

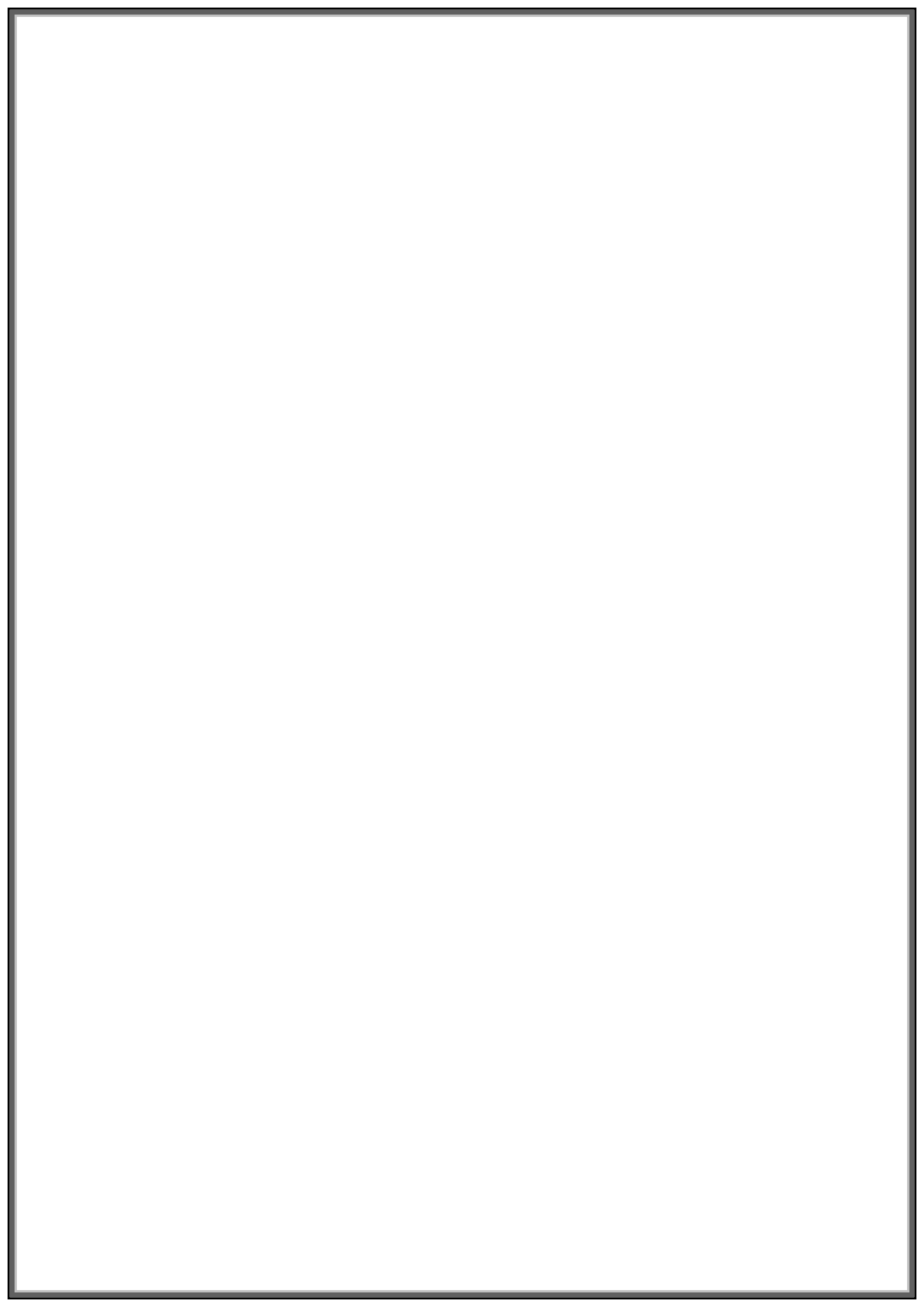
Getting Started With

Cut+2D



**Tutorial 5 – Intermediate Level
Connecting Rod**

Vetric



Disclaimer

All CNC machines (routing, engraving, and milling) are potentially dangerous and because Vectric Ltd. has no control over how the software described in this manual might be used. Vectric Ltd. or any associated Resellers cannot accept responsibility for any loss or damage to the work piece, machine or any individual, howsoever caused by misusing the software. Extreme care should always be taken and the output from the software thoroughly checked before sending it to a CNC machine.

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Introduction

This **Intermediate Level Tutorial** will show you how to make the Model Connecting Rod pictured on the front cover. It will explain the steps required in Cut2D to import the original CAD design, produce the toolpaths and save these toolpaths, ready to be transferred to your router or machine tool for cutting.

We estimate that this tutorial should take you approximately **15 minutes** to complete.

Getting Help

If you need assistance when using the software there are 5 primary places to look.

1. **Program Help File** - From the Main menu select Help
2. **Video Tutorials** - These are supplied on the installation CD or can be downloaded from the Vectric website.
3. **User Forum** - The Vectric user forum at www.vectric.com/forum is a very useful resource for information on Cut2D along with materials, cutters etc. and also to share knowledge and experiences.
4. **E-mail Support:** - The Vectric Support Team at support@vectric.com
5. **Frequently Asked Questions (FAQ)** - The support area on the Vectric web site at www.vectric.com maintains a list of the most frequently asked questions along with the answers.

Watch the supporting tutorial videos



The video camera icon indicates there is a video file for that particular section of the manual.

Many of the tutorials and help files have associated video footage that will make learning to use this software more interesting and enjoyable. These are on the installation CD or Downloadable from the web site. Windows Media Player is required to view the video files.

If you experience problems running these files or need assistance please visit the technical support area on the web site and follow the links.

View Controls

The View Control options available when working in the 2D Design and 3D Preview windows are,

2D Design Window



Zoom Interactive

Mouse with Middle Wheel – Push / Pull



Zoom Box

Click top left corner
Click bottom right corner



Pan

Click and hold the Left mouse button – Esc to cancel
Shortcut: Click and drag the **Middle** mouse button



Zoom Extents

Zooms to show material limits in the 2D window



Zoom Selected

Click to select an object or objects
Zooms to the bounding box of the selections

i Mouse with Middle Wheel can be used to interactively zoom in / out.

3D Window



3D Twiddle

Click and drag **Left** mouse button in the 3D window



Zoom

Right mouse button – Push / Pull
Mouse with Middle Wheel – Push / Pull



Pan

Click and drag **Right** mouse button + **Ctrl**
Click and drag **Right** and **Left** mouse button



Plan View

Looks directly down the Z axis onto the design in 3D window



Isometric View

Shows the model in a 3D isometric view in the 3D window

i Pressing **F2 & F3** will toggle between displaying the **2D & 3D windows**

Tutorial 5

Connecting Rod

Design Courtesy of John Stevenson
L Stevenson [Engineers]

Introduction

This **Intermediate Level Tutorial** will show you how to make the part shown below in Figure 1, which is approximately 110mm (4.3") by 45mm (1.75"). The artwork for this design has been constructed within a CAD package and saved in AutoCAD DXF format.

We estimate that this tutorial should take you approximately **15 minutes** to complete.




Figure 1. The finished Piece

There are 4 key stages in opening and preparing toolpaths for this design.

1. Importing a design
2. Calculate the toolpaths
3. Preview the completed job
4. Save the toolpaths

1. Importing a Design

1. From the **Startup Tasks** tab toolbar click on the **Open an Existing file**  icon.

Navigate to the Cut2D Samples folder on your PC and double click on the file named “ConRod.dxf” the design, as shown below in Figure 2, will now be displayed in the 2D window and the Material Setup form is opened.

