

# Getting Started With

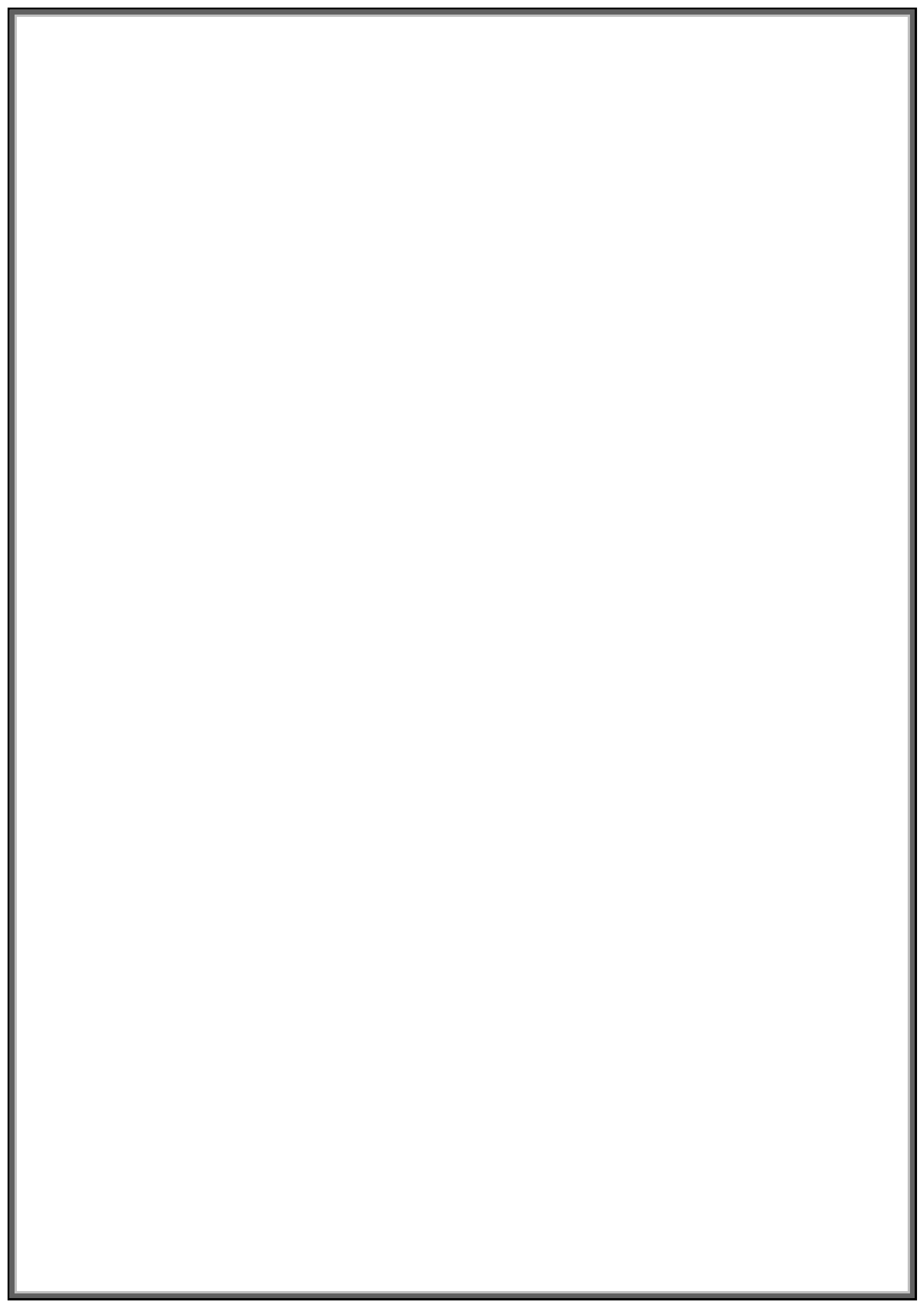
# Cut2D

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**Tutorial 4 – Intermediate Level  
Model Locomotive Wheel**

**Vectric**



## 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 Locomotive Wheel 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](http://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](mailto:support@vectric.com)
5. **Frequently Asked Questions (FAQ)** - The support area on the Vectric web site at [www.vectric.com](http://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

 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

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

## Tutorial 4

## Model Locomotive Wheel

Design Courtesy of John Stevenson  
L Stevenson [Engineers]

### Introduction

This **Intermediate Level Tutorial** will show you how to make the Wheel shown below in Figure 1, which is approximately 2 ¾" (70mm) in diameter. 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 Wheel

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 “LocoWheel.dxf” the design, as shown below in Figure 2, will now be displayed in the 2D window and the Material Setup form is opened.

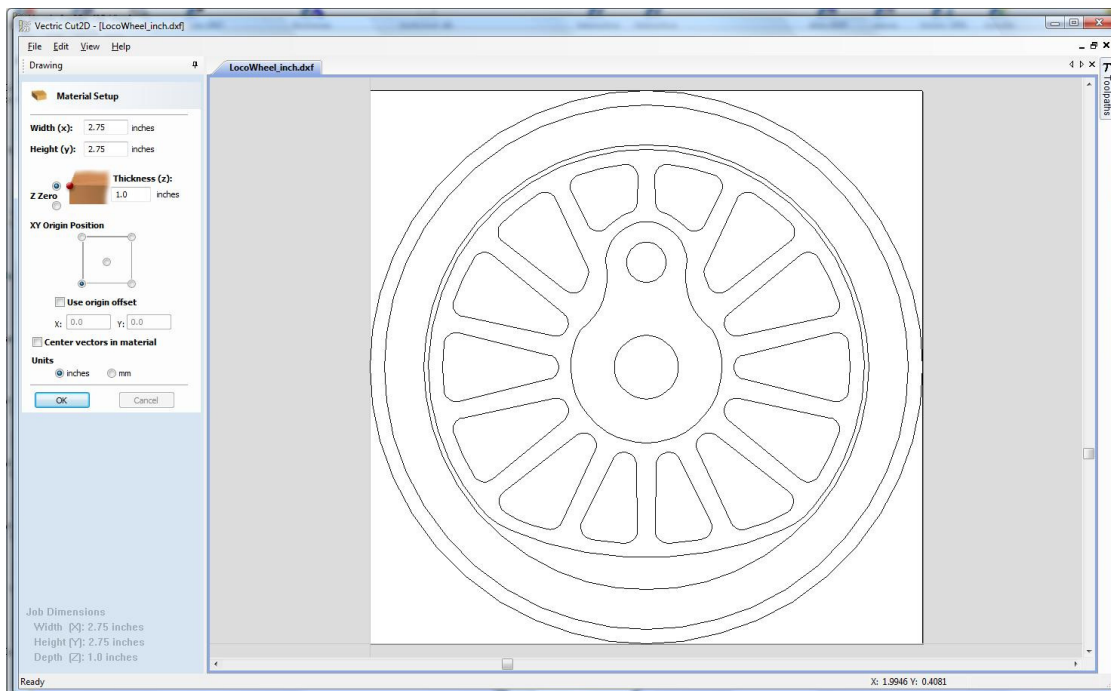


Figure 2 Imported Design.




