ArtCAM JewelSmith 2010
Training Course

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1. Introduction

Introduction

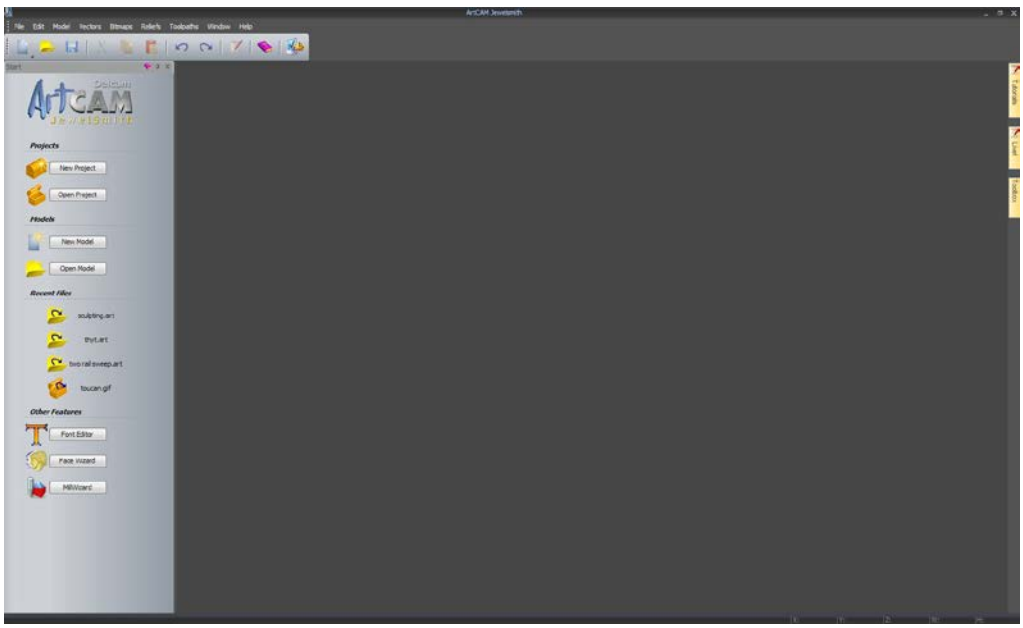
ArtCAM JewelSmith allows complex **Reliefs** (**ArtCAM 3D models**) to be created quickly and easily from **2D vectors** (**ArtCAM Wireframe**) or **bitmaps** (**Image files**). These **vectors** and **bitmaps** can be generated within **ArtCAM** or imported from other systems. **ArtCAM** can also import **3D Surface** data, which is translated on entry as a **Relief** model.

ArtCAM JewelSmith contains tools for editing the reliefs and combining stored reliefs. Once a 2D model or a 3D relief has been created, toolpaths can be generated to machine it. Multiple toolpaths are easily generated for roughing, finishing and engraving. The toolpaths can then be simulated to allow complete visualisation of the product before actual machining.

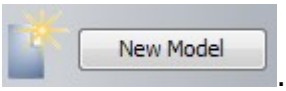
Starting ArtCAM JewelSmith

- Double click the **ArtCAM** icon

on the desktop screen with the **left mouse button**.



The **ArtCAM** start up screen appears as shown above. To start working in **ArtCAM** the user must create a **New Model** or for more complex assemblies, a **New Project**. **Projects** will be covered later at a more advanced stage of the training course.

- Select **Create New Model** 

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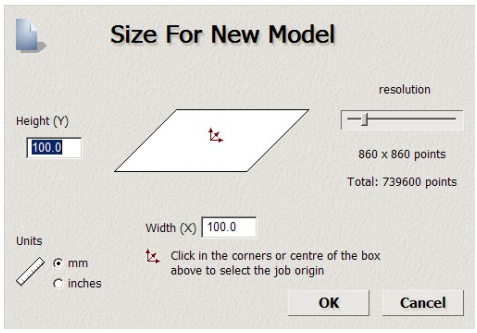