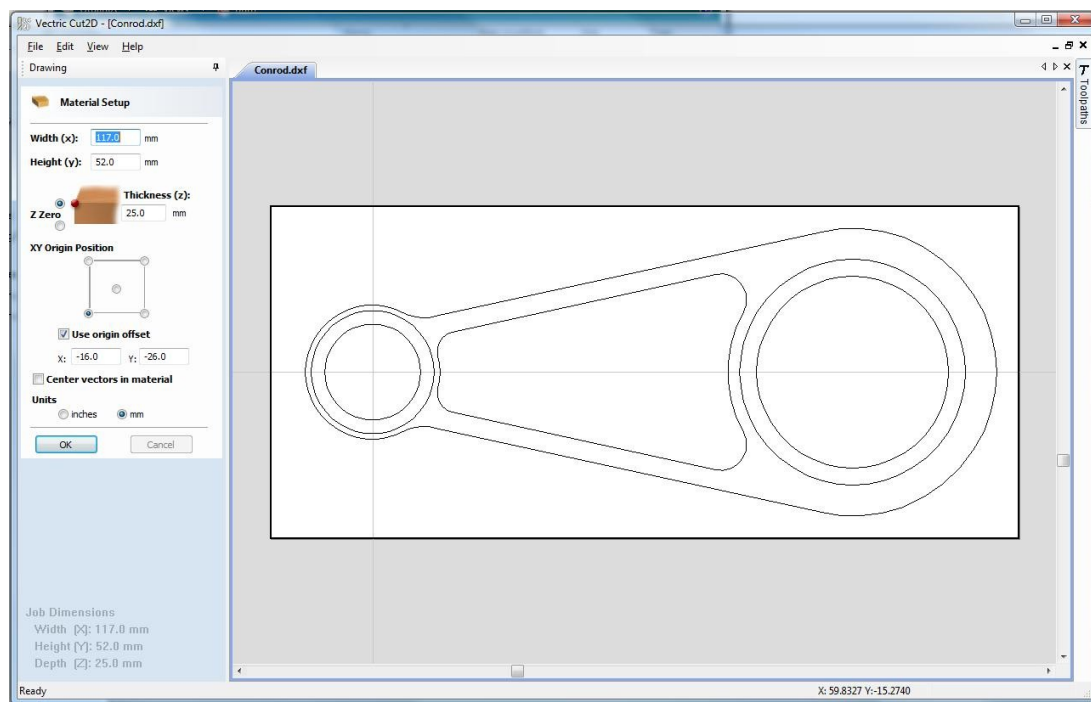


Figure 2 Imported Design.



Note: The horizontal and vertical **dotted pale grey lines** across the block represent the **X0 and Y0 axes**.

Material Setup

Width (x): 125.0 mm

Height (y): 60.0 mm

Thickness (z): 12.0 mm

Z Zero

XY Origin Position

Use origin offset

X: -20.0 Y: -30.0

Center vectors in material

Units

inches mm

OK Cancel

Figure 3. Material Setup Form

2. Complete this form as shown above, to match the dimensions of a pre-prepared block of material.

Width (X)= **125.0mm** Height (Y) = **60.0mm**

Material Thickness = **12.0mm**

Z Zero on the **Material Surface**

Click X0, Y0 Origin to be **Bottom Left**

Tick the **Use origin offset**

Set the origin offset to be

X: = **-20.0** Y:= **-30.0**

Select the Units = **mm**

Click **OK** to set the material size and close the form.

2. Calculate the Toolpaths

For our design, we will create four toolpaths.

The first will be a pocketing toolpath to lighten the inner portion of the rod we will call this the Lightening Pocket.

To do this we must select the required vector.

To select the vector, **Click the Left mouse button** on the central pocket vector.

(When you release the left mouse button, the vector will now be colored purple (selected) as shown in Figure 4).

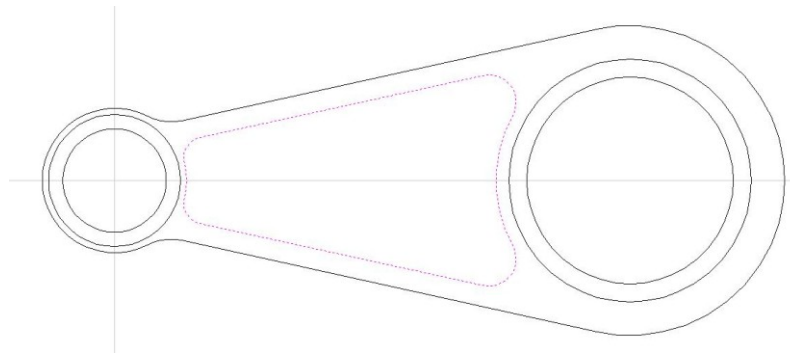

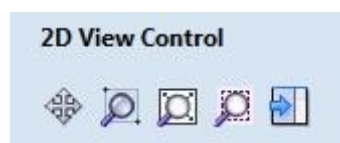


Figure 4. Central Pocket Vector Selected.

The design is now ready to calculate the pocketing toolpath.

3. From the **2D View Control** area select the **Switch to Toolpaths tab** .



This automatically **closes** the **Drawing Tab** and **opens** the **Toolpath Tab** on the **Right** side of the screen as shown below in Figure 5.

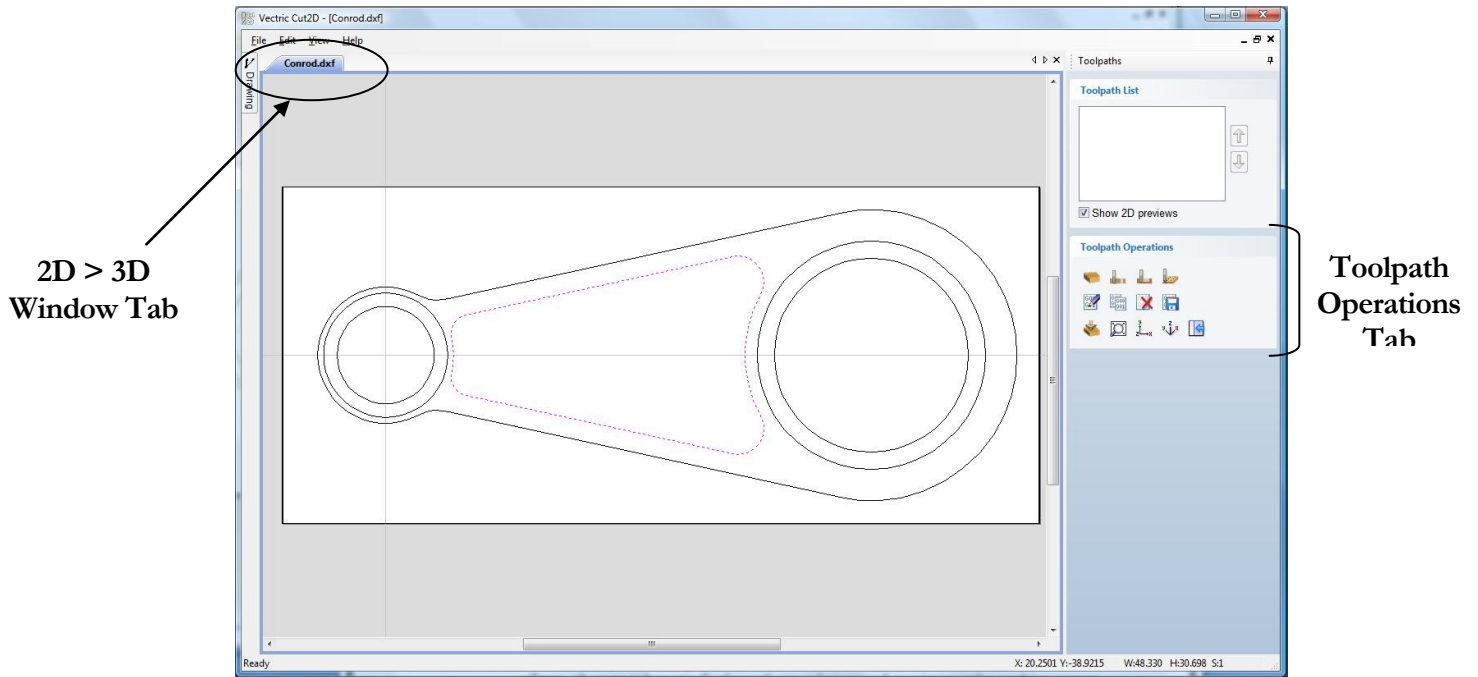


Figure 5. Toolpath Tab



To re-open the **Drawing Tab** simply click the cursor on the **Drawing icon** in the **Top Left corner** of the screen and the drawing tools will automatically appear.