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



**Material Setup**

Width (x): 3.5 inches

Height (y): 3.5 inches

**Z Zero**  **Thickness (z):** 0.275 inches

**XY Origin Position**

Use origin offset

X: 0.0 Y: 0.0

Center vectors in material

**Units**

inches  mm

OK Cancel

Figure 3. Material Setup Form

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

Width (X) = 3.5"

Height (Y) = 3.5"

Material Thickness = 0.275"

Z Zero on the **Material Surface**

Click X0, Y0 Origin to be **Center**

Tick the **Center vectors in material**

Select the Units = **Inches**

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

## 2. Calculate the Toolpaths

For our design, we will create six toolpaths.

The first will be a profile toolpath to raise up the inner portion of the wheel, we will call this the Inner Profile.

To do this we must select the required vector.

To select the vector, **Click the Left mouse button** on the third circle from the outside.

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

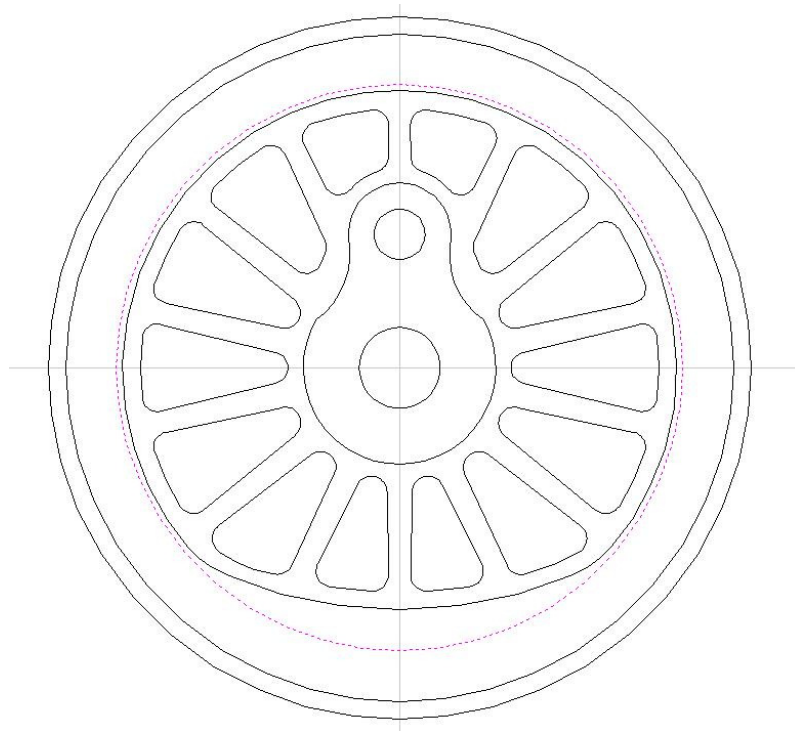



Figure 4. Inner Profile Vector Selected.

The design is now ready to calculate the profile 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.

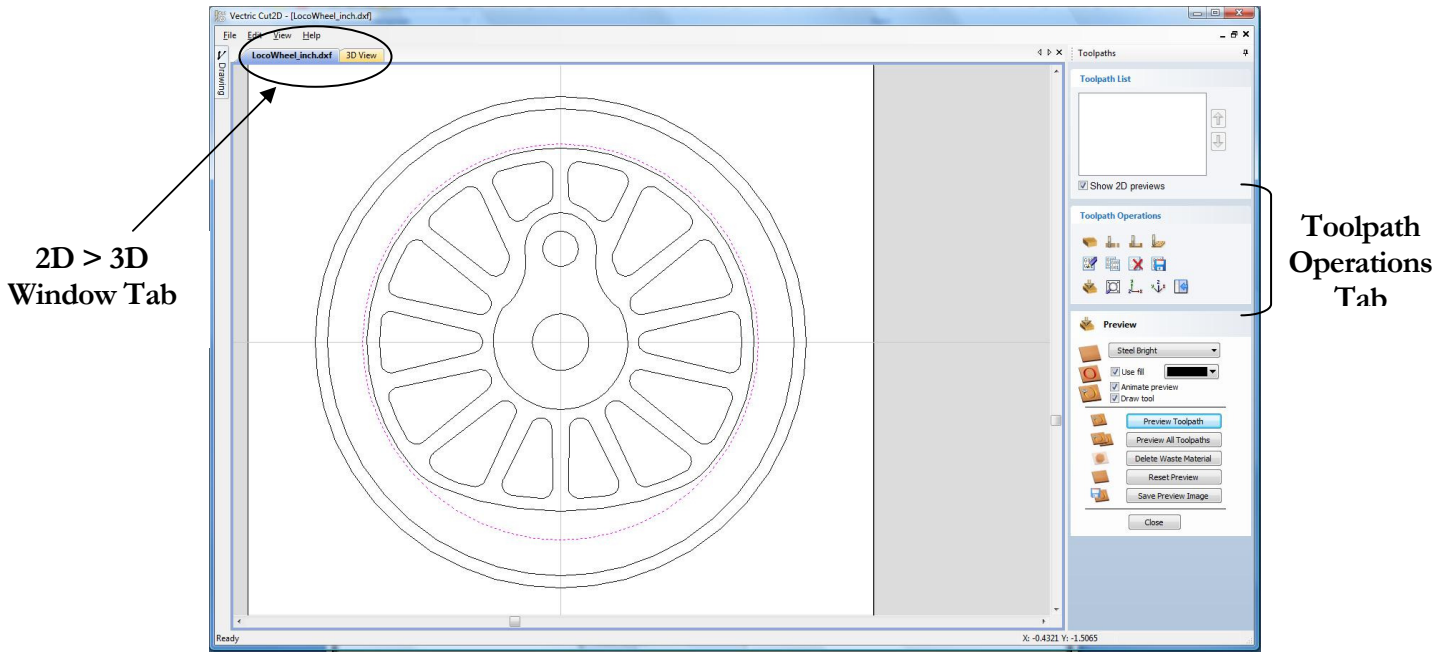


Figure 5. Toolpath Tab



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.

