphics®, and Catia® 3D CAD systems, and STEP files for 3D Printing.
- Design Expert for generating your own free-form 3D geometries with an easy-to-use and powerful 3D CAD system.