The **Drawing** and **Toolpath Tabs** have an Auto Hide and Show behavior, which allows them to automatically close when not being used, maximizing the working screen area.

Click the **Push-Pin** to lock them in the Open position as shown below in Figure 6.

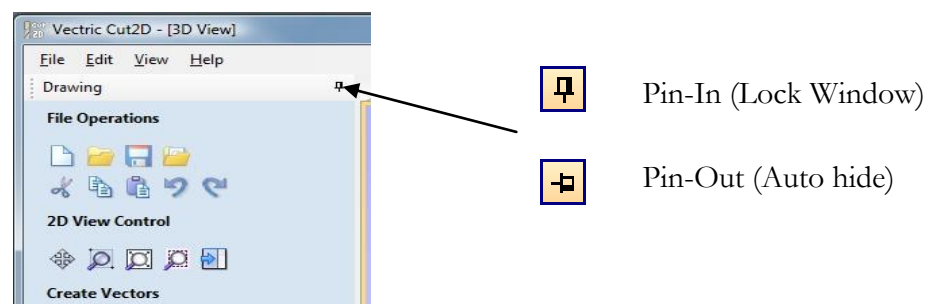


Figure 6. Auto Hide & Show windows

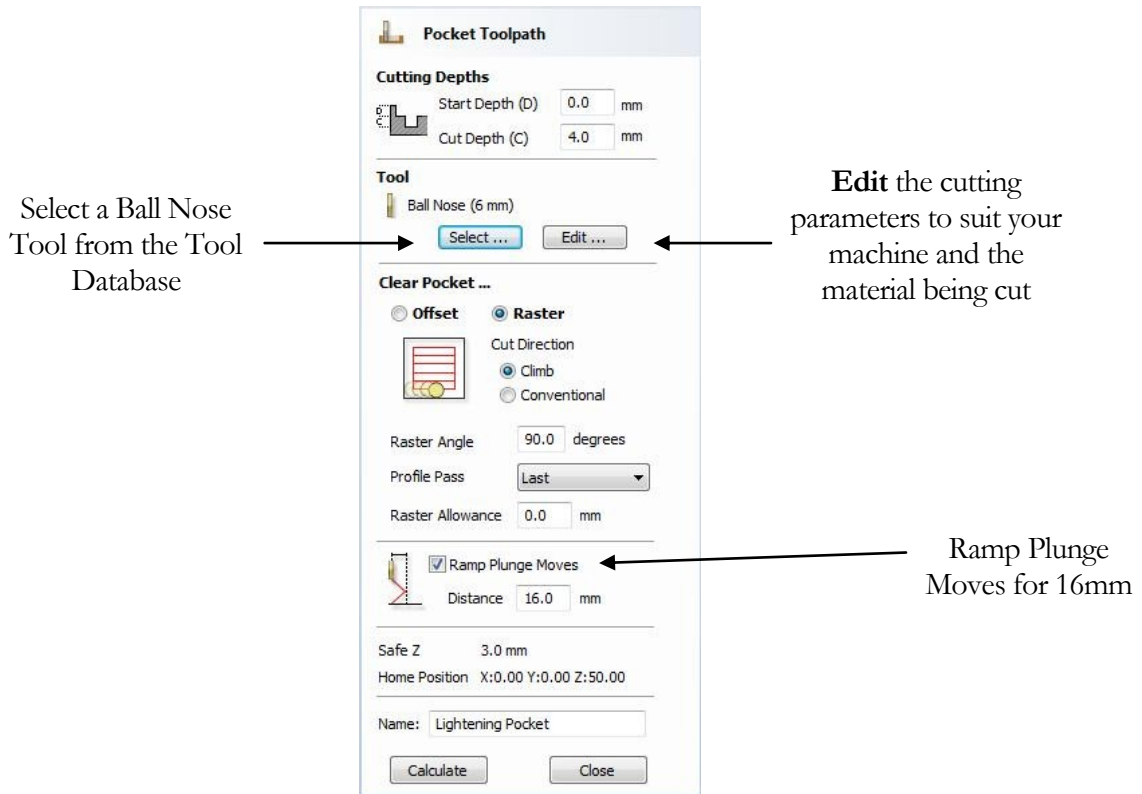


Figure 9. Inner Pocket Toolpath parameters

Click on the **Select** button to open the Tool Database and select a tool as shown below.

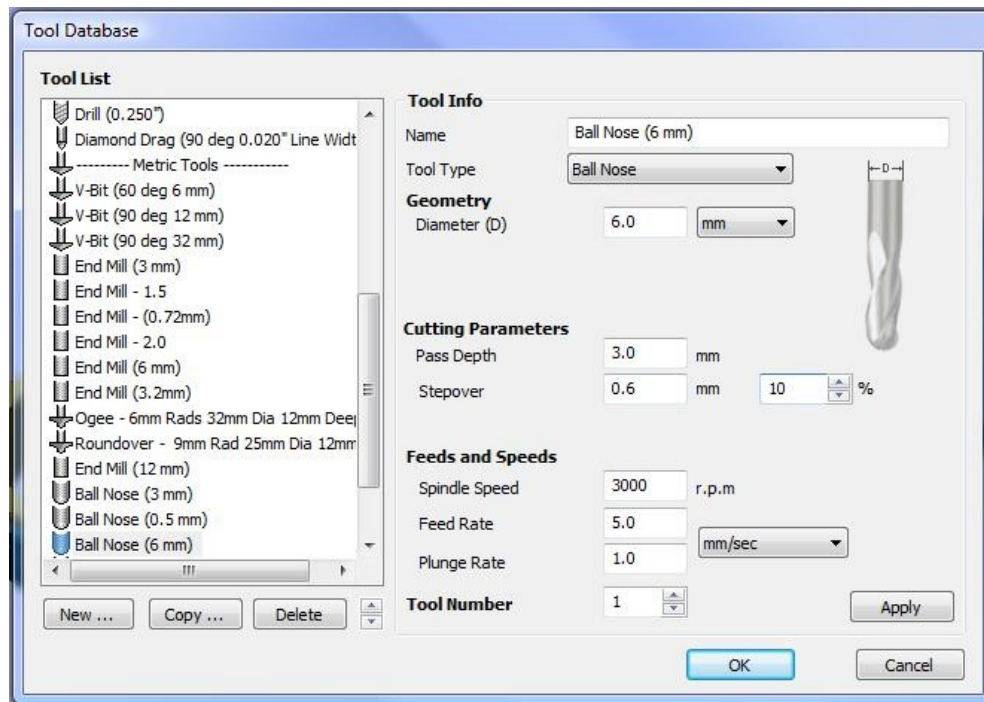


Figure 10. Tool Database

Important The **Cutting Parameters** should be set for the material you are cutting and to suit your machine tool.

Click the **Edit** button to modify the cutting parameters to match the tooling you are using and the material being machined.

- Click the **Calculate** button and the resulting toolpath will automatically be drawn in the **3D view** and the **Preview job** form opened, as shown below in Figure 11.

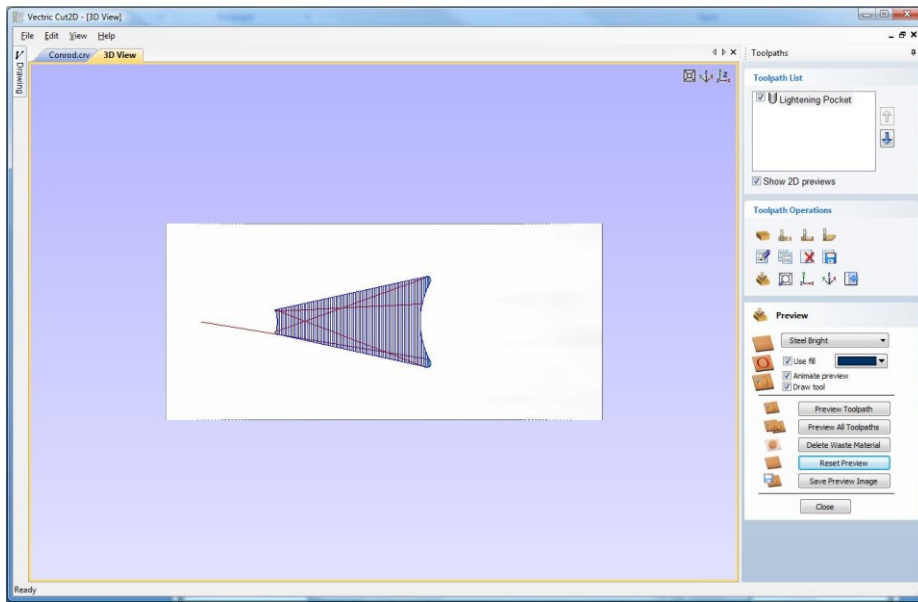


Figure 11. 3D View showing Toolpath & Material

Next we will produce a pocketing toolpath to produce the mail level of the rod.

First we need to return to the 2D window, to do this **Click the Left mouse button** on the 2D Window tab.

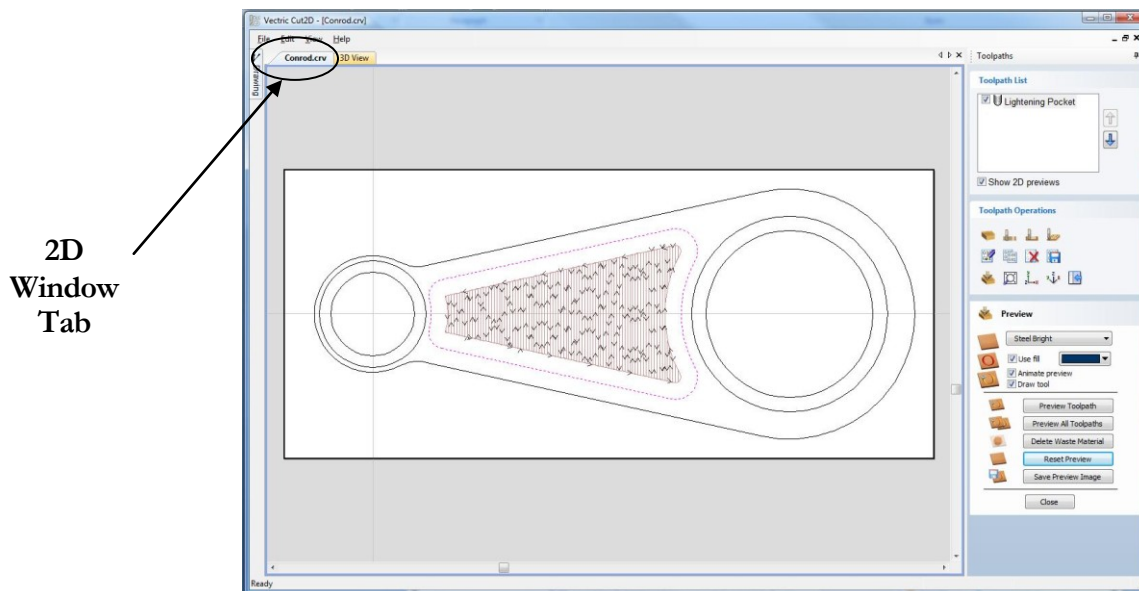


Figure12. Selecting the 2D window.

In the 2D window, **Click the Left mouse button** on each of the outer bore circles and the border vectors. (All three will now be colored purple).

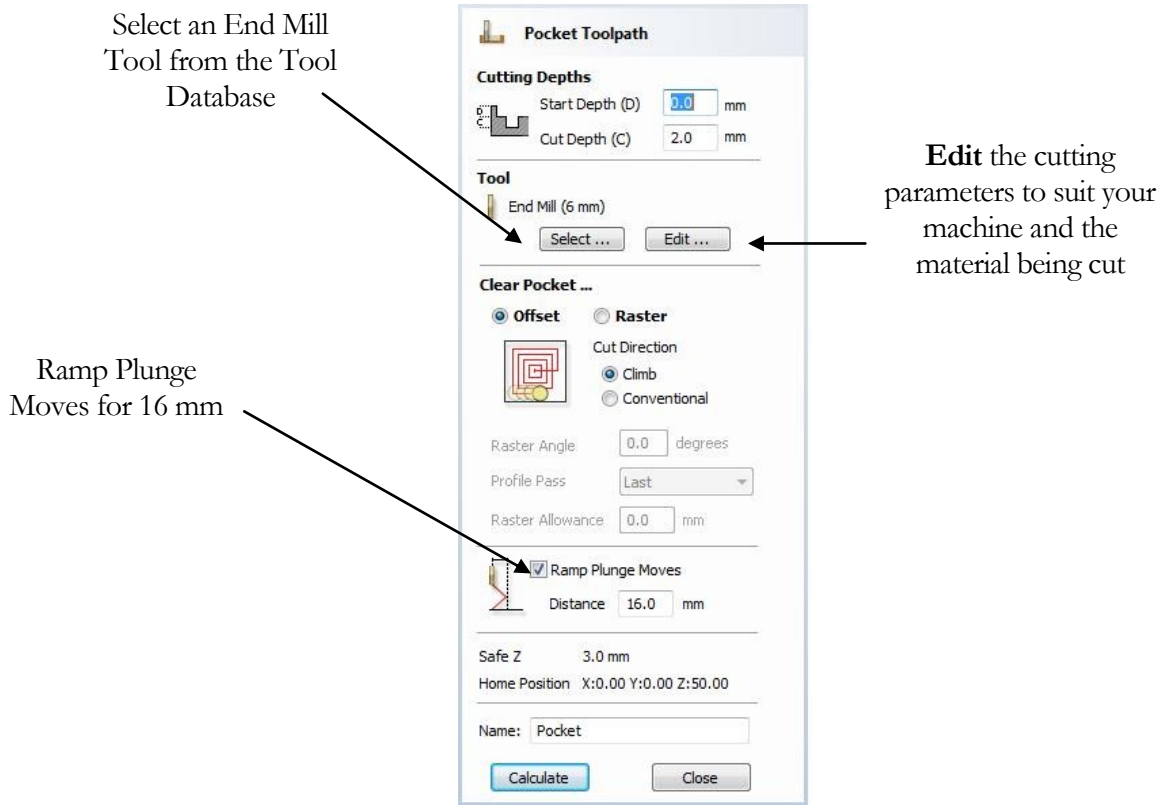


Figure 15. Main Pocket Toolpath parameters

Click on the **Select** button to open the Tool Database and select a tool as shown below.

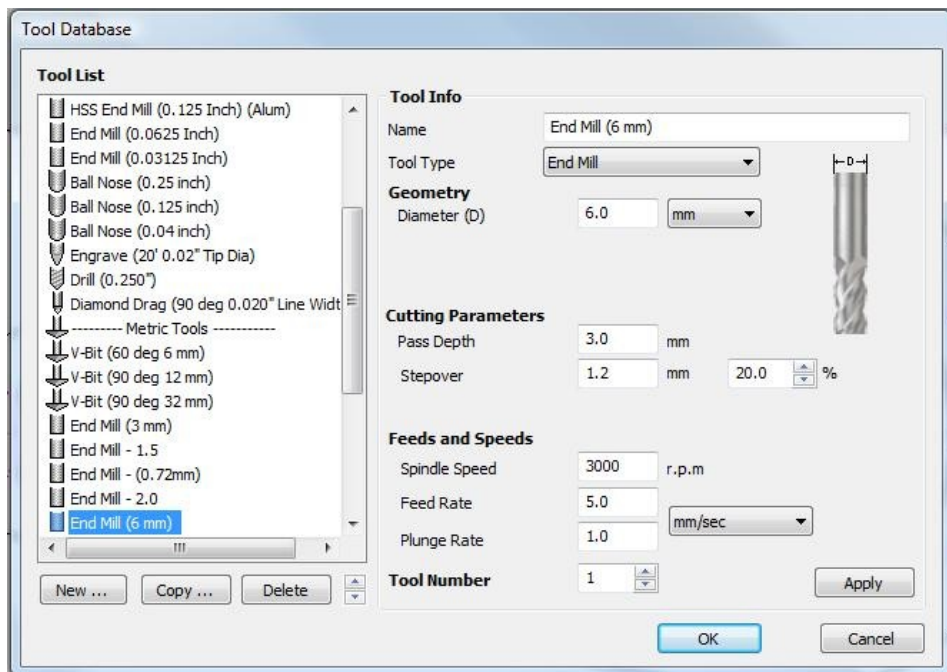


Figure 16. Tool Database

Important The **Cutting Parameters** should be set for the material you are cutting

Click the **Edit** button to modify the cutting parameters to match the tooling you are using and the material being machined.

- Click the **Calculate** button and the resulting toolpath will automatically be drawn in the **3D view** and the **Preview job** form opened, as shown below in Figure 17.

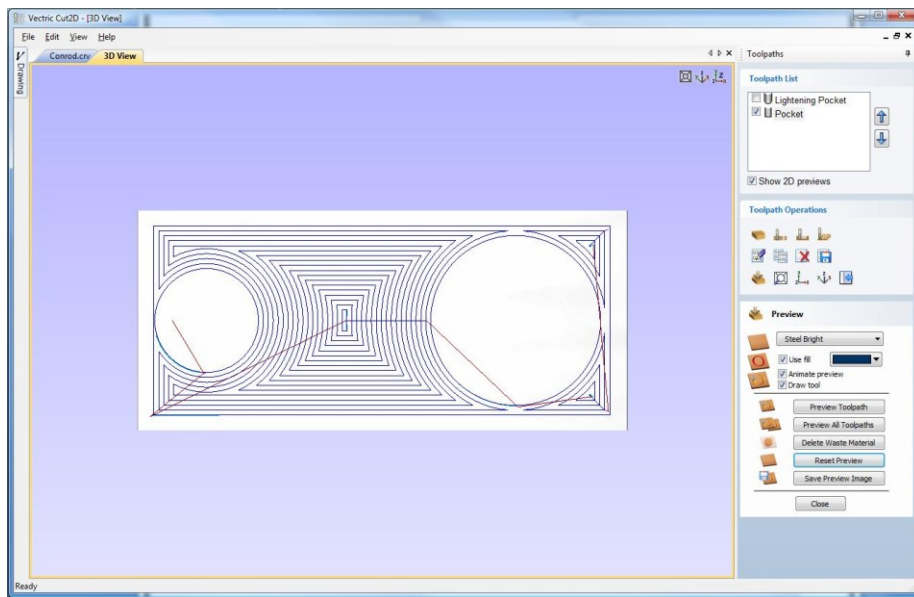


Figure 17. 3D View showing Toolpaths & Material

The next step we will take is to bore out the holes for the crankshaft and gudgeon pin.

- Click the inner two circle vectors (as shown in Figure 18.)

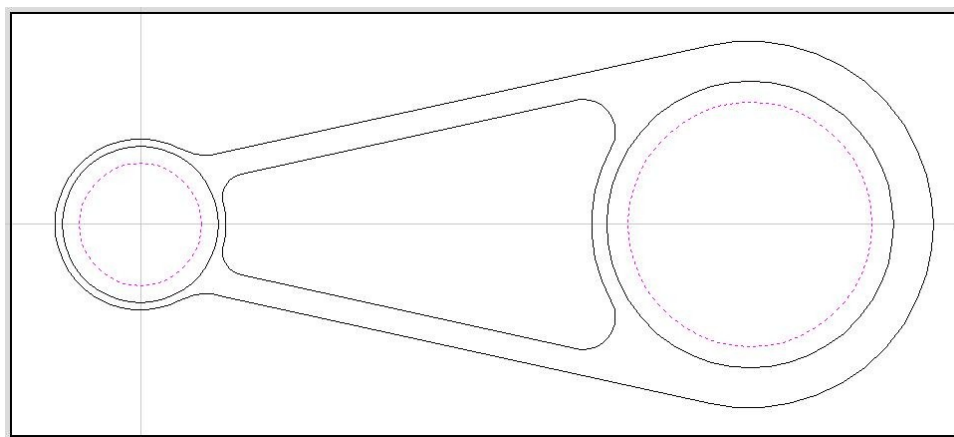


Figure 18. Bore Vectors Selected.

10. Next, select the **Create Pocket Toolpath**  icon from the **Toolpath Operations** list (Figure 19) and complete the form as shown below in Figure 20.



Figure 19. Toolpath Operations Tab.

For the profile we will use a **6.0mm (1/4") Diameter, End Mill Tool** and the maximum cut depth per pass will be set to 3.0mm (0.125"), this can be greater if cutting soft materials or less, if cutting harder materials.

Select an End Mill Tool from the Tool Database

Edit the cutting parameters to suit your machine and the material being cut

Ramp Plunge Moves for 6 mm

Figure 20. Bore Holes Pocket Toolpath parameters

Click on the **Select** button to open the Tool Database and select a tool as shown below.

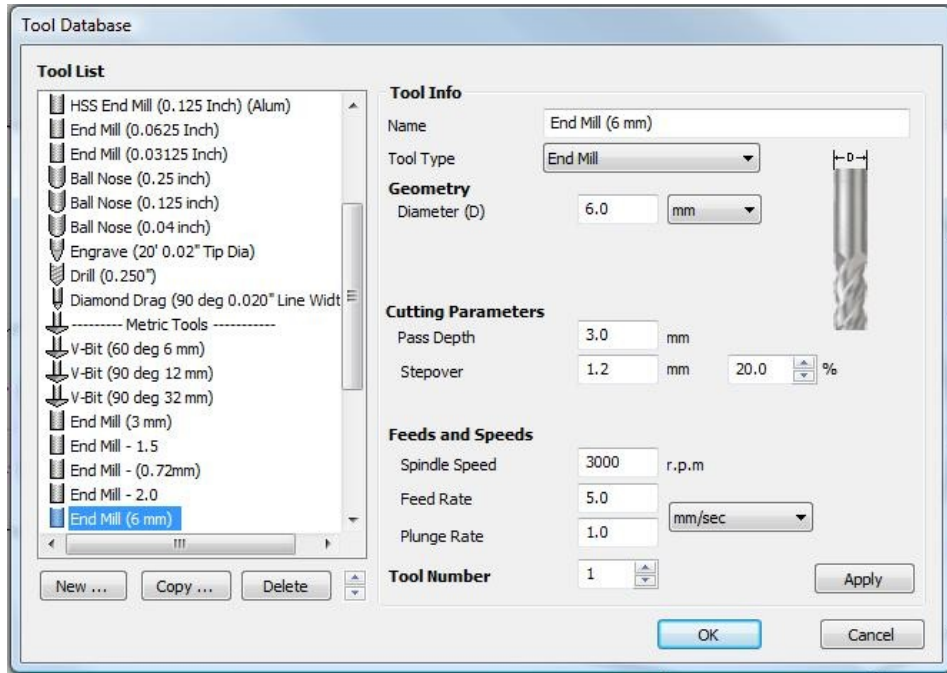


Figure 21. Tool Database

Important The **Cutting Parameters** should be set for the material you are cutting

Click the **Edit** button to modify the cutting parameters to match the tooling you are using and the material being machined.

11. Click the **Calculate** button and the resulting toolpath will automatically be drawn in the **3D view** and the **Preview job** form opened, as shown below in Figure 22.

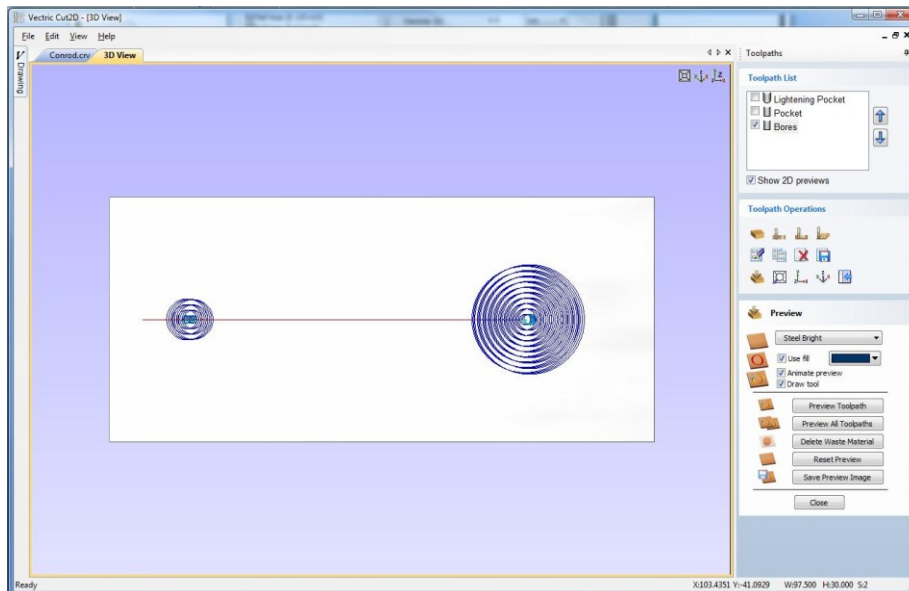


Figure 22. 3D View showing Toolpaths & Material

- Our final toolpath will profile the outside edge of the rod, to produce this first select the outer vector of the rod. (as shown in Figure 23.)

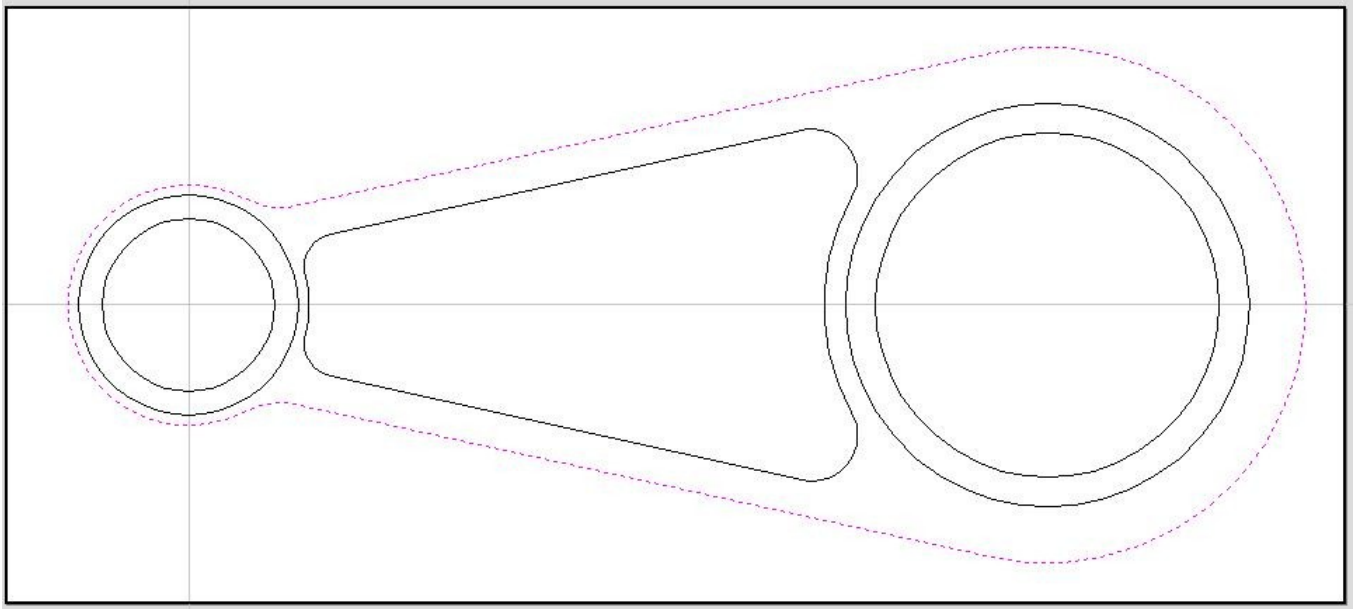


Figure 23. Outer Profile Vector Selected.

- Next, select the **Create Profile Toolpath**  icon from the **Toolpath Operations** list (Figure 24) and complete the form as shown below in Figure 25.



Figure 24. Toolpath Operations Tab.

For the profile we will use a **6.0mm (1/4") Diameter, End Mill Tool** and the maximum cut depth per pass will be set to 3.0mm (0.125"), this can be greater if cutting soft materials or less, if cutting harder materials.

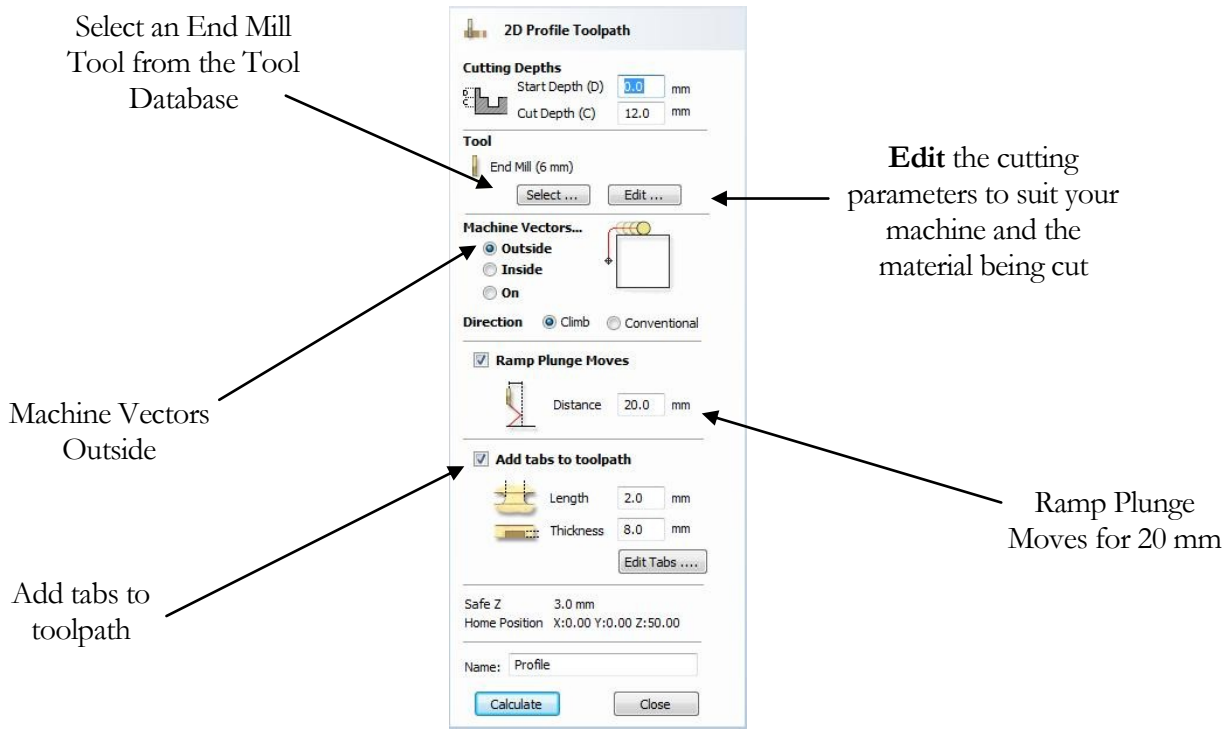


Figure 25. Profile Toolpath parameters

Click on the **Select** button to open the Tool Database and select a tool as shown below.

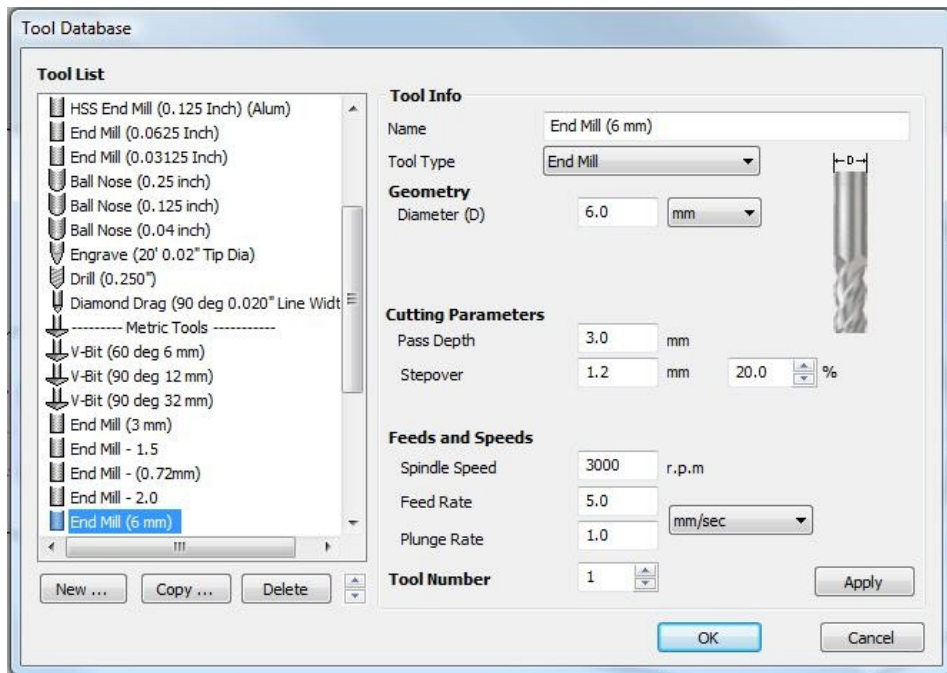


Figure 26. Tool Database

Important The **Cutting Parameters** should be set for the material you are cutting

Click the **Edit** button to modify the cutting parameters to match the tooling you are using and the material being machined.

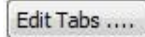
Adding Holding Tabs

Tick the **Add tabs to toolpath** tickbox.

Set the **Length** to be 2 mm.

Set the **Thickness** to be 8 mm.

Click on the **Edit Tabs...** button.




The **Toolpath Tabs** form will appear, as shown below in Figure 27.



Figure 27. Toolpath Tabs Form.

We will add four holding tabs by clicking four times around the profile vector in the locations that we would like the tabs to be positioned.

-  The tabs can be moved after they have been added, by clicking and dragging them around the profile to the desired position.

Click the **Close** button, to finish adding the tabs.

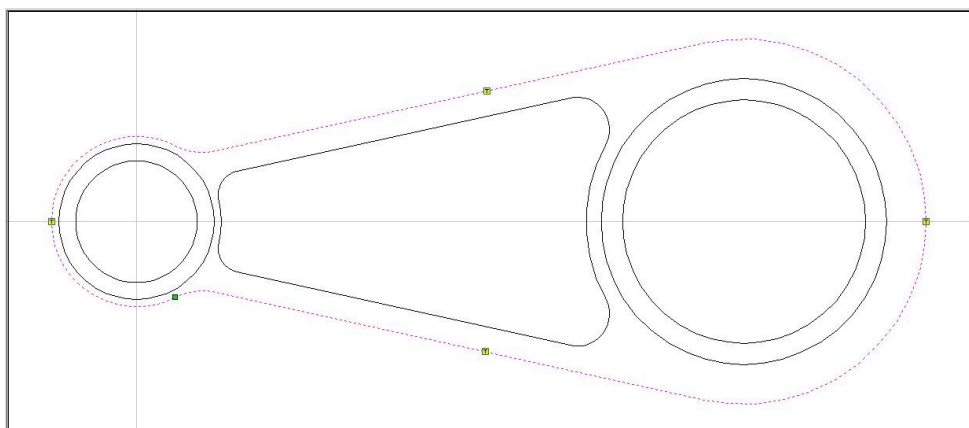


Figure 28. Profile Toolpath with Holding Tabs Added.

(The Tabs are denoted by small yellow squares marked with a black "T")

14. Click the **Calculate** button and the resulting toolpath will automatically be drawn in the **3D view** and the **Preview job** form opened, as shown below in Figure 29.

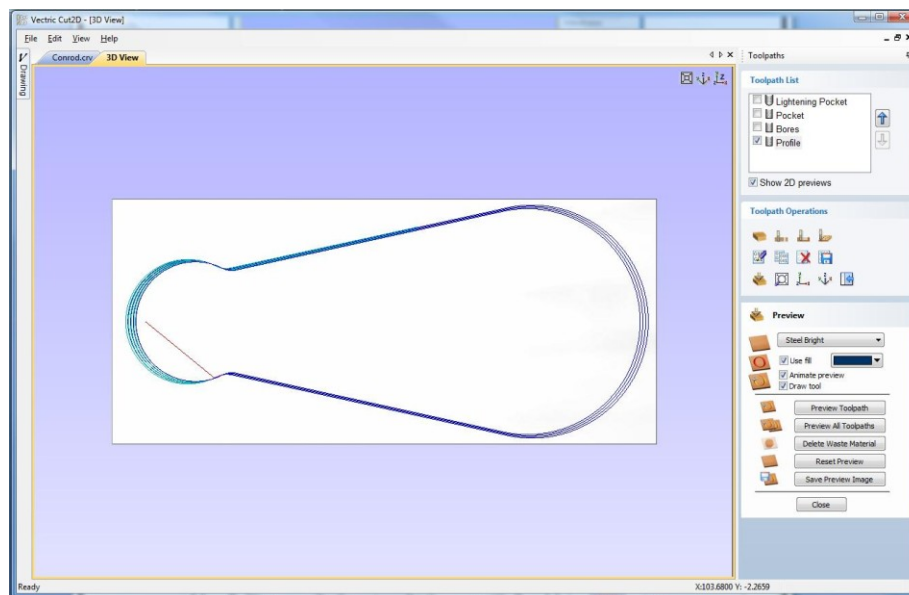




Figure 29. 3D View showing Toolpaths & Material

Rotating the 3D View

To rotate the model, **Click** and hold the **Left** mouse button whilst moving the mouse.

To zoom, use **Middle Wheel** on mouse or **Push / Pull** the **Right** mouse button

Pan using **Ctrl + Right** mouse button or the **Left + Right** mouse buttons together


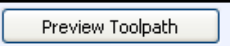
For the standard views use the **ISO**  and **Plan**  view icons in the top right corner of the 3D view.

3. Preview the finished job

After calculating a toolpath the **Preview form** is automatically opened. This form is used to simulate the toolpath and also to define different material and colour fill settings, which can be changed to create realistic screen images.



Figure 30. Job Preview

15. Click the **Preview Toolpath**   icon and an animated representation of the Tool cutting into the material will be shown in the 3D window.



If running the software on low performance / old hardware, you might wish to switch off the **Animate Preview** and **Draw Tool** options, as this will increase the simulation speed.

16. The finished design can be shaded in different Material types and as shown below in Figure 31. Shows the design in Bright Steel and Brass with different fill colors.

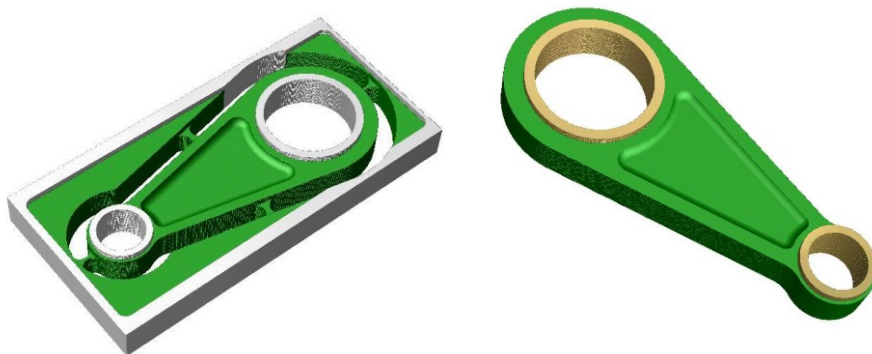

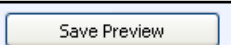


Figure 31. Finished design shown in Bright Steel and Dark Brass.



If you have used holding tabs and you wish to preview the finished job without the waste material, un-tick the tabs option and re-calculate the toolpath, then re-preview.

17. Click the **Save Preview**   button to save the 3D window as an image file (bmp, jpg or gif) for use in customer quotations, marketing brochures or web site pictures etc.

4. Editing and Saving the Toolpaths

Calculated toolpaths can be edited by either,



Clicking the **Edit Toolpath** icon or **Double clicking** on the name of the Toolpath name in the Toolpath List.

18. **Save** one of the Toolpaths by clicking the **Save Toolpath**  icon.

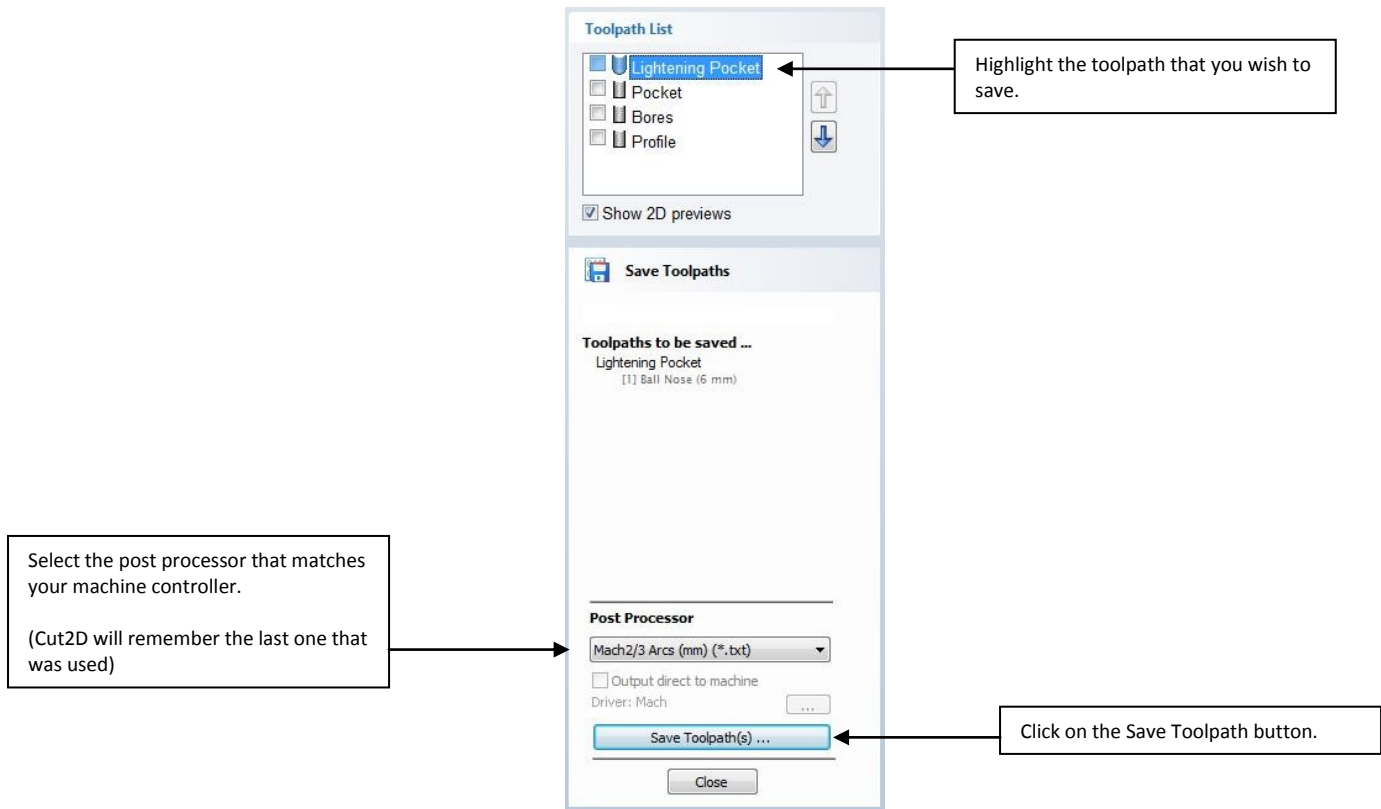



Figure 32. Save Toolpath form

19. From the pull-down list of postprocessors, select the appropriate one for your CNC machine as shown above in Figure 32.
20. Click the **Save Toolpaths** button and enter a name to save the toolpath with, repeat for the remaining toolpaths.

You have now saved the NC files that can be run on your machine tool.

-  Take extreme care to ensure the material and cutter are setup correctly before using the toolpath.

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If you have any questions or need assistance

Visit the Vectric User Forum - www.vectric.com/forum

Or

E-mail – support@vectric.com