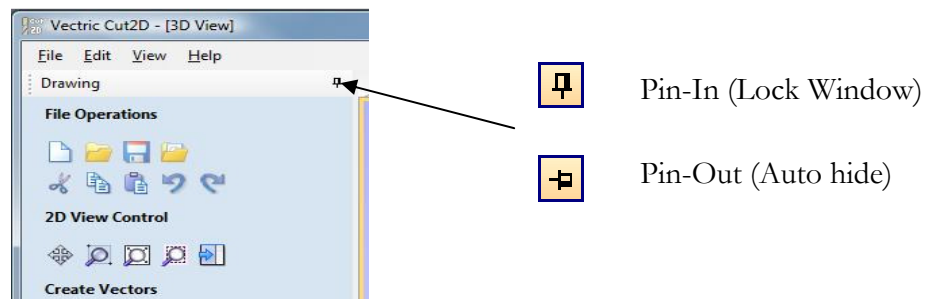



Figure 6. Auto Hide & Show windows

4. Select the **Material Setup** icon  from the **Toolpath Operations** list on the Toolpaths tab and specify the Rapid Clearance Gap to be **0.2"** and Home position to be **X0, Y0, Z2"** as shown below in Figure 7. (or a home position to suit your machine) Click **OK** to confirm.

**Note**  
Z Zero position is set to the top of the material.

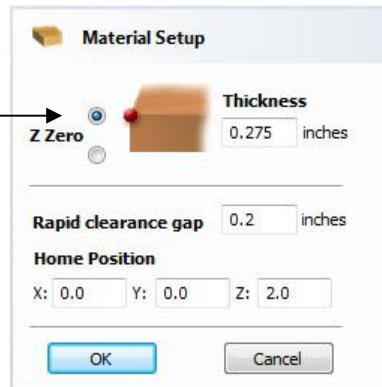


Figure 7. Material Setup


5. Next, select the **Create Profile Toolpath**  icon from the **Toolpath Operations** list (Figure 8) and complete the form as shown below in Figure 9.



Figure 8. Toolpath Operations Tab.

In this example we are cutting Free Machining Aluminium with a **1/4" (6.3mm) Diameter, End Mill Tool** and the maximum cut depth per pass will be set to 0.125" (3.175mm), this can be greater if cutting soft materials or less, if cutting harder materials.

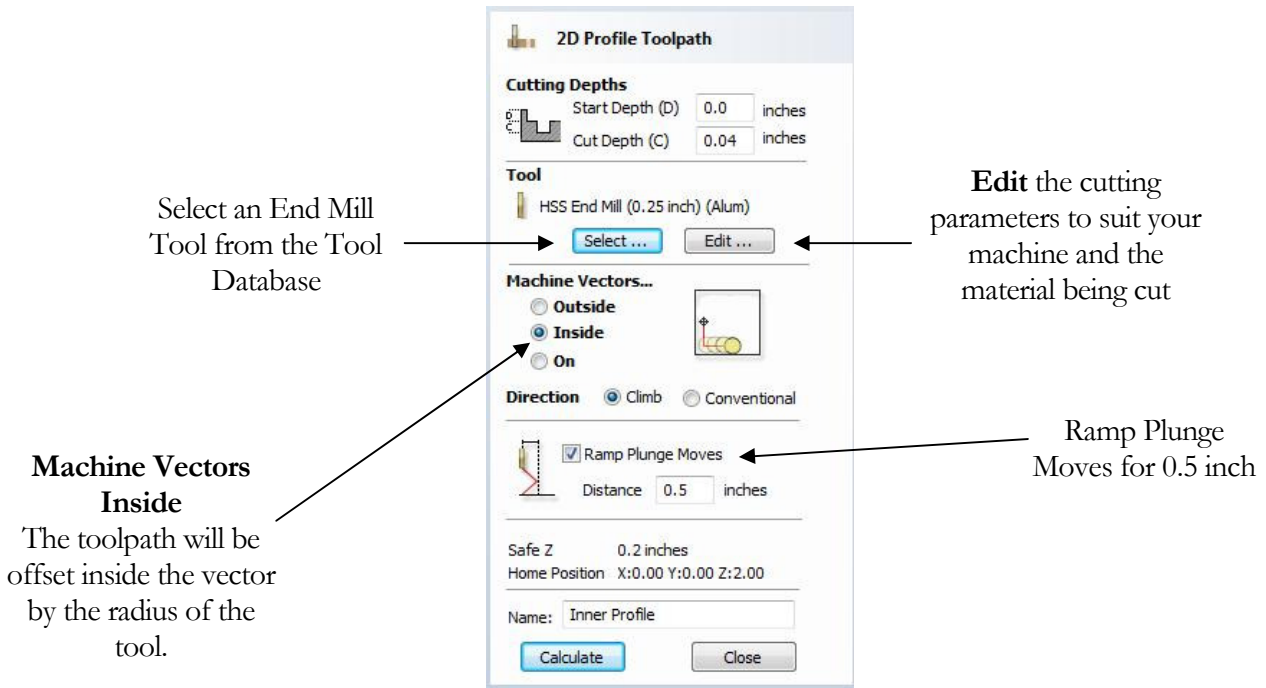


Figure 9. Inner Profile Toolpath parameters

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

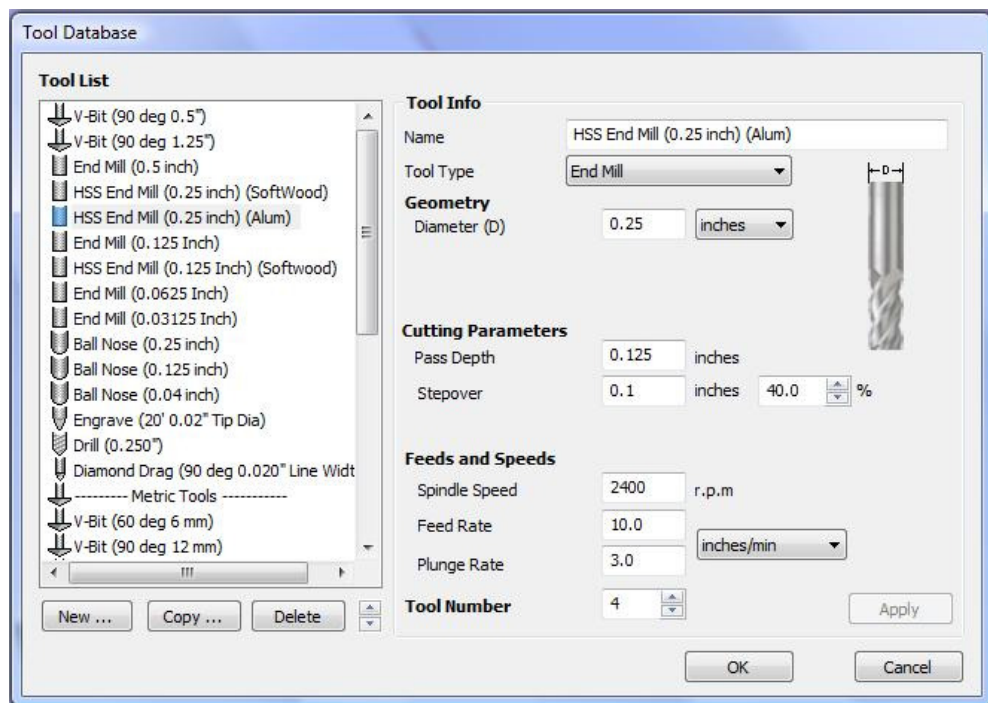


Figure 10. Tool Database

**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.

6. 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.