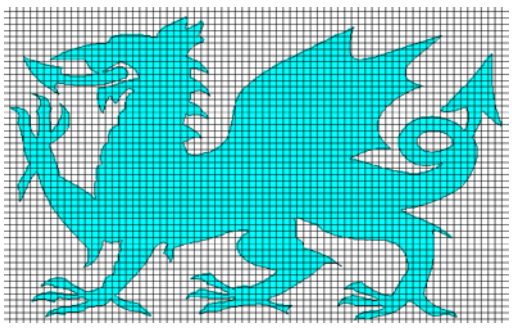
A **New Model** must have:

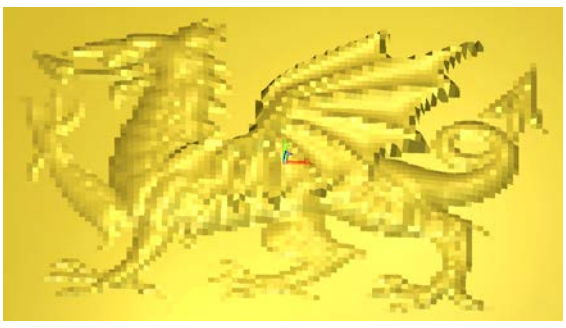
- A defined area in **Y** and **X** to work in;
- An **origin** (datum) position;
- A **resolution** (the total number of squares within the working area). Each square defined by the **resolution** will either, stay put or extrude up or down to produce a tiny part of the **3D Relief** form.

When working with **bitmaps** the **resolution** is inherited from the imported image file, as a result it is important to use as higher quality image as possible.

Resolution

The dragon model shows the **2D view** of the model broken up into a number of squares (pixels). Each square is given a height in **ArtCAM** dependent upon the command used. The first relief uses a low resolution, which means a loss of fine detail in the resulting **3D Relief**.

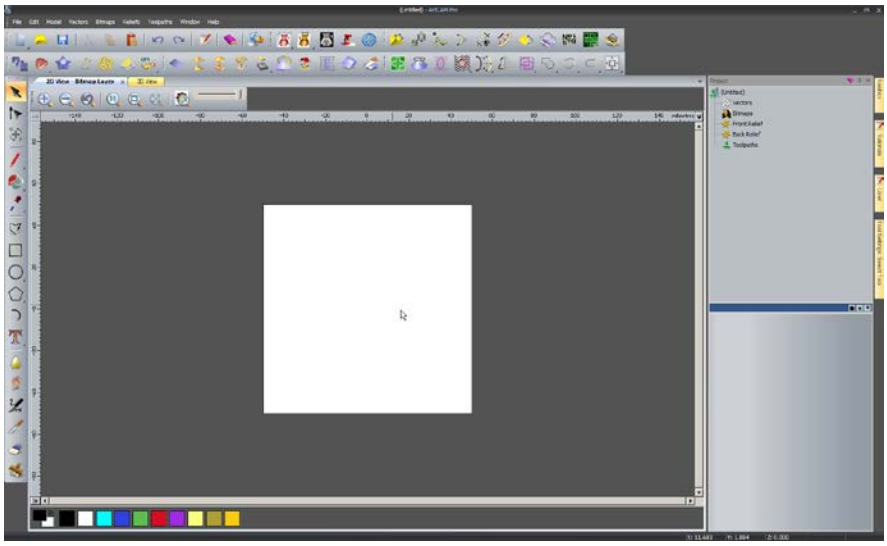




If a high **resolution** is applied, the model is broken into more pixels, which is in turn reflected in the definition and quality of the **Relief** model.

Note: The trade-off with having a high resolution can normally result in larger file sizes, calculation and machine cutting times.

- Set the **Height and Width** as 100 with **origin in the centre**.
- Ensure the **units are set to mm** and the **resolution as 796 x 796 points**.
- Select **OK**.



ArtCAM opens up displaying the **2D view**, with the **Relief** displayed in the **3D View**. You can toggle the views by selecting

(or **F2** or **F3** shortcut key).

The **2D view** is traditionally used for designing **vectors** (2D artwork) and **bitmaps** (images). **Reliefs** (3D models) created or generated from these entities can be viewed in 3D.

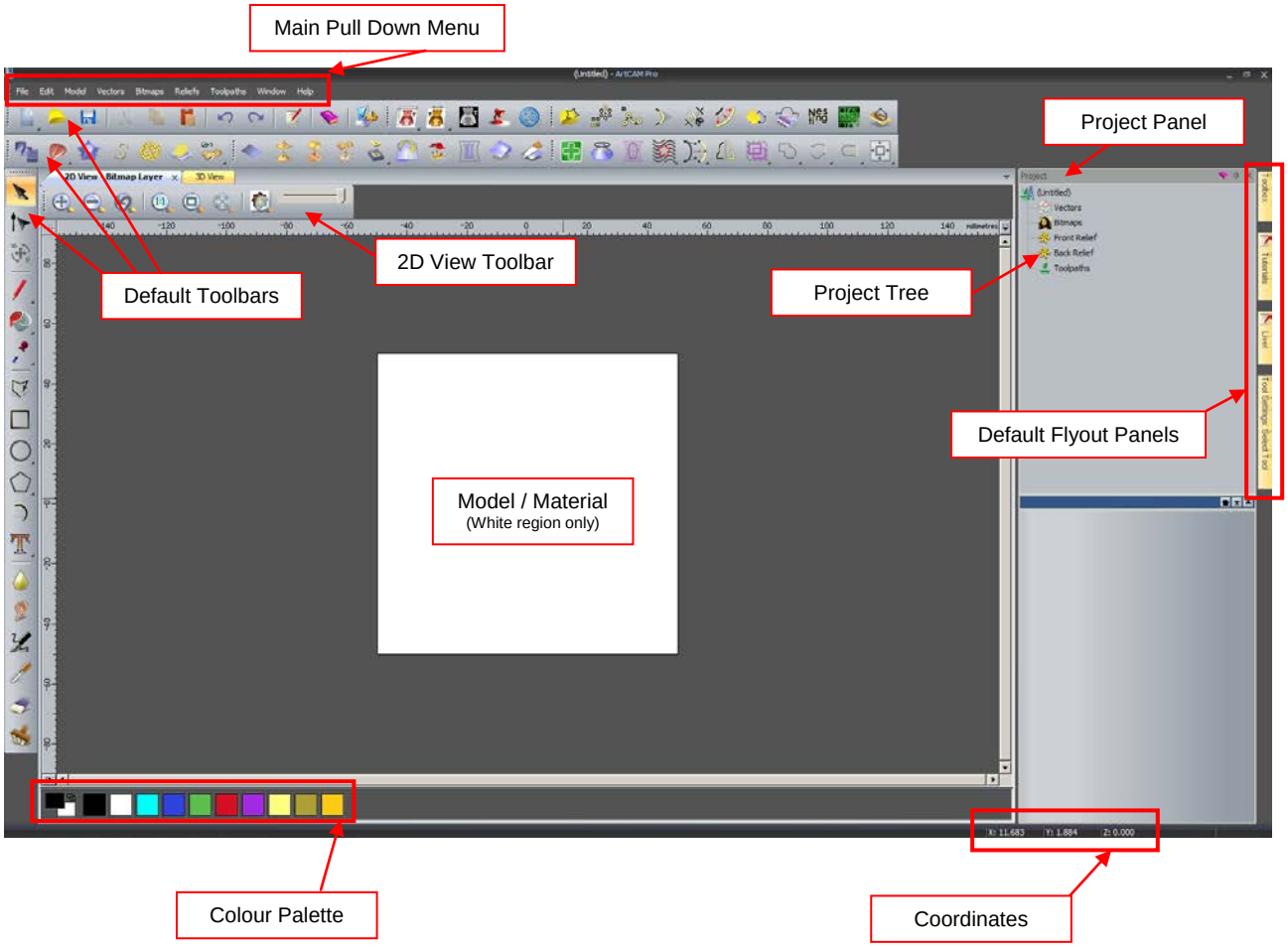
Promoting a more efficient design process, ArtCAM 2010 now also allows direct modelling from vectors and bitmaps all within the 3D environment. This will be illustrated within forthcoming exercises.

The following pages will summarise the key areas and available functionality within the **default** 2D and 3D environments.

ArtCAM commands are accessed from the **drop down Menu Bar** options or directly from their respective **Toolbars**.

2D View Summary

The following summarises the **key** 2D view area and functions (default settings).



Zoom In - Zoom in the 2D view.

Zoom Out - Zoom out the 2D view.

Zoom Previous - Zoom to the previous view.

Zoom 1:1 - Zoom to 1 image pixel = 1 screen pixel.

Window Fit - Fit the artwork in the view.

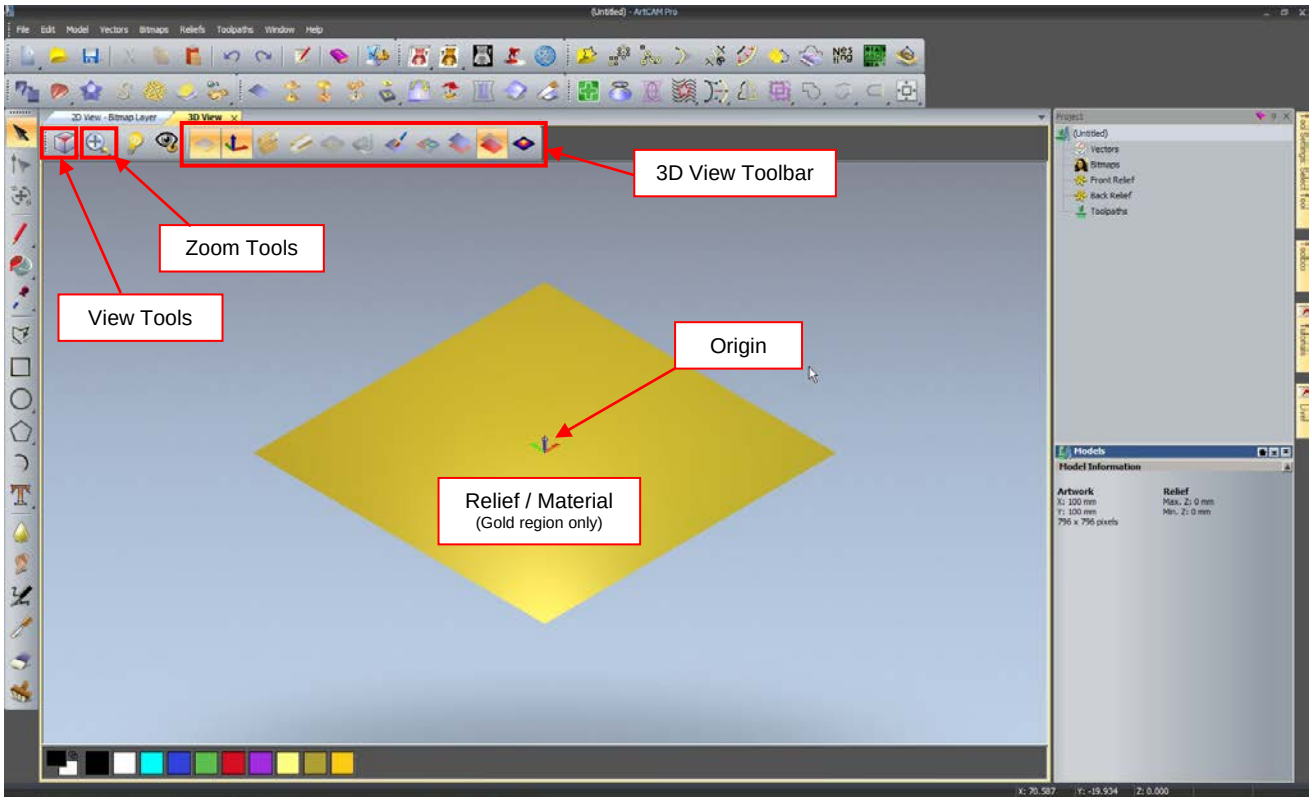
Zoom objects - Zoom to fit the selected object(s).

Preview Relief layer - Show a colour preview of 3D Relief in the 2D view.

Bitmap Transparency - Adjust transparency of Bitmap in the 2D view.

3D View Summary

The following summarises the key 3D view area and functions (default settings).



Isometric View.

View along the X axis.

View along the Y axis.

View along the Z axis.

Zoom In.

Zoom Out.

Zoom to previous view.

Scale view to fit.

Objects to draw (view) dialogue box.

Control various 3D graphics options.

Toggle Z zero plane.

Toggle drawing of the origin.

Toggle visibility of root assembly (in project)

Toggles between displaying flat and rotary reliefs.

Toggles visibility of the defined material block.

Toggles visibility of the simulation block (from machining).

Toggles colour shading (bitmap)

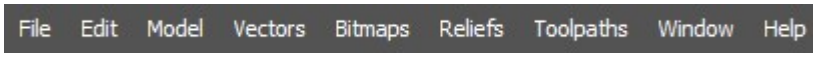
Toggle display of the front relief.

Toggle display of the back relief.

Toggle relief gradient analysis tool.

Main Menu Bar

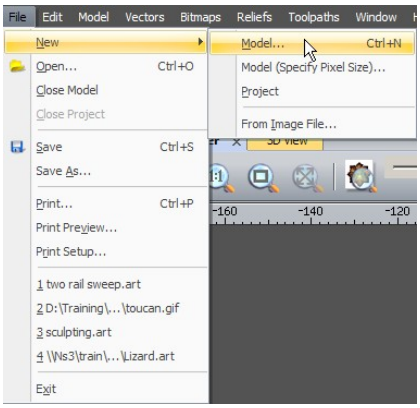
At the top of the **Main window**, there is a **Pull Down Menu Bar**.



Clicking on a menu item opens a pull-down menu that contains submenus and commands. If a menu item does not apply to the currently active view it will be greyed out.

Sub menus are indicated and selected via the arrow at the right hand side (where applicable).

For example, the File menu expands to show the following.



A yellow bar highlights the function over which the mouse cursor passes. Left mouse button then activates the function.

On certain commands, the keyboard shortcut is listed next to the description. For example, the shortcut to create a new model would be to press the **CTRL** key and then the letter **N**.

Toolbars

The **default toolbars** are summarised below.
The **left hand side** of the ArtCAM interface is occupied by a Toolbar. This is the **Design Tools** Toolbar and contains four key design areas.

Selection Tools
This section contains tools that **change the vector** mode, such as the default **select** function, the **Node Editing** and the **Transform function**.

Bitmap Tools
This section contains the most common tools for painting and working with colours. Items such as paint brush, flood fill and pick colours are located here.

Vector Tools
This section contains all the main vector drawing tools. Available are the creation of Polylines, Squares, circles, ellipses, stars, polygons, arcs and text.

Sculpting Tools
This section contains all the available relief sculpting tools. These can be described as free form tools used for smoothing, smudging, depositing, carving, erasing and transferring.

File Toolbar

Contains the standard **Windows functionality** including the **Help reference** and **Options settings**.

New Model/New Project - Creates a new blank ArtCAM Model or Project (flyout).

Open - Open an existing ArtCAM file or image (.art, .bmp, .tif, .gif, .jpg, .rlf (relief)).

Save - Save the current ArtCAM model or Project.

Cut - Move the currently selected object to the clipboard.

Copy - Copy the currently selected object to the clipboard.

Paste - Paste the currently selected object into the model.

Undo - Undo the last command

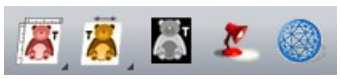
Redo - Redo the last Undo command

ArtCAM Notes - Add written notes to the current ArtCAM file.

Help - Launch ArtCAM's online help.

Options - Change global settings for ArtCAM.

Model Toolbar



Includes tools to **modify** the Model size, resolution, Origin, Position and Lighting (shading).

Vector Creation

Advanced creation tools for vectors including Offset, Bitmap to vector and Nesting.

Relief Creation

Tools to create Reliefs including Shape Editor, Weave wizard and Paste relief from a file.

Relief Editing

Tools to edit a current relief such as Scale, Smooth, Invert, Mirror and Offset.

Vector Editing

Tools to edit current vectors such as Vector doctor, Wrap vectors, Clipping, and Mirroring.

Flyout menus

Several icons have a **small arrow** located at the bottom right hand corner. This indicates that this icon has further hidden functions which can be accessed from a flyout.

Select and hold the mouse button over an icon (with the arrow) will reveal the functions in the flyout menu. Releasing the mouse over the desired function will activate it.

For example selecting the **Circle icon** from the **Design Tools Toolbar** reveals the ellipse.

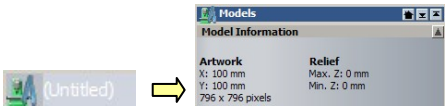
Selecting Draw reveals the Paint and Paint selective functions.

Project Panel

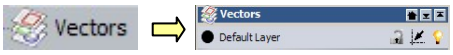
The right hand side of the ArtCAM interface is occupied by the **Project Panel** and several **Flyout panels**.

The **Project Panel** serves as a central area to manage the main design and machining aspects of the **ArtCAM model.**
When an item is highlighted, the lower half of the panel displays further information.

A summary is provided below.



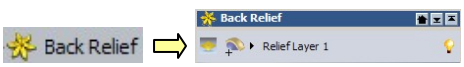
Summarises the **Model information**.



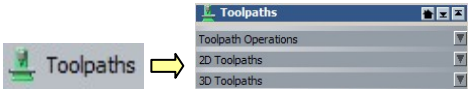
Displays the **Vector layers Toolbar**.

Displays the **Bitmap layers Toolbar**.

Displays the **Front Relief layer Toolbar**.

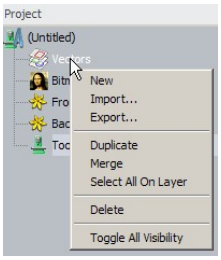


Displays the **Back Relief layer Toolbar.**



Access to all **2D** and **3D Toolpath** functions.

Right mouse selecting on an item in the Project Panel reveals the equivalent functionality (summarised above).



For example, Right mouse selecting the **Vectors** option reveals all the **Vector Layers functionality**.

The functionality above will be discussed in greater detail throughout the training course.

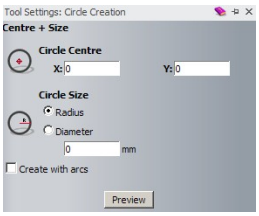
Note: Although the **Project panel** provides a central area, all individual functionality shown above can also be accessed from either the **top Pull down menu,** or their **specific toolbars**.

Flyout Panels

The four default hidden panels on the **right hand side** can be activated by simply **holding the mouse cursor** over the desired flyout tab.

The **Tool Settings Panel** displays all the **settings and information** about the **current** or active function.

For example, If the **create circle** function is selected, The Tool settings Tab will reveal the Circle Creation form where required sizes and coordinates can be entered. **Keyboard shortcut F6** also reveals this tab.



The **Toolbox Panel** reveals external **ArtCAM Plug ins** (applications) that have been created and are compatible with ArtCAM. For Example, the **Face Wizard** can be found here.

The **Tutorials panel** will provide a resource for Training materials and tutorials.

New to 2010, The **Live Panel** will provide access to an online database of **Training videos**. This area is subject to live updates and additional videos released by Delcam. **Note: Internet access** is required to obtain this resource.

Fly out Panels can be **fixed** (stay out) by selecting the **Pin icon** at the **top right hand corner** of the panel.

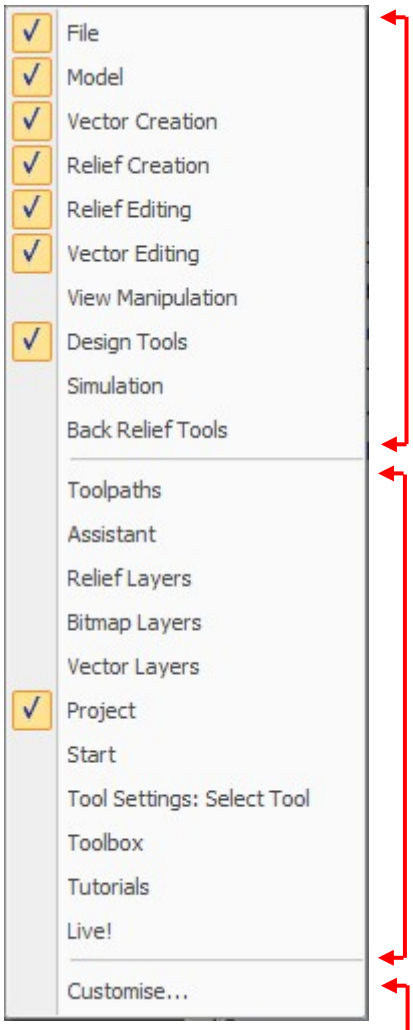
Reselecting the Pin will **hide** the panel.

Selecting the **cross** will **close and remove the panel tab** from the screen.

The following section will outline the ability of **ArtCAM 2010 to customise the interface** including **adding** and **removing** toolbars, functions and Fly out panels.

Interface customisation

Right mouse selecting in the **toolbars or grey border region** will present the following menu.



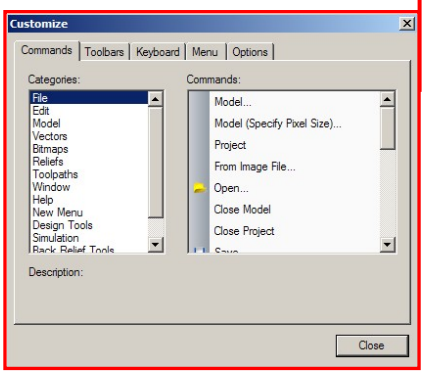
The **top half** of this menu lists all the **standard toolbars** available in ArtCAM. Items indicated by the **Tick**, ✓ are currently **visible**. Selecting or unselecting the option will toggle its visibility from the interface.

The **lower half** of this menu lists all **standard Fly out Panels** available in ArtCAM.

As above, selecting/unselecting the ✓ will toggle its visibility.

If a **Panel was closed** × previously, it can be reactivated here.

Selecting **Customise** will present a **new menu** which allows extensive customisation of the layout. This is outlined below.



Commands All **Commands are listed** here. These can be **dragged and dropped** into existing visible toolbars.

Toolbars Toggles **Toolbar visibility** and ability to create a **new customised Toolbar**.

Keyboard **Keyboard shortcuts** can be assigned here.

Menu Options to **customise menu** including animation.

Options General Toolbar options including Tool tips and icon size.

Docking Toolbars

Toolbars can be dragged into the interface and allowed to 'float' in a desired location.

At the **end** or **top** of each toolbar there is a dotted line.

When the mouse cursor is placed over this line, it changes to a cross at which point the toolbar can be selected and dragged.

Double Mouse clicking in the **top margin area** of the Toolbar returns it to the original fixed position.

Docking Fly out Panels

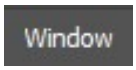
When a **Fly out** Panel is **fixed,** it also can be **dragged (to float)** or **docked in a fixed position** at each end of the screen.

Select and Hold the **mouse cursor** in the top margin to drag the Panel into the screen.

Whilst **dragging**, the interface displays a **cursor pad** in the **centre and edges of the page.** Depending on which arrow the panel is moved over, the screen will display a blue region where the panel will dock. Release the mouse button to dock the panel in this location.

Panels can also be docked onto the top or bottom half of other fixed Panels. This is achieved by dragging a panel (as described above) onto another Panel to activate the 'cursor pad'.

Themes and Layout

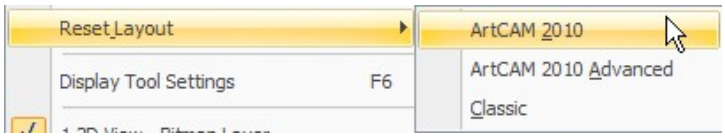
From the top **Window** 

drop down menu, a number of interface options are available.

From **Window - Theme**.

Select **Classic** to change the colour scheme from the current 2010 theme a traditional ArtCAM background.

From **Window - Reset Layout**.



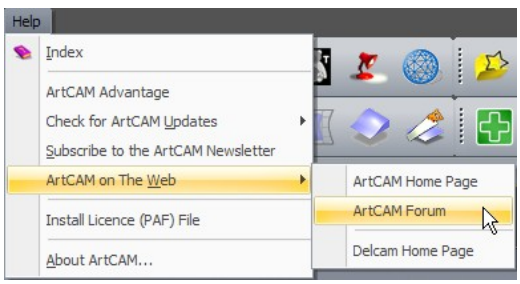
Select **ArtCAM 2010** to quickly **reset** the interface to **default settings.**

Select **ArtCAM 2010 Advanced** to change the interface to an **advanced setting** where all toolbars are switched off.

Select **Classic** to change the interface back to **ArtCAM 2009**.

ArtCAM Help

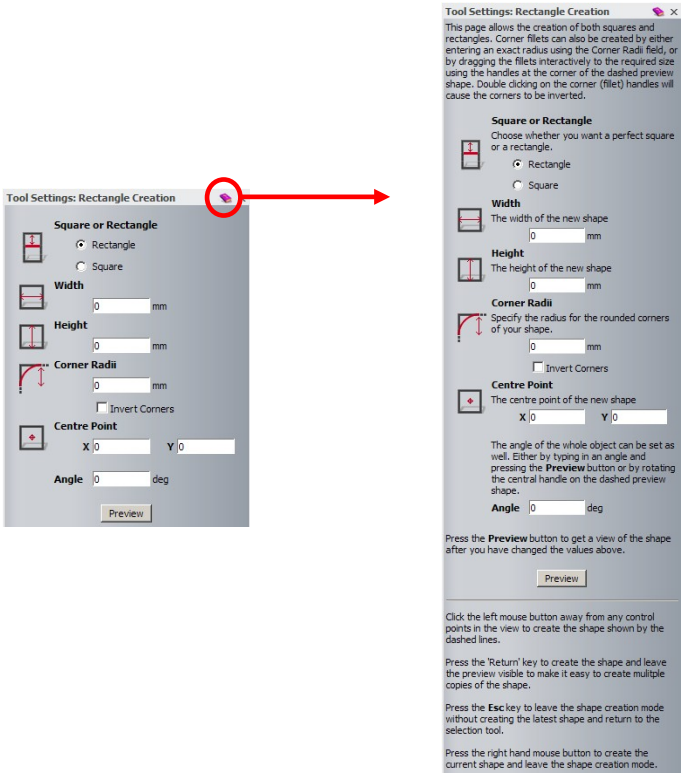
By selecting **Help - Index** from the top Menu bar (or by pressing the F1 shortcut key) a Help Page will open over the graphics area.



Further sources of information and help can be obtained from the **ArtCAM website** and dedicated **Forum**.

Individual function forms can be expanded to provide a detailed explanation of each available option/entry.

This is achieved by selecting the **Help icon** in the top right hand corner of the active form. The example below applies to the **Rectangle creation** function .



ArtCAM File structure

ArtCAM Models (*.art)

An **ArtCAM Model** will contain all entities created within the session such as **Bitmaps** (image files), **Vectors** (2D geometry) **Reliefs** (3D models) and **Machining data** (Toolpaths). This ArtCAM file is identifiable by having an **.art** extension and can be saved or exported as a whole.

It is also possible to save/export independent entity types from within the **ArtCAM Model**. These include the **Vectors** (mainly **.eps .dxf .dgk .pic** formats), **Reliefs** (**.rlf**), **Triangle Models** (**.stl .dmt**) and **Machining Output** (**.tap**).

For more advanced applications where it is required to create an assembled group of separate **Relief models (.rlf),** an **ArtCAM Project** is first opened in which several

ArtCAM Models can be created and combined as required for an assembled item. When saved, the **Artcam Project** is identifiable by a **.3dp** