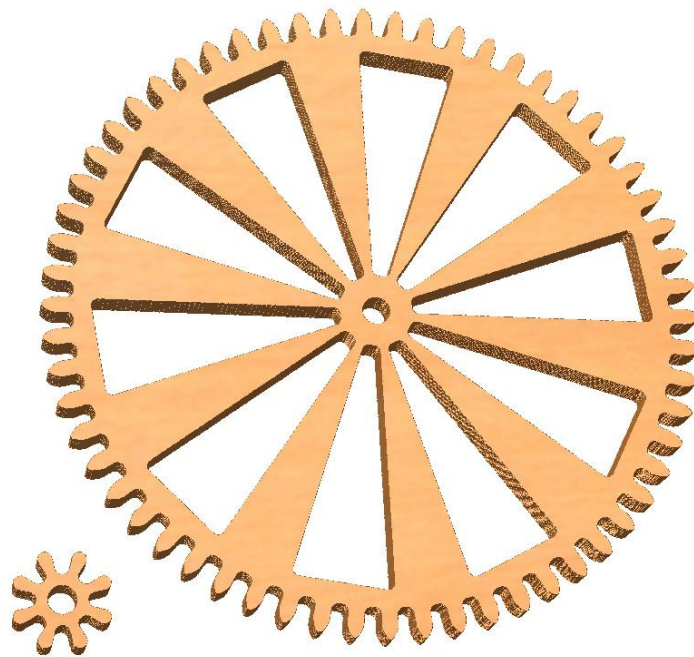


Getting Started With

Cut2D



Tutorial 2
Wooden Clock Gear Wheels

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.

The information in this manual may be subject to change without any prior notice. The software described in this manual is supplied under the terms and conditions of the software license agreement and may only be used in accordance with the terms of this agreement.

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Introduction

Many hobbyists and businesses use their CNC machine for simply cutting out flat letters and shapes from plastic sheet, or machining standard badges and nameplates, which are all based on simple 2D machining strategies. Cut2D provides an incredibly simple way to handle these day to day tasks and introduce you to the exciting world of CNC machining.

Cut2D requires no formal classroom training, it has a simple intuitive interface that will take you step by step through the very simple tasks required to produce toolpaths for your CNC machine.

The idea is to make CNC machining an enjoyable experience and hopefully, if you run a business, more profitable.

The manual takes you step-by-step through an illustrated tutorial that shows and explains exactly how to use the Cut2D Software.

Tips and tricks have also been included that will help you get the most from your CNC machine.

We hope you enjoy using the software.

What the software allows you to do

Cut2D can be used to produce objects and products such as,

Sign making	House signs, Business, Restaurants, Pubs, Gold Leafed and Gilded
Woodworking	Kitchen cabinet doors, Chairs, Doors, Table tops
Engraving	Commemorative Brass plaques, Company logos
Gifts	Key rings, Personalized gifts
Model Engineering	Parts for Model Locomotives, Aeroplanes, Automobiles

What file formats can be used?

Cut2D will open files that have been saved in the following formats.

DXF	Drawing Exchange Files from CAD systems
EPS	Encapsulated Postscript from Adobe Illustrator and Corel Draw etc.
AI	Adobe Illustrator
PDF	Portable Document Format for industry standard print data



If the designs are being prepared with software such as Corel Draw or Adobe Illustrator we recommend that you **convert the vector geometry and text to curves** and **switch off all patterns or colour fills** before exporting, **preferably as an EPS file**.

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.

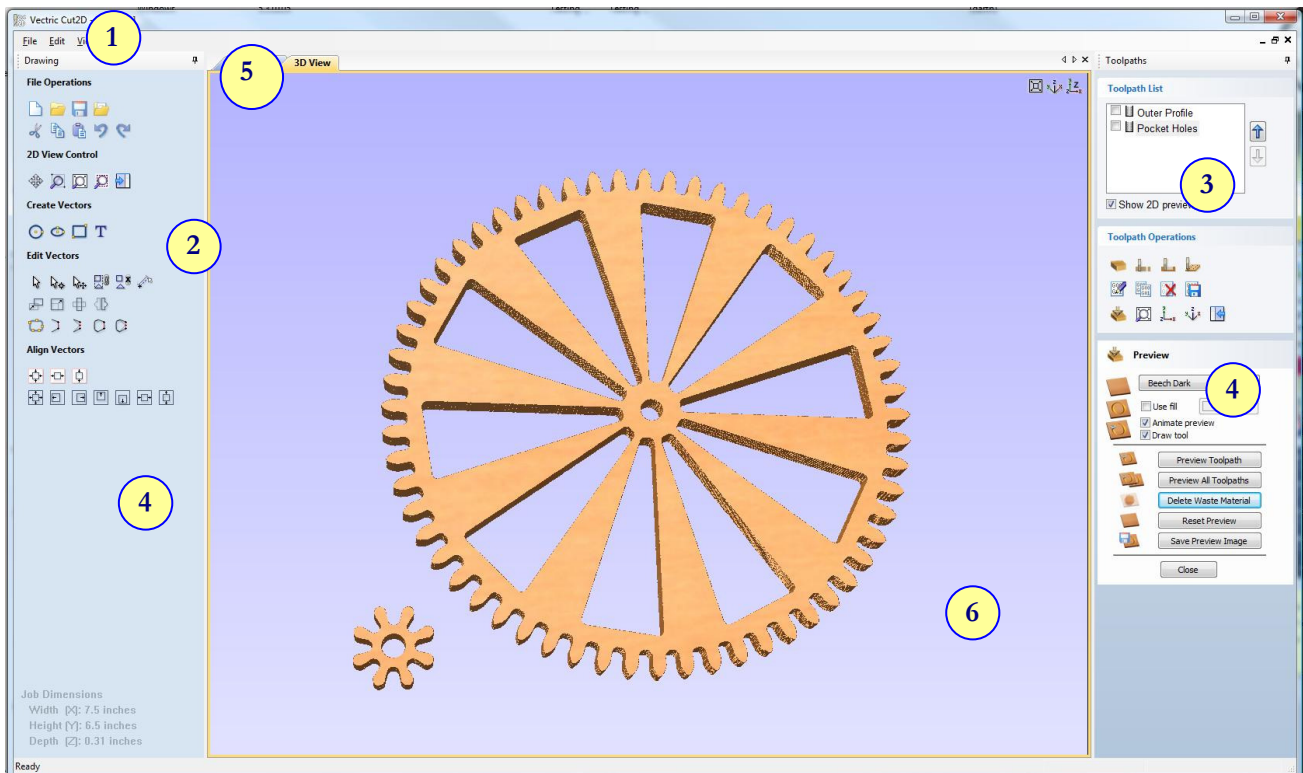
Many of the tutorials and help files have associated video footage that will make learning to use this software more interesting and enjoyable. These are on the installation CD or Downloadable from the web site. Windows Media Player is required to view the video files.

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

Overview of the interface

The screen area is split into 6 main regions.