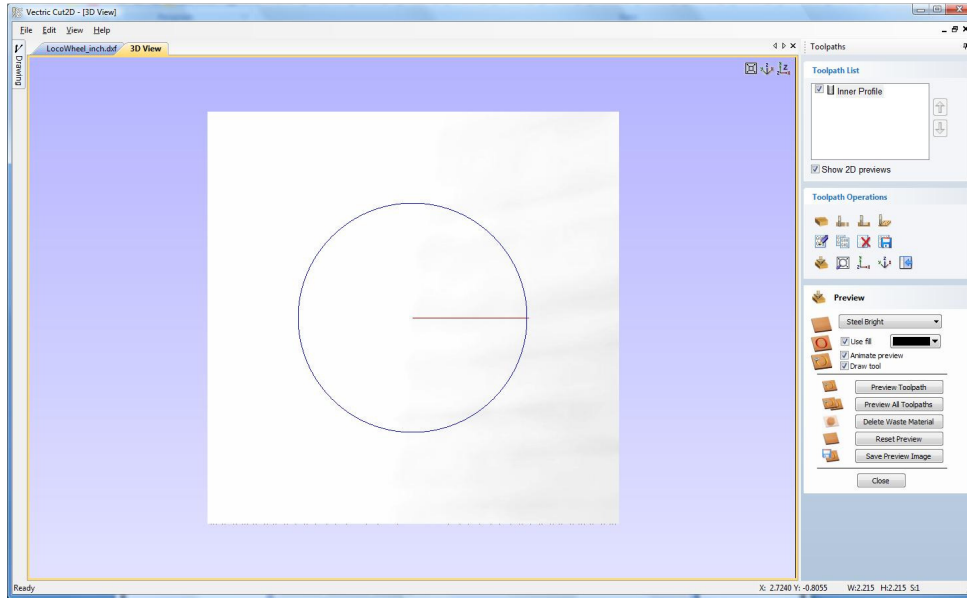


Figure 11. 3D View showing Toolpath & Material

Next we will produce a pocketing toolpath to shape the drive cam.

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

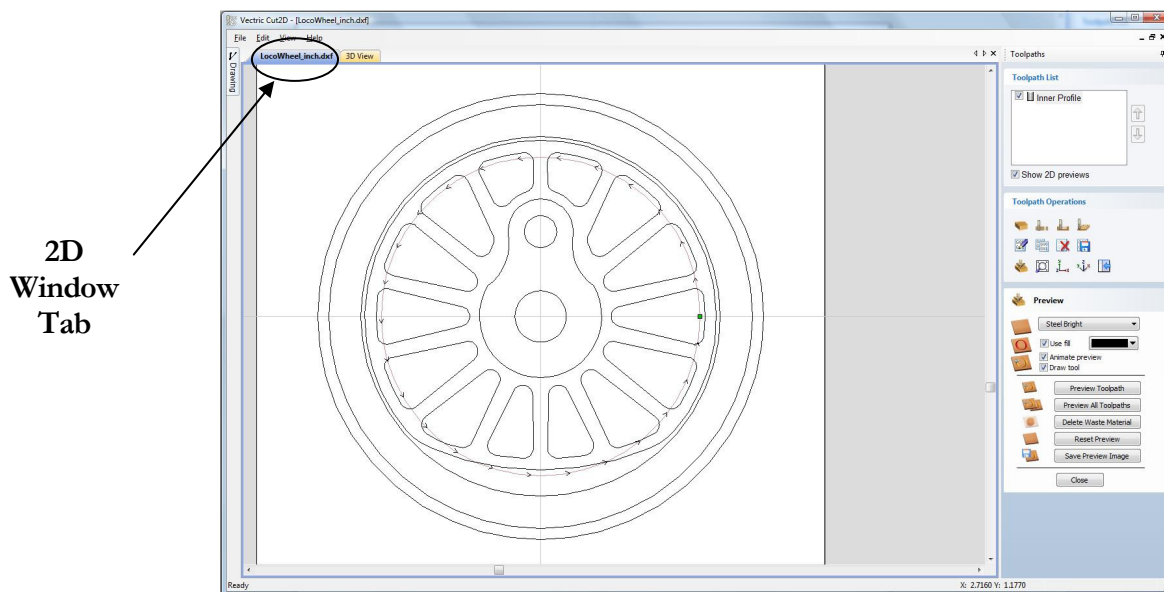


Figure12. Selecting the 2D window.

In the 2D window, **Click the Left mouse button** on the Counterweight vector and the Cam vector.  
(They will now both be colored purple).

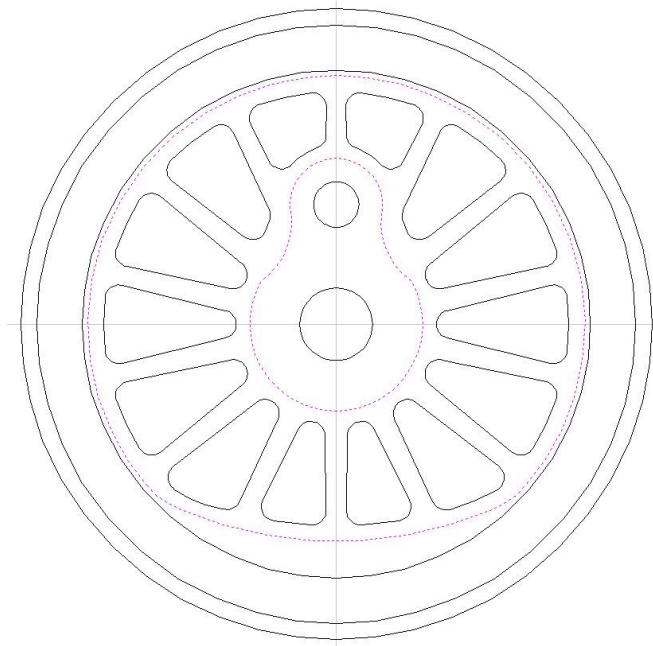


Figure 13. Counterweight & Cam Vectors Selected.

7. Next, select the **Create Pocket Toolpath**  icon from the **Toolpath Operations** list (Figure 14) and complete the form as shown below in Figure 15.



Figure 14. Toolpath Operations Tab.

For the profile we will use a **1/4" (6.3mm) Diameter, End Mill Tool** and the maximum cut depth per pass will be set to 0.125" (3.175mm), this can be greater if cutting soft materials or less, if cutting harder materials.

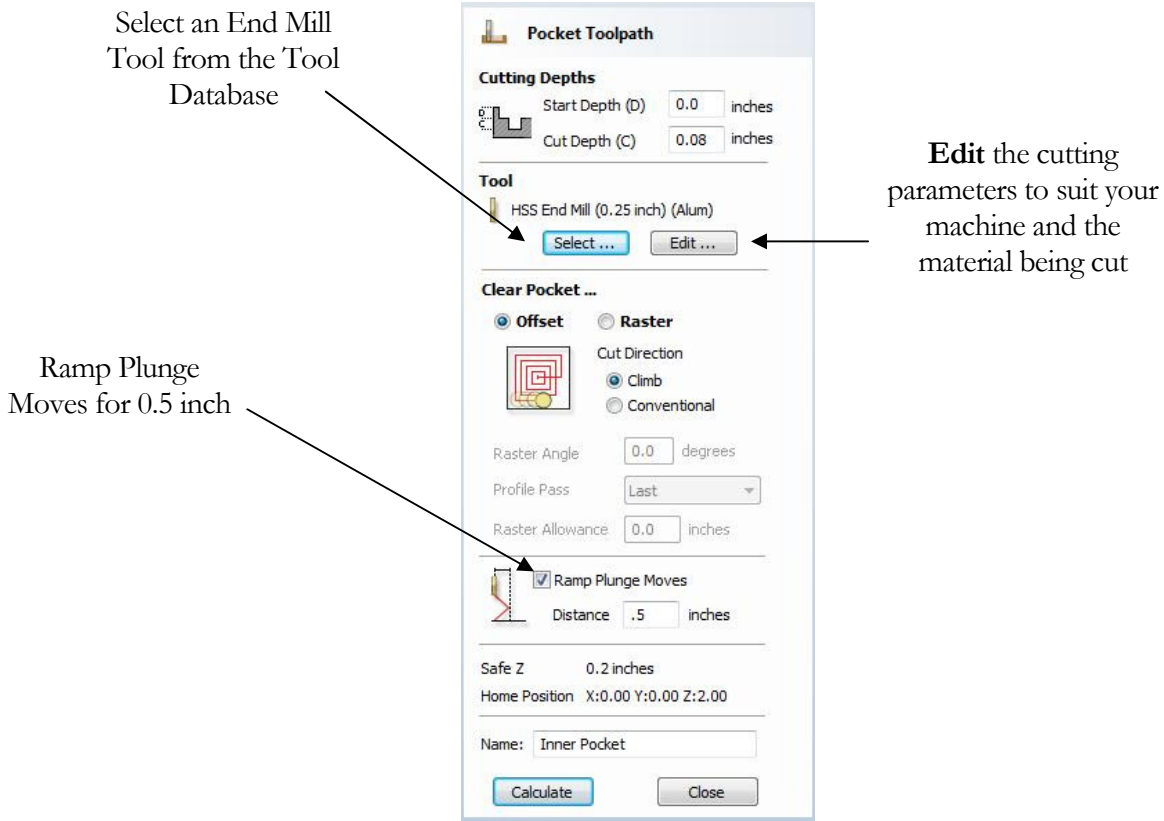


Figure 15. Inner Pocket Toolpath parameters

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

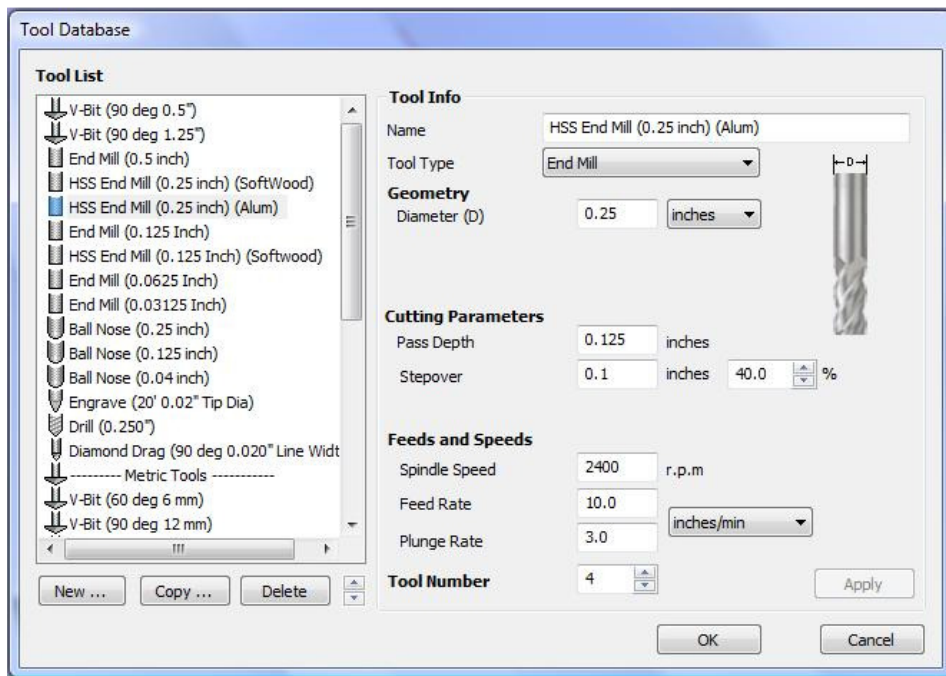


Figure 16. Tool Database

**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.



8. 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.

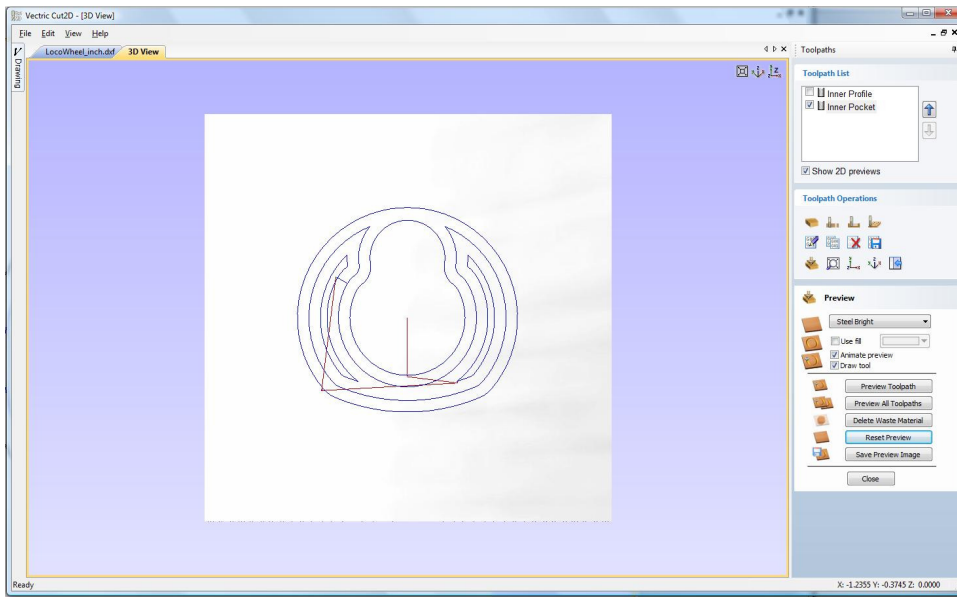


Figure 17. 3D View showing Toolpaths & Material

9. The next toolpath that we will create is a profile toolpath to create the rim of the wheel.
10. Select the second outermost circle, this will be used to create the rim of the wheel.

Repeat steps 5 to 6 to create a new Profile toolpath called **Rim Profile**, enter the values as shown in the form below.

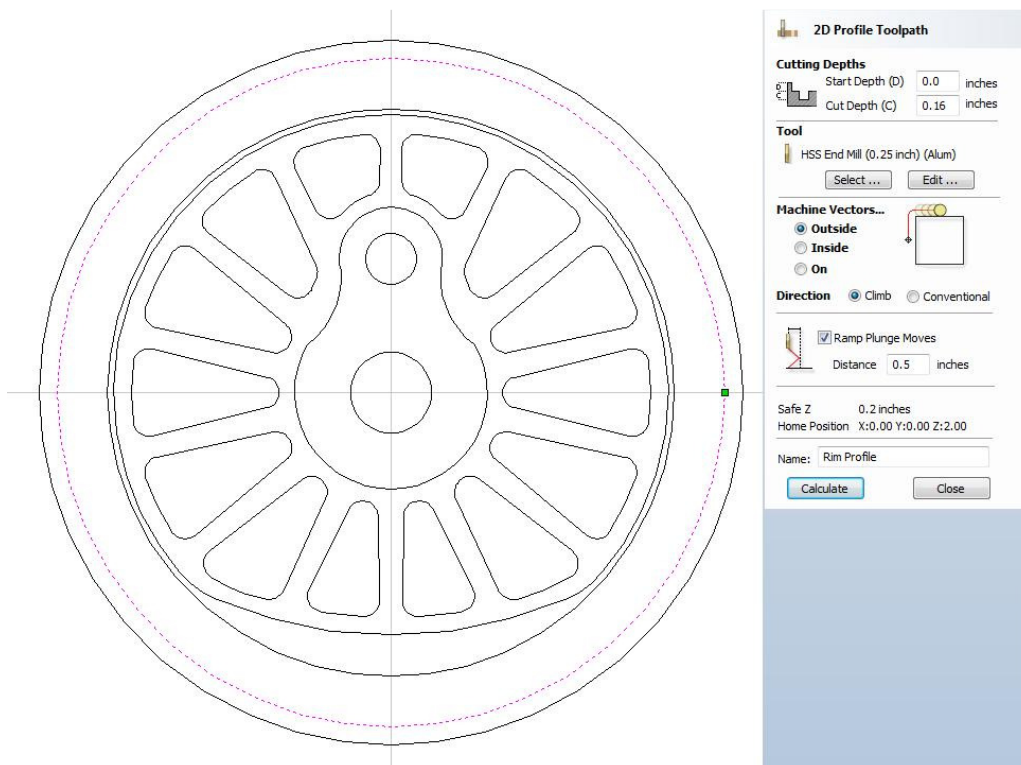


Figure 18. Rim Profile Selected.

11. Next we will produce a toolpath to profile the outside edge of the wheel, to do this first select the outermost circle.

Repeat steps 5-6 and create a profile toolpath called **Outer Profile** using the values specified in the form below.

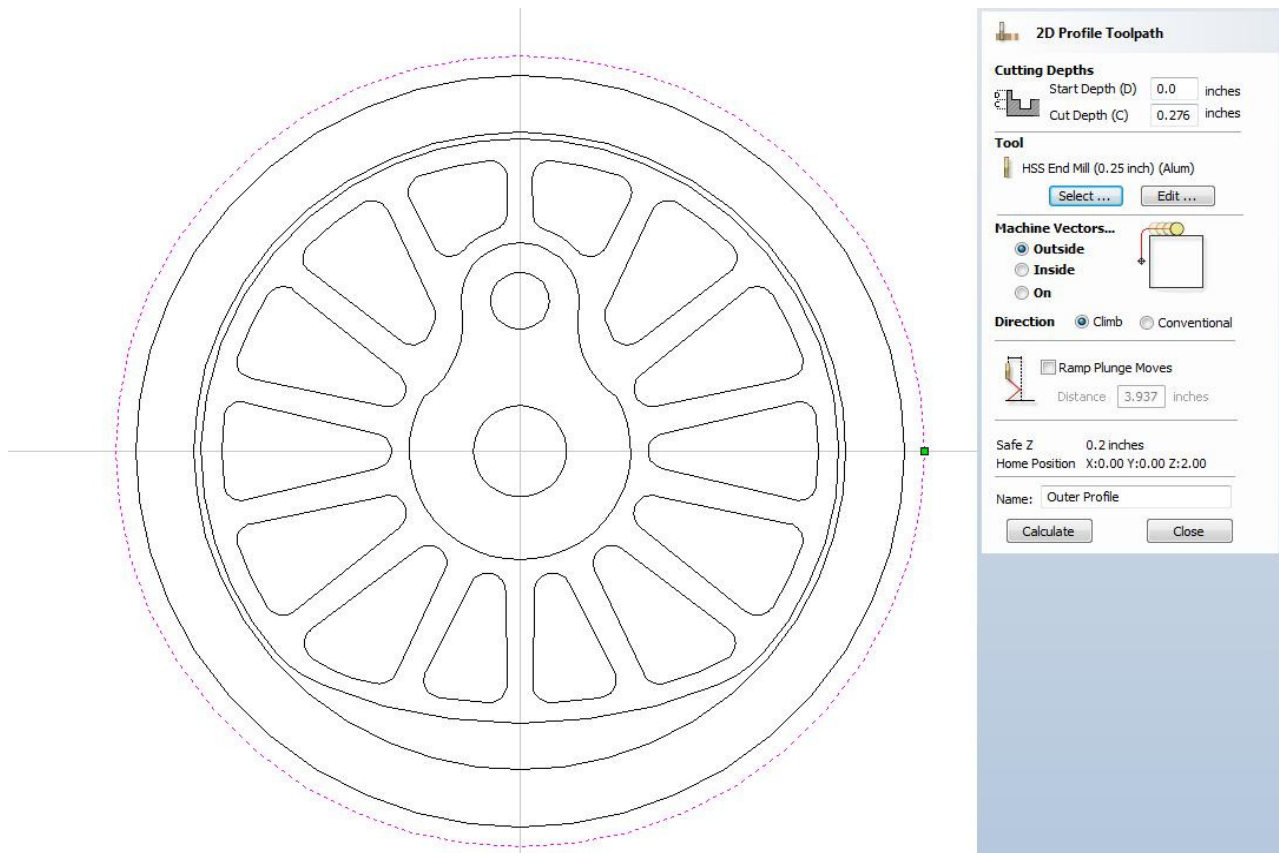


Figure 19. Outer Profile Vector Selected.

**i** This toolpath is set to cut deeper than the material, you might want to alter the “Cut Depth (C)” setting, depending on how you have clamped your material . Whenever Cut2D is set to cut deeper than the material, the following warning box will be displayed.

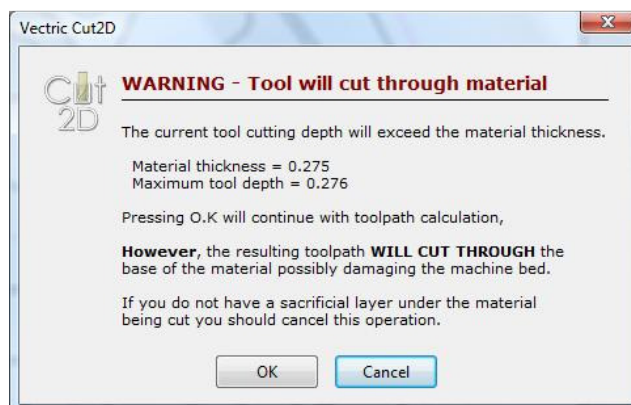


Figure 20. Warning Message

**i** Depending on how you have clamped your material, you might choose to run this toolpath last, it has been run at this point to minimize tool changes You can change the order in which you run toolpaths by using the arrows, to the right hand side of the **Toolpath List** .

The final two toolpaths will use a 1/8" (3.175 mm) End Mill tool.

The next toolpath will bore out the holes in the design with an end mill tool as an alternative to drilling the holes. **These holes will also cut deeper than the material.**

12. Select the two holes and Repeat the steps 7-8 to create a Pocket Toolpath called **Holes**, using the values from the form below.

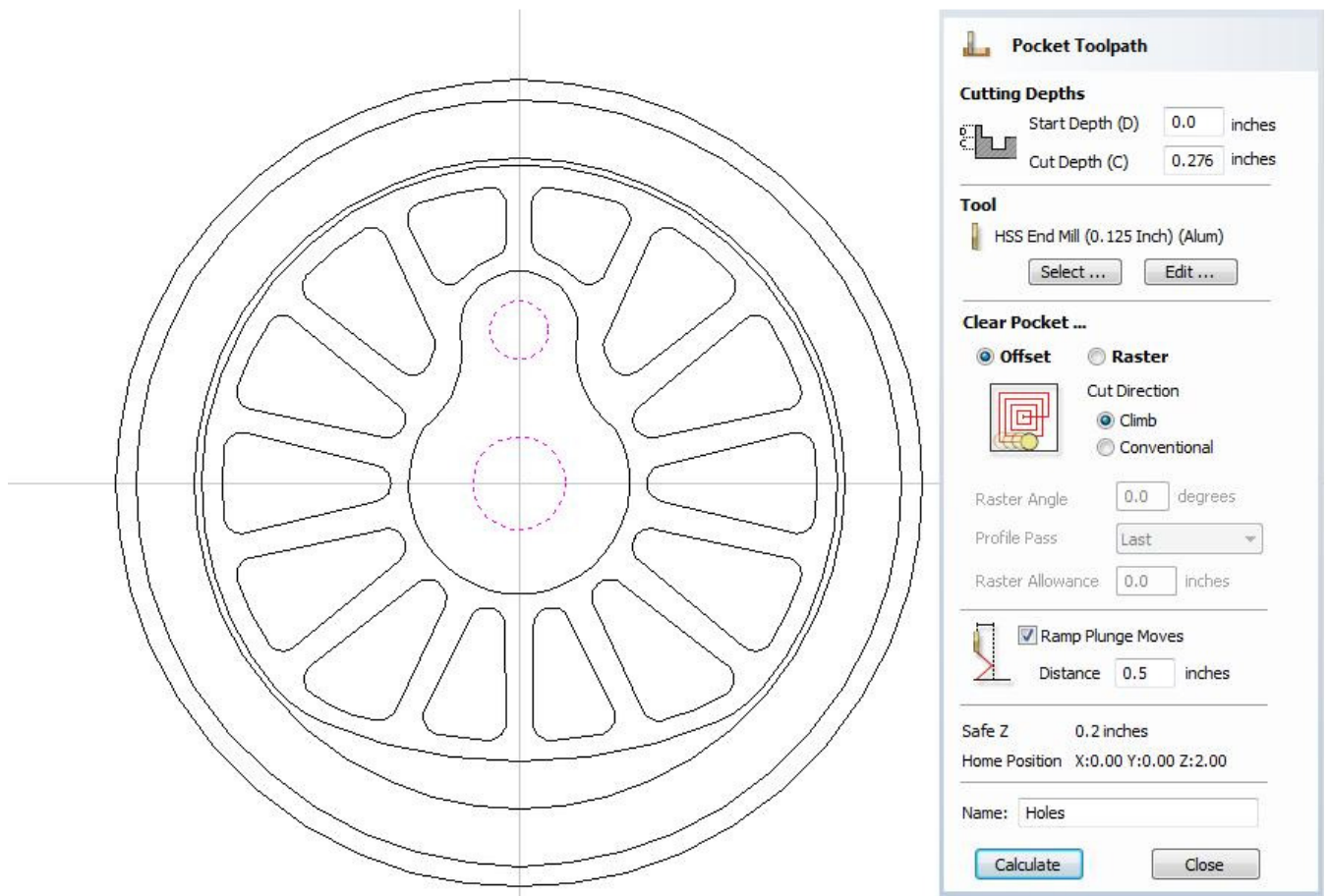


Figure 21. Hole Vectors Selected.

Our final toolpath, will be a pocket toolpath to create the spokes on the wheel.

13. Select the radial slots that surround the Cam vector and Repeat the steps 7-8 to create a Pocket Toolpath called **Spokes**, using the values from the form below.

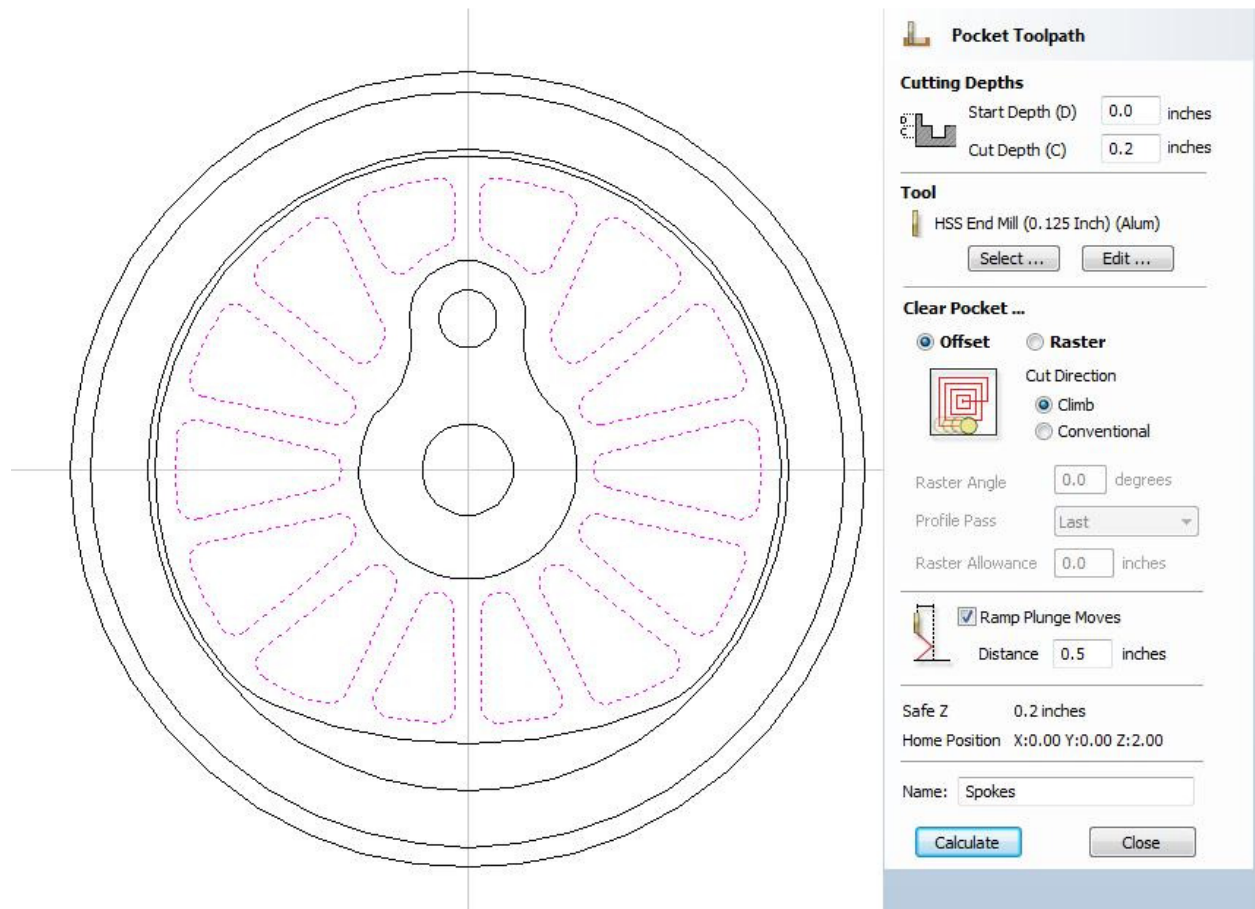




Figure 22. Spoke Vectors Selected.

## 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


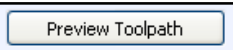
For the standard views use the **ISO**  and **Plan**  view icons in the top right corner of the 3D view.

### 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 23. Job Preview

14. 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.

15. The finished design can be shaded in different Material types and as shown below in Figure 24. Shows the design in Bright Steel, with and without waste material and using a fill color.

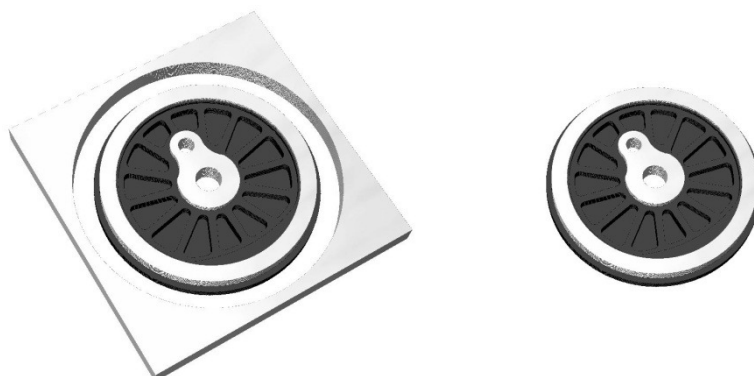

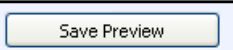



Figure 24. Finished design shown in Bright Steel, with and without waste material.

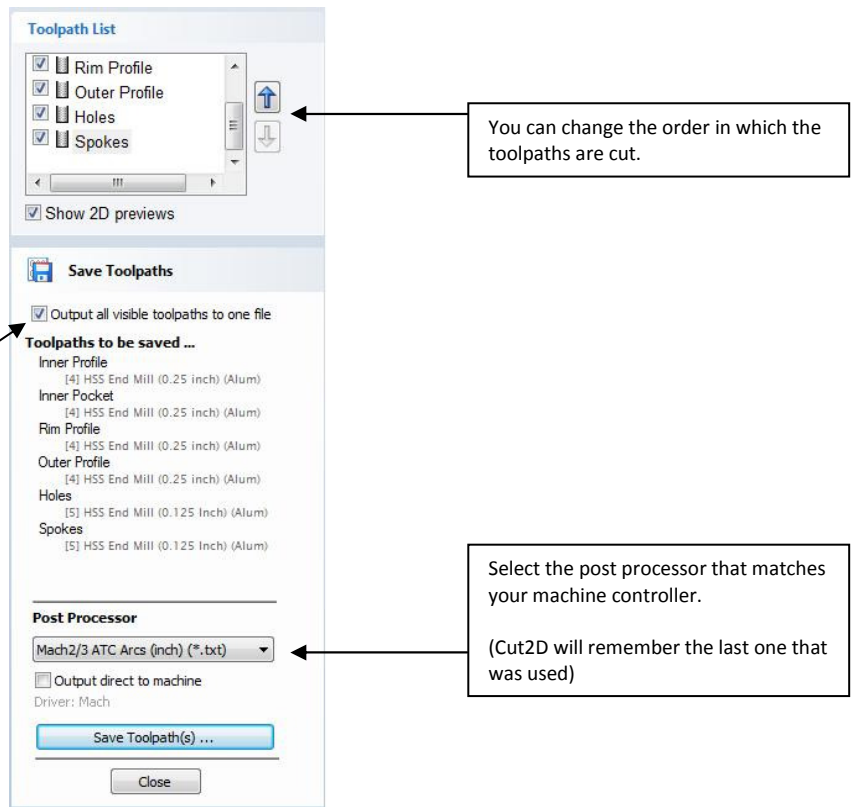
16. Click the **Save Preview**   button to save the 3D window as an image file (bmp, jpg or gif) for use in customer quotations, marketing brochures or web site pictures etc.

## 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.

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



You can change the order in which the toolpaths are cut.


Post Processors with "ATC" in the name support Automatic Tool Change commands. If your machine controller supports these commands, you have the option to save all toolpaths to a single file.

Select the post processor that matches your machine controller.  
(Cut2D will remember the last one that was used)

Figure 25. Save Toolpath form

18. From the pull-down list of postprocessors, select the appropriate one for your CNC machine as shown above in Figure 25.
19. Click the **Save Toolpaths** button and enter a name to save the toolpath with, repeat for the remaining toolpaths, if your machine tool does not support Automatic Tool Change commands (ATC).

You have now saved one or more 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.

# Vectric

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If you have any questions or need assistance  
Visit the Vectric User Forum - [www.vectric.com/forum](http://www.vectric.com/forum)

Or

E-mail – [support@vectric.com](mailto:support@vectric.com)

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