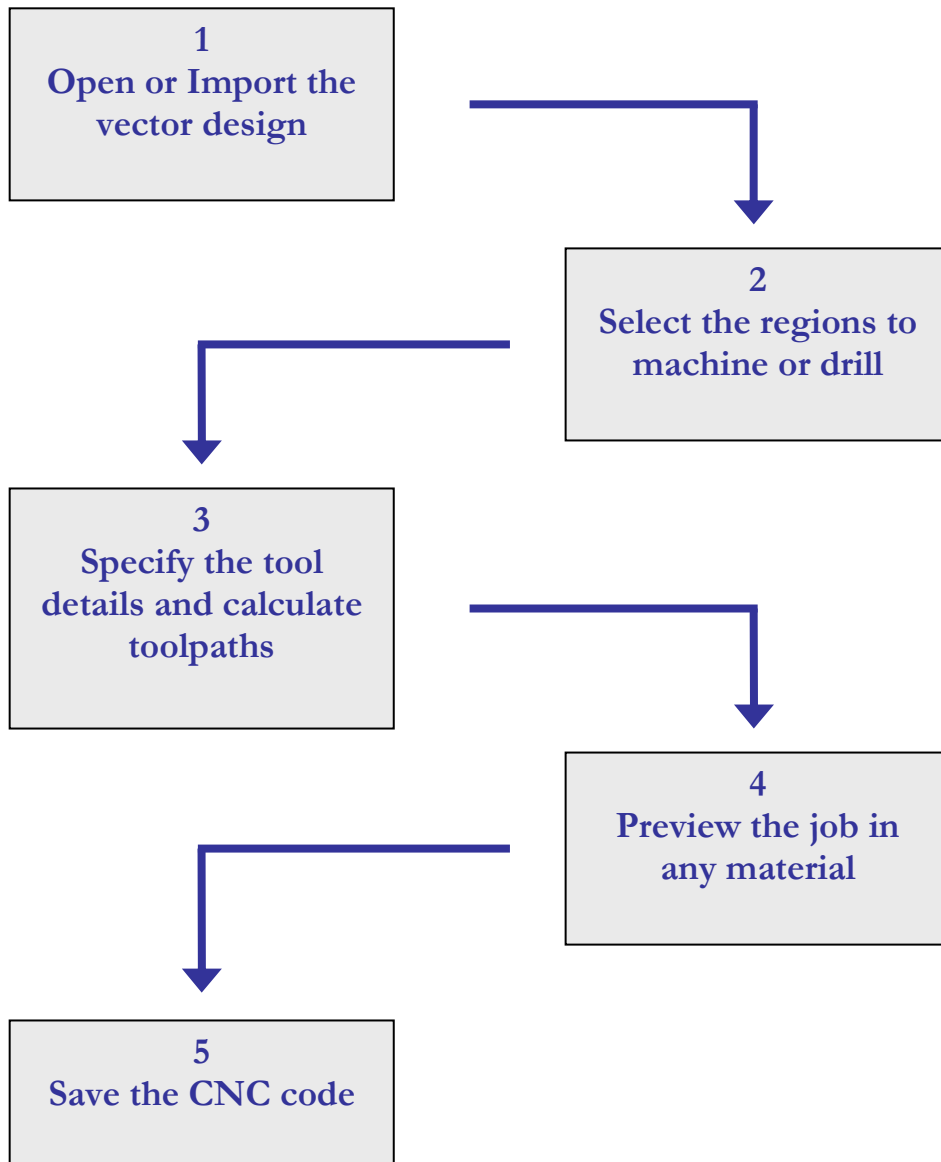
1. The **Main Menu bar** along the top of the screen provides access to additional, less commonly used commands available in the software. Simply click and each option will show a drop-down list of the functions.
2. The **Drawing Tab** on the left side of the screen provides general drawing tools for design modification, sizing, alignment etc. prior to machining.
3. The **Toolpath Tab** on the right side of the screen is where toolpaths are defined, calculated, edited and deleted. The Material set-up and Job Preview tools are also in this area.
4. The **Command forms** automatically appear in the Drawing window and the Toolpath tabs when tools are selected that require details to be entered such as dimensions for sizing or positioning etc.
5. The **2D Design window** is where the design is drawn, edited and selected ready for machining. Designs can be imported or created directly in Cut2D. This occupies the same area as the 3D Preview window and the display can be toggled between the two using F2 and F3 or the tabs at the top of the window.
6. The **3D Preview window** is where toolpaths and the colour shaded job preview are displayed.



The User Interface

The Cut2D Logic

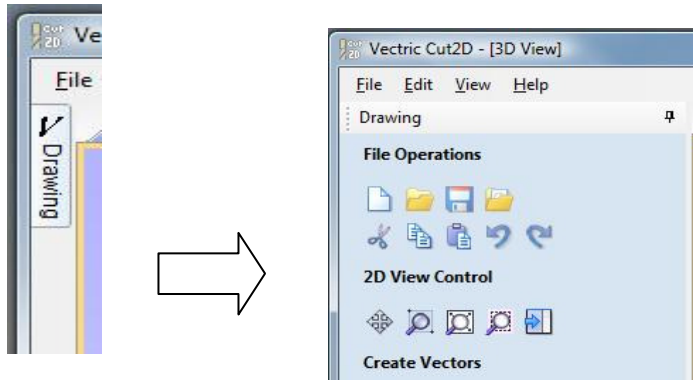
Cut2D has been developed specifically to open decorative designs and calculate perfect 2D Profile, Pocketing and Drilling toolpaths as quickly and easily as possible. The general work flow logic to apply to most jobs is explained in the diagram below.



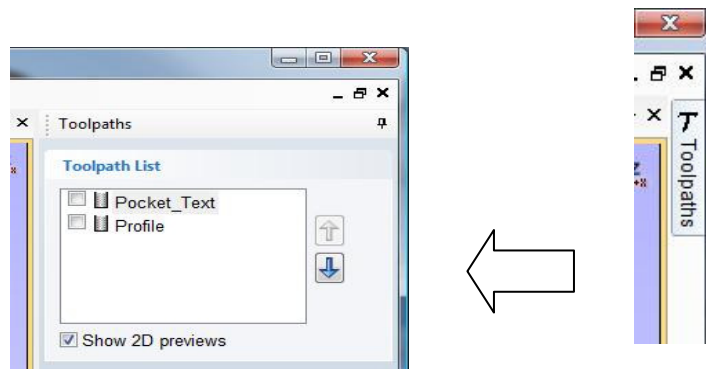
Cut2D is an excellent toolpath engine that also includes boundary and editing tools that allow designs to be prepared and modified. Tools for positioning, alignment and node editing are very easy to use and multiple design elements can also be imported, scaled, positioned and interactively edited to make a new design. Text can also be created using any TrueType font installed on your computer.

Managing windows - Auto Show / Hide

The two primary **Drawing** and **Toolpath Tabs** have Auto Hide / Show behaviour which allows them to automatically close when not being used, maximizing the working screen area. They can be opened and closed at any time by clicking the left mouse over the **Drawing** and **Toolpaths** tabs in the **top left** and **top right** corners of the interface.



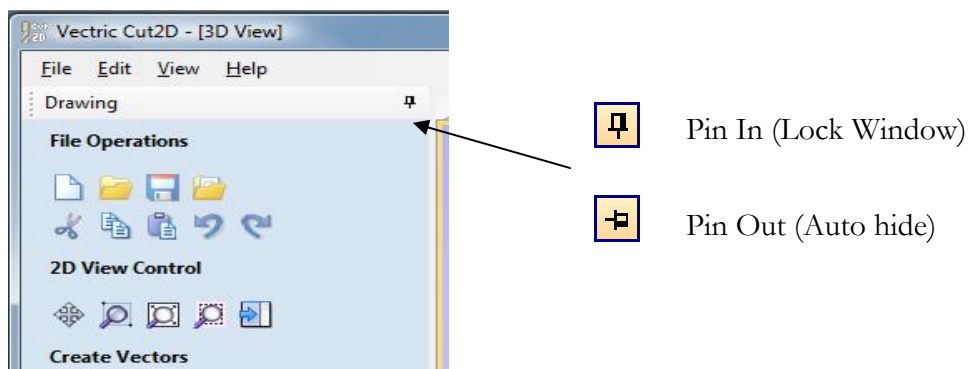
Click on the Drawing Tab to open the Drawing Window



Click on the Toolpaths Tab to open the Toolpaths Window

i Clicking on the Drawing or Toolpath tab will also close an open window.

Both windows have Auto Hide / Show behavior and can be locked open by clicking on the **Push-Pin button** in the top right corner of the window region as shown below.



Auto Hide / Show windows

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**

Vectors

Decorative vector designs and shapes will be imported from a drawing package such as Corel Draw, AutoCAD etc. The imported vector shape(s) can be moved, modified, scaled, rotated, mirrored or deleted.

Vector selection methods

Multiple vectors can be selected in the following **4 ways**.

1. Manual multiple selection

Hold down the **Shift** key while clicking the **Left** mouse button on each vector required.

Objects can be deselected simply clicking on the object again with the **Shift** key pressed.

2. Moving the cursor from **Left** to **Right** selects only **FULLY enclosed** objects.

Click and drag the left mouse button moving from **Left to Right** selects all objects fully inside the selection rectangle.

3. Moving the cursor from **Right to Left** selects all objects **INSIDE** the selection rectangle and also any objects that the selection rectangle **TOUCHES**.

Click and drag the left mouse button moving from Right to Left selects all objects inside the selection rectangle + any that the selection touches.

4. Pressing the keyboard keys **Ctrl + A** will select all vector objects in the design

 Selected vectors are displayed as dotted purple lines.

Vector deselect

Selections can be cancelled by simply,

1. Left clicking on an area outside the selection

2. Pressing the **Right mouse button** and selecting **Unselect All** (top option) from the list. You must click on the white drawing background to get this option in the menu.

Vector editing

A design is created from vector lines, arcs and bezier spans, which all have different properties that can be selected, modified and moved at any time.



Vector Selection Tool

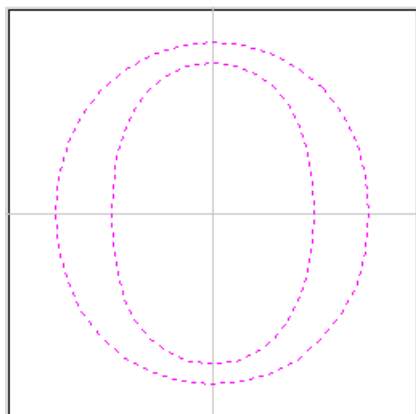
Selected from the Drawing tab on the left

Selected vectors are shown as dotted purple lines. Vectors need to be selected before any of the editing tools such as scaling and moving etc. can be used.

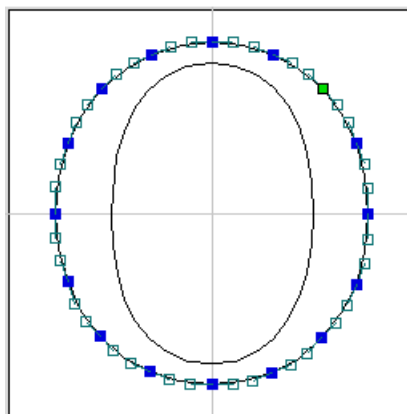


Node Editing Tool

Selected from the Drawing tab on the left



Vectors selected



Bezier node editing

When the Node Editing tool is active the cursor changes to a Black Arrow indicating that individual points (nodes) can be edited. Nodes can be interactively moved by clicking and dragging the left mouse button on a node to select and move the node to a new position.

The shape of lines, arcs and bezier spans can be edited by clicking and dragging on the nodes or control points to move them. Multiple nodes and control points can be selected and moved by using the multiple selection options such as the Shift key and dragging to make a selection.

If you right click on nodes or spans a context sensitive popup menu will be displayed which allows you to insert or delete points and nodes, cut the vector, move the start point etc.

Drawing shapes

Simple shapes and designs can be drawn using the Circle, Oval and Rectangle options. These shapes are commonly used to create new borders for signs or as a reference plate for a kitchen cabinet door etc. Shapes can be created by either entering exact dimensions in the Command Window or simply clicking the left mouse button in the 2D window to specify the parameters and coordinates interactively.

Drawing shapes is covered in more detail in the tutorials available on the Vectric Website.

Introduction

This tutorial will show you how to make the Gear Wheels shown below in Figure 1, which are approximately 6 ¼” (158mm) and 0.9” (23mm) 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 **10 minutes** to complete.

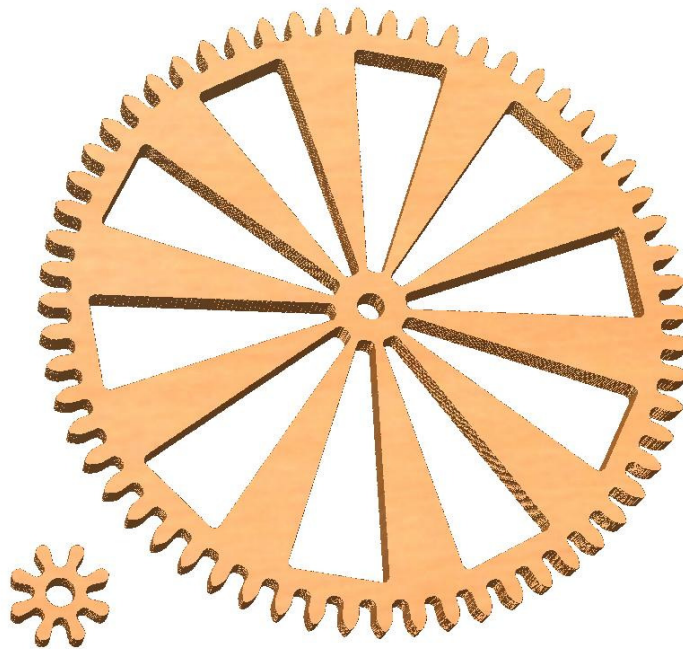



Figure 1. The finished Gear Wheels

There are 5 key stages in opening and preparing toolpaths for this design.

1. Opening a new design
2. Import and scale the Vectors
3. Calculate the toolpaths
4. Preview the completed job
5. Save the toolpaths

Opening a New Design

1. From the **Startup Tasks** tab toolbar click on the **Create a new file**  icon.

A new blank design, as shown below in Figure 2, will now be displayed in the 2D window and the Material Setup form is opened.

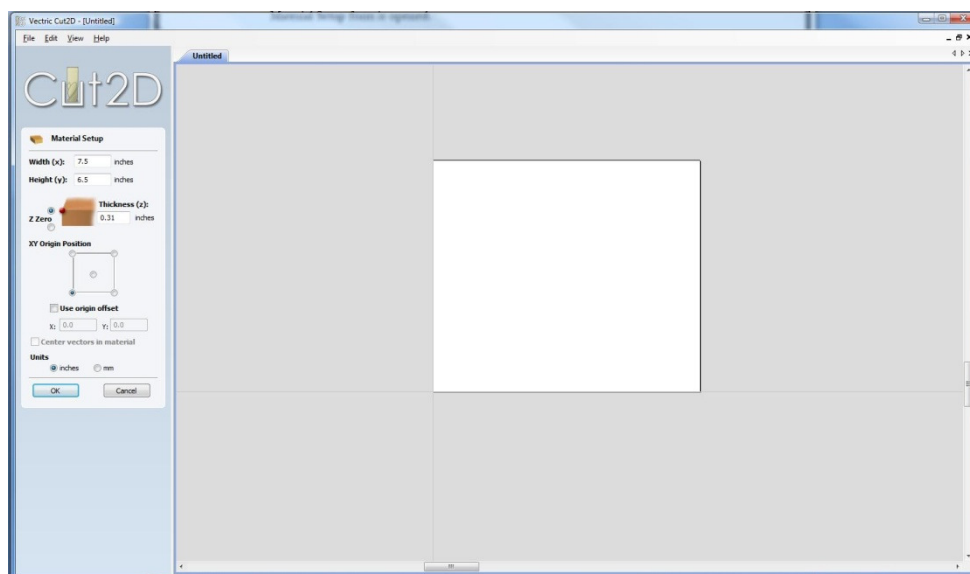


Figure 2 New blank design



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

The image shows a 'Material Setup' dialog box with the following fields and options:

- Width (x):** 7.5 inches
- Height (y):** 6.5 inches
- Thickness (z):** 0.31 inches
- Z Zero:** A small 3D model of a rectangular block with a red dot on the top surface, indicating the Z-zero position.
- XY Origin Position:** A 2D diagram of a rectangle with a central dot and four corner dots, representing the origin and corners.
- Use origin offset**
 - X: 0.0
 - Y: 0.0
- Center vectors in material**
- Units:**
 - inches
 - mm
- Buttons:** OK and Cancel

Figure 3. Material Setup Form

2. Complete this form as shown above

Width (X) = **7.5"**

Height (Y) = **6.5"**

Material Thickness = **0.31"**

Z Zero on the **Material Surface**

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

Select the Units = **Inches**

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

2. Import and Scale the Vectors

3. From the Menu Bar, click on File, then click on Import.

Within the "Open" dialog box, navigate to the Samples folder and select the "GearWheels.dxf" file, then click on "Open"

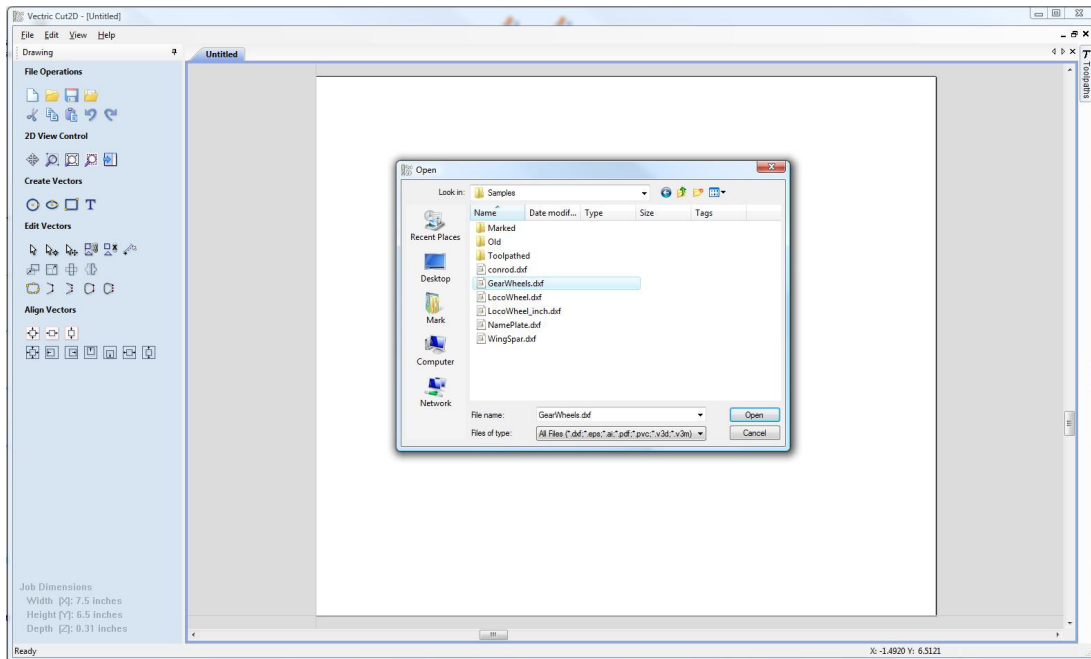


Figure 4. Select the File to Import.

When the design has been imported, it will look similar to Figure 5.

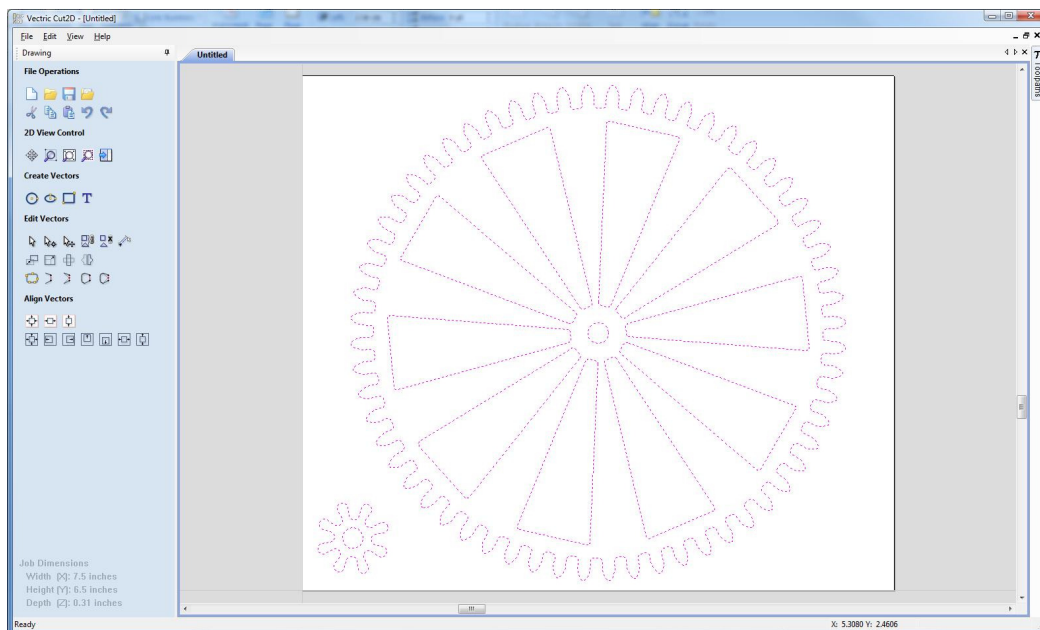



Figure 5. File Imported.

- Next, we might need to center the imported vectors, to do this, **Click the Left mouse button** on the

Center In Material  icon, The vectors will now have Centered as shown in Figure 6.

(This is located in the Align Vectors section within the Drawing tab)

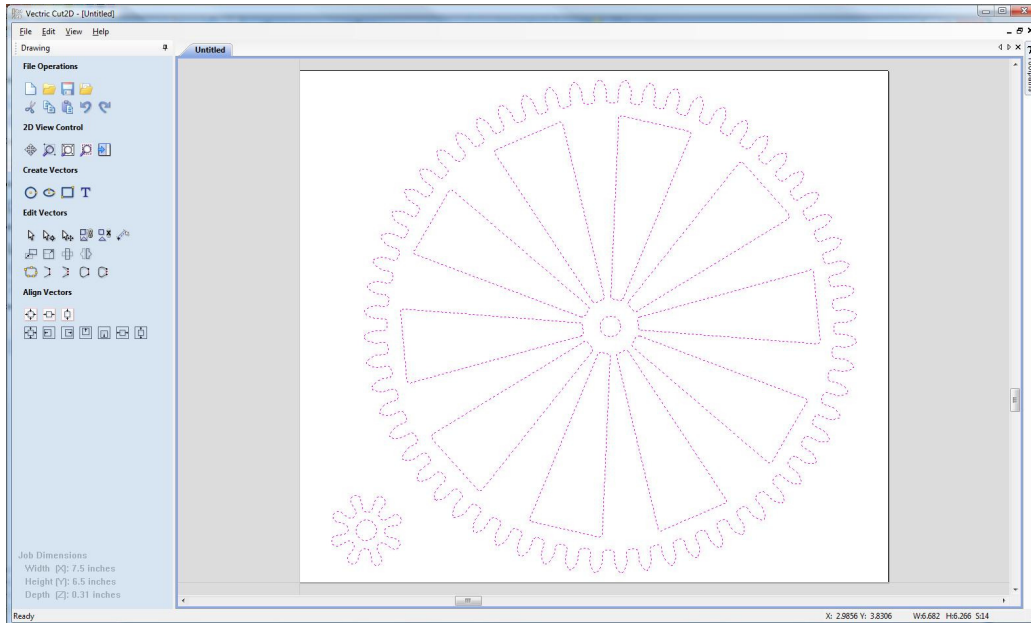



Figure 6. Imported Vectors Centered.

The imported vectors can be scaled as required, to do this **Click the Left mouse button** on the **Scale Selected Vectors Icon**.  Set the size that you would like to scale the vectors to, in the **Set Size** form.

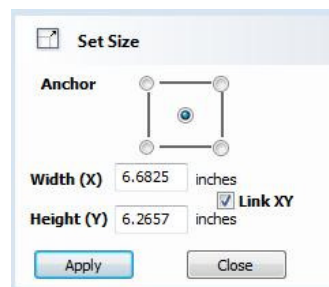


Figure 7. Scale Vectors – Set Size.

3. Calculate the Toolpaths

For our design, we will create two toolpaths.

The first will be a pocket toolpath to cut out the holes.

To do this we must select the internal vectors of both gears.

First we will select the inner vectors of the large Gear Wheel.

To select the vectors, move the mouse cursor inside the outer profile vector, to the right of the lower right hand most inner vector.

Click the Left mouse button and move the mouse across the center of the inner vectors and move the mouse up to include the upper left inner vector.

This has the result of creating a thin blue box that selects the inner vectors, as shown in Figure 8.

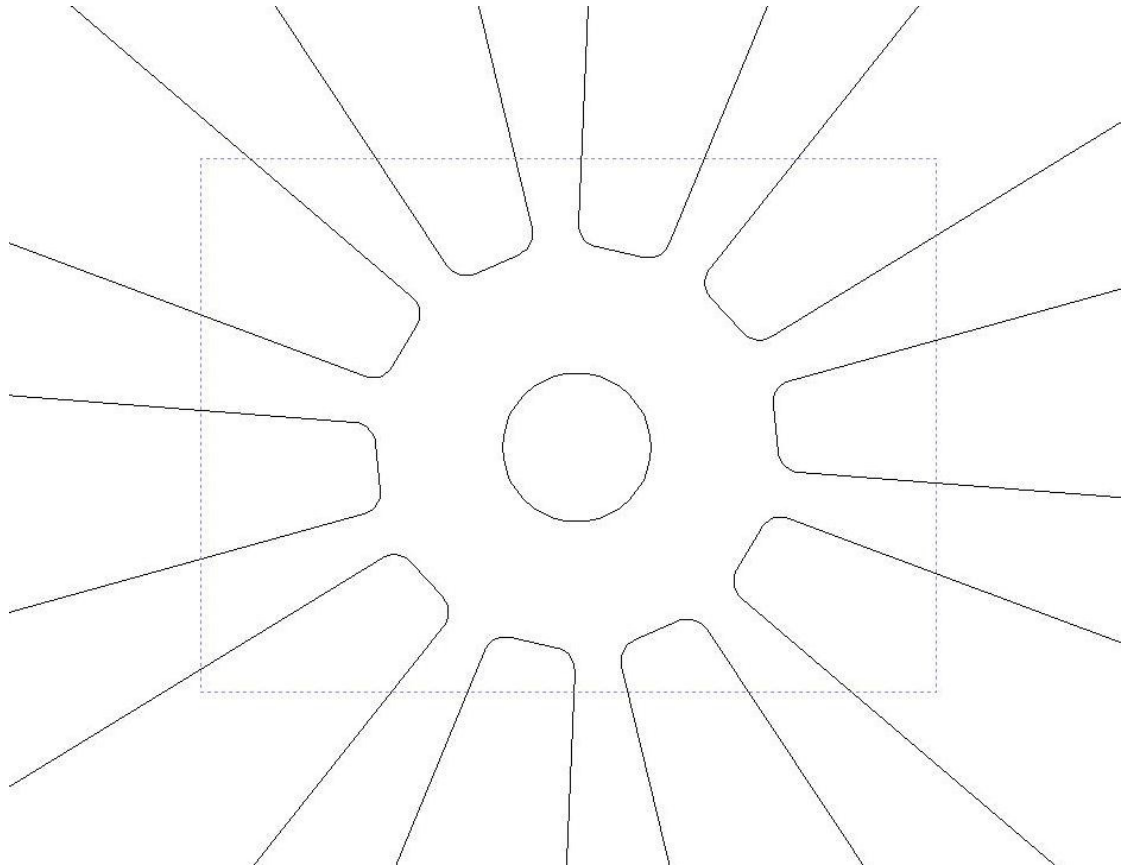


Figure 8. Dragging a box over the vectors to be selected.

When you release the left mouse button, the inner vectors will now be colored purple (selected) and the outer profile vector will be colored black (de-selected) as shown in Figure 9.

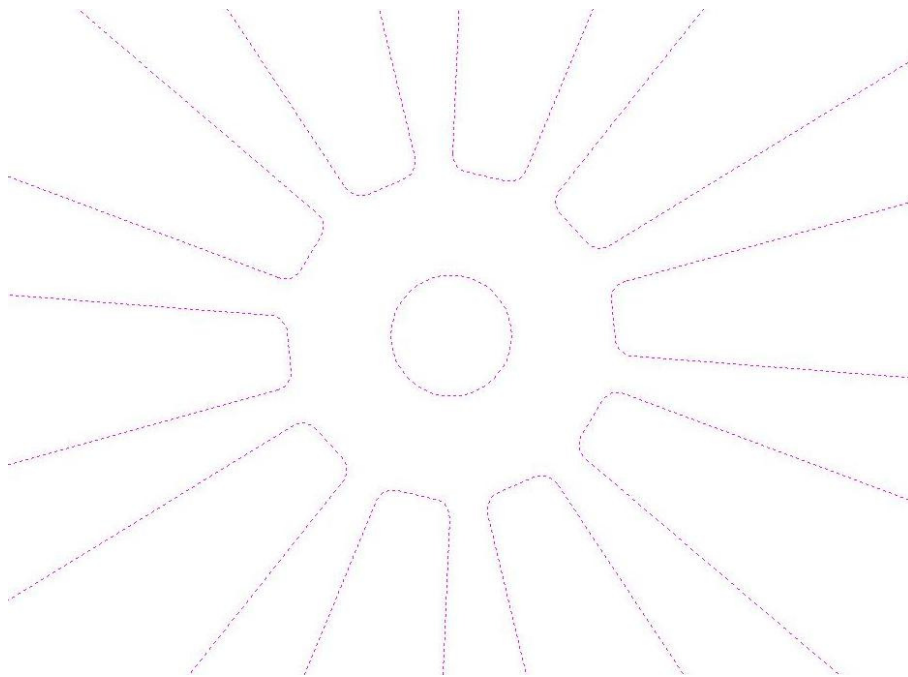



Figure 9. Inner Vectors of Large Gear Selected.

Next we need to select the inner hole of the small Gear Wheel.

To do this, Press and hold Down the Shift key on the keyboard, then **Click** the **Left mouse button** on the hole in the center of the Small Gear Wheel.

(All of the inner vectors will now be colored purple)

The design is now ready to calculate the pocketing toolpath.

5. 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 10.

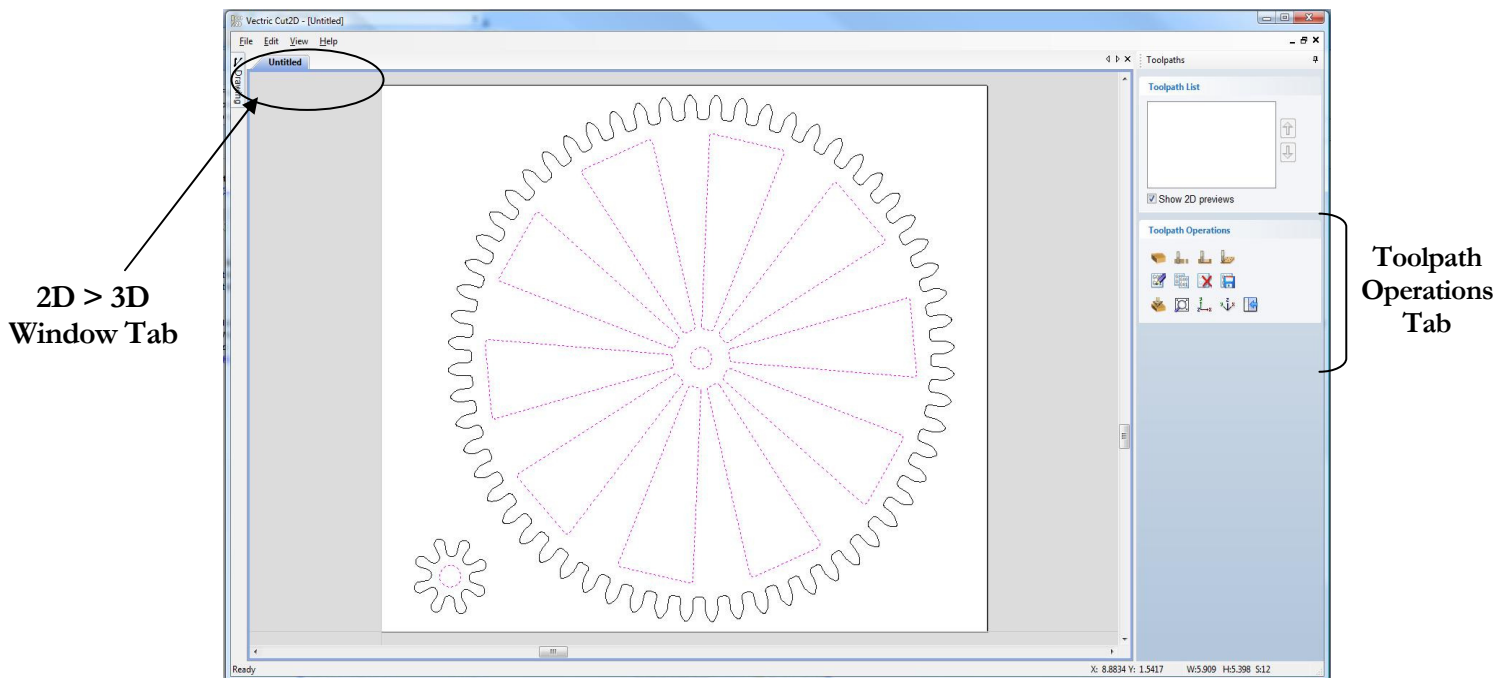


Figure 10. Toolpath Tab



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 11.

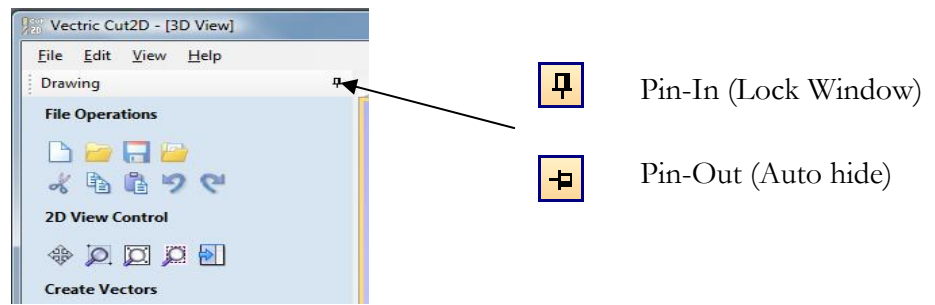



Figure 11. Auto Hide & Show windows

6. 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 12. (or a home position to suit your machine) Click **OK** to confirm.

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

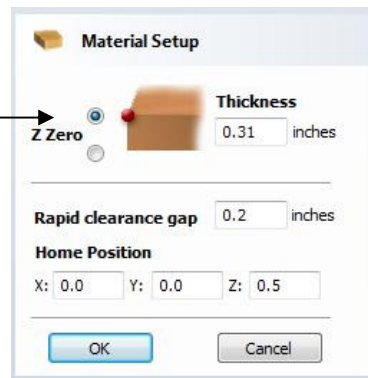


Figure 12. Material Setup

7. Next, select the **Create Pocket Toolpath**  icon from the **Toolpath Operations** list and complete the form as shown below in Figure 13.



Figure 13. Toolpath Operations Tab.

In this example we are cutting wood with a **1/8" (3.175mm) 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.

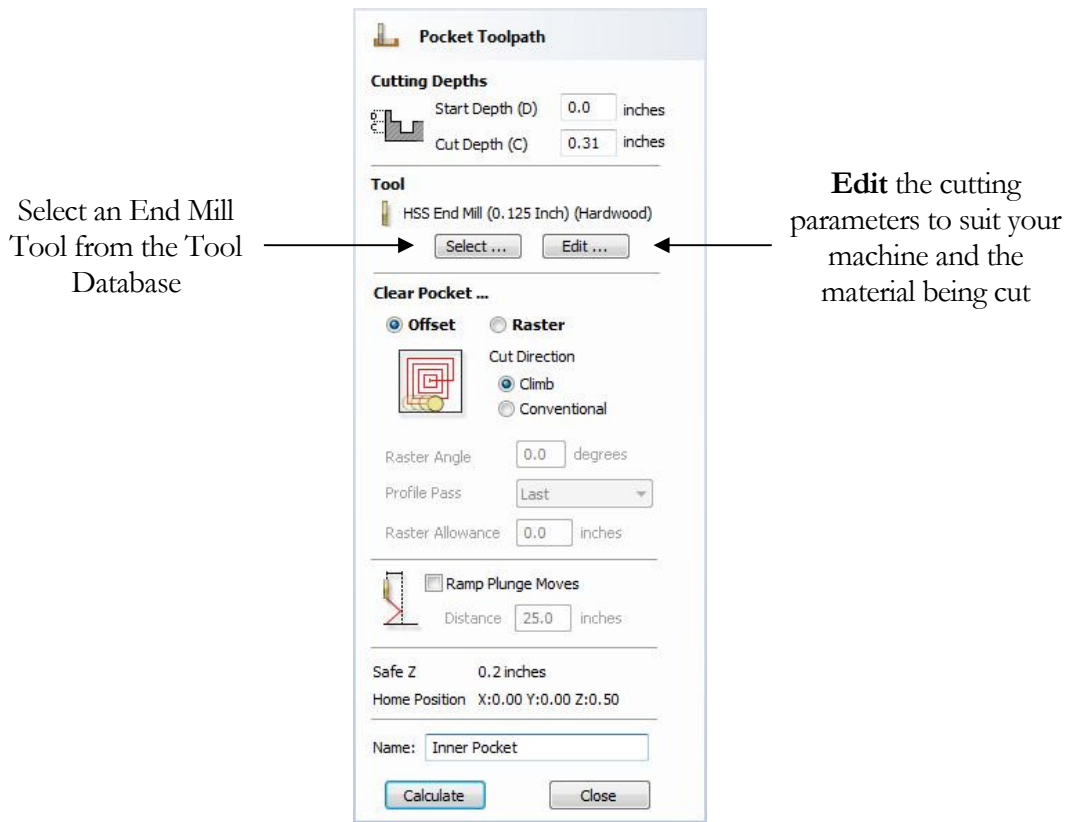


Figure 14. Pocket Toolpath parameters

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

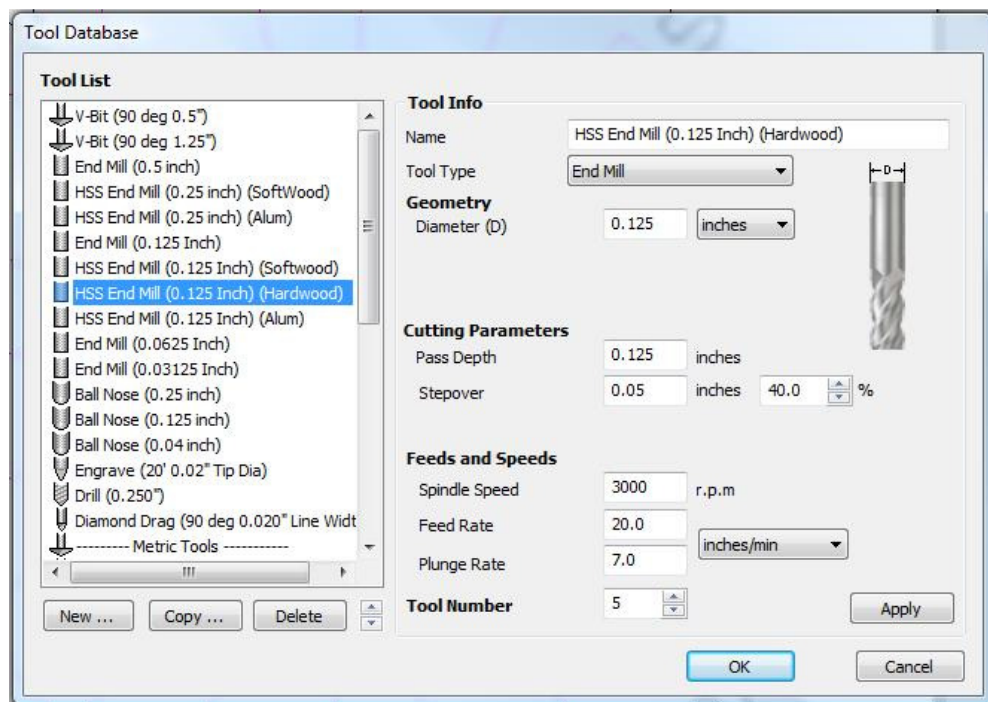


Figure 15. Tool Database

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 16.

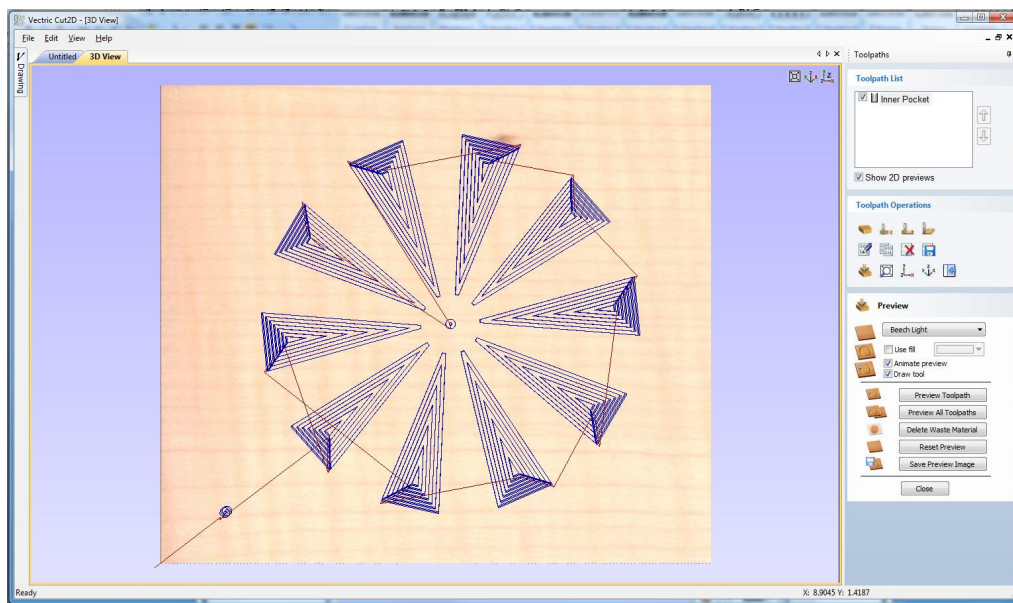


Figure 16. 3D View showing Toolpath & Material

Next we will produce a profile toolpath to cut out the Gear Wheels.

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

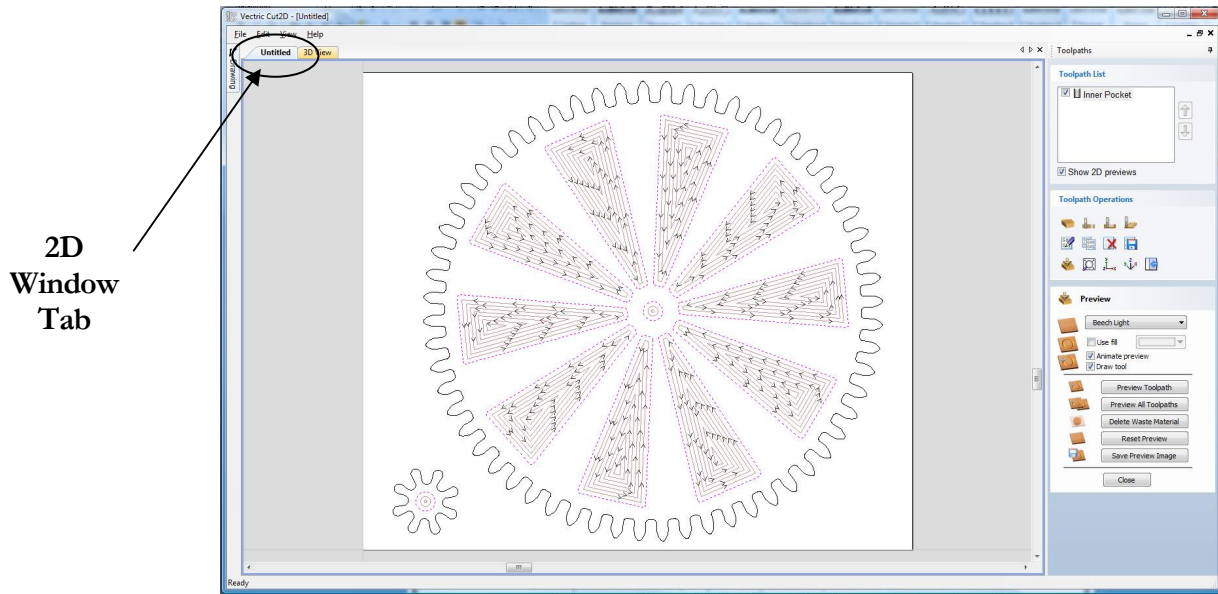


Figure17. Selecting the 2D window.

In the 2D window, **Click** the **Left mouse button** on the outer border of the Large Gear Wheel, then **Press** and **Hold Down** the **Shift** key on the keyboard, next **Click** the **Left mouse button** on the outer border of the Small Gear Wheel

(The outer borders of both of the Gear Wheels will now be colored purple).

9. Next, select the **Create Profile Toolpath**  icon from the **Toolpath Operations** list and complete the form as shown below in Figure 18.



Figure 18. Toolpath Operations Tab.

For the profile we will use the same **1/8" (3.175mm) 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.

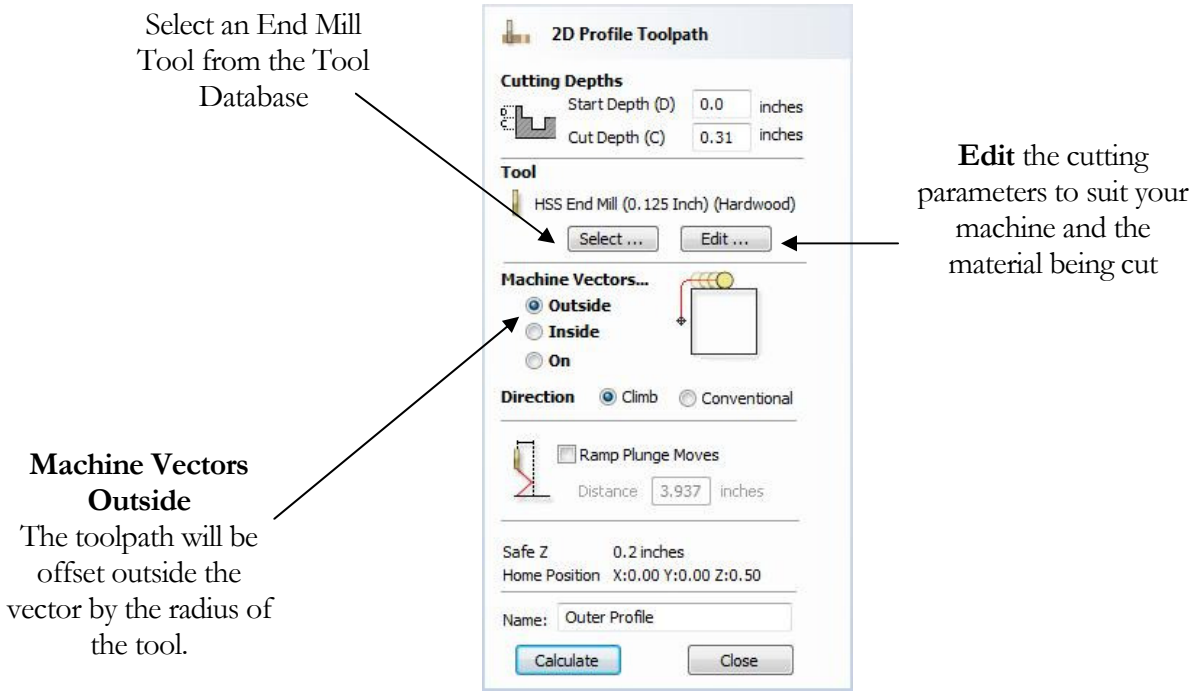


Figure 19. Profile Toolpath parameters

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

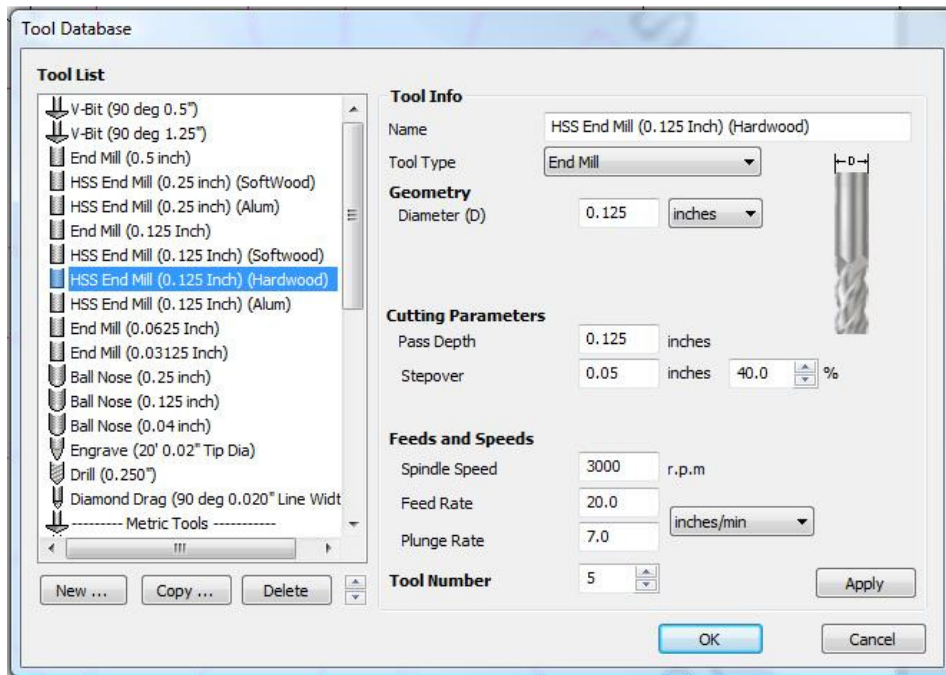


Figure 20. Tool Database

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.

10. 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 21.

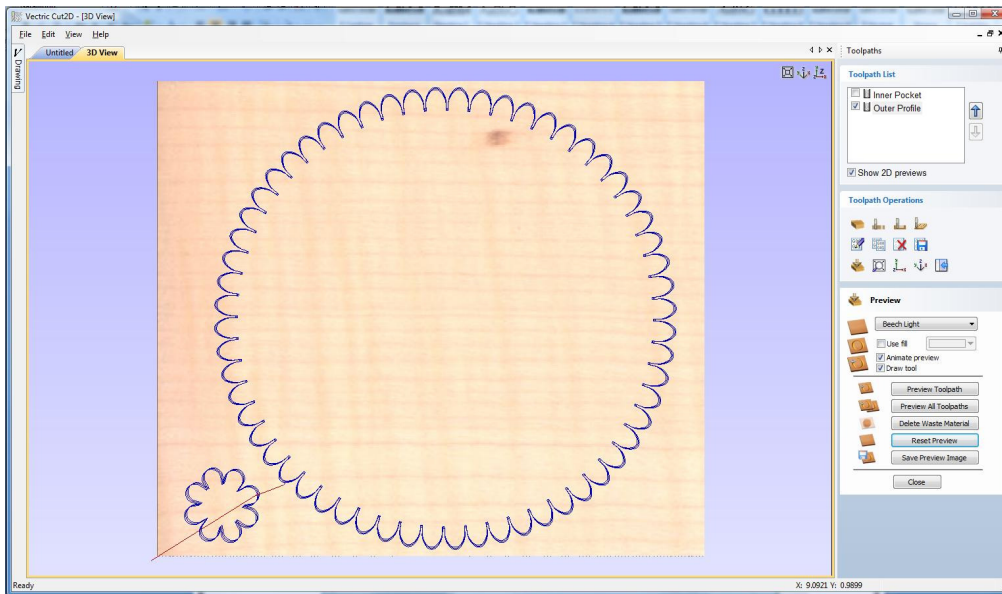




Figure 21. 3D View showing Toolpaths & Material

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.


4. 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 22. Job Preview

11. 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.

12. The finished design can be shaded in different Material types and as shown in Figure 23 below.

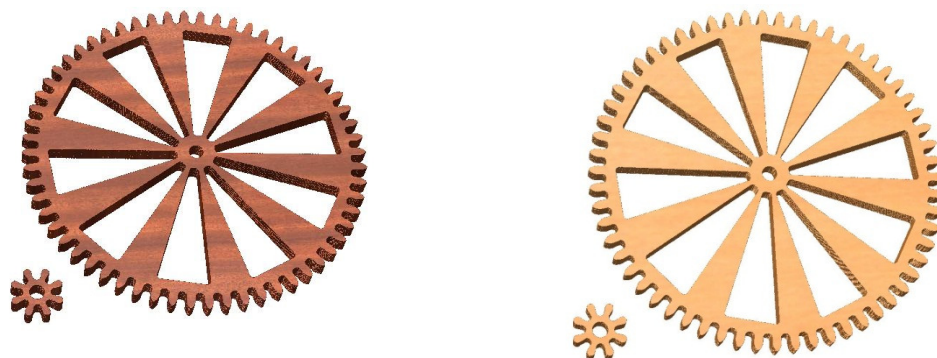

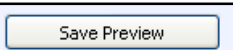



Figure 23. Finished design shown in Mahogany and Light Beech.

13. 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.

5. 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.

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

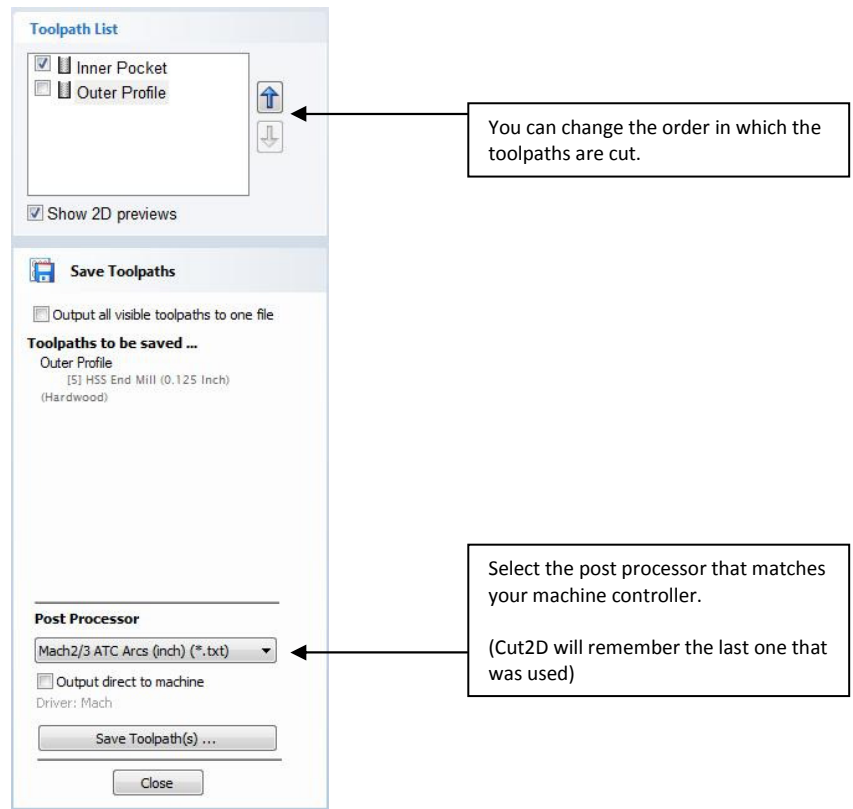



Figure 24. Save Toolpath form

15. From the pull-down list of postprocessors, select the appropriate one for your CNC machine as shown above in Figure 24.
16. Click the **Save Toolpaths** button and enter a name to save the toolpath with.

You have now saved an NC file that can be run on your machine tool, repeat the process to save the other toolpath.

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

Vectric

If you have any questions or need assistance
Visit the Vectric User Forum - www.vectric.com/forum

Or

E-mail – support@vectric.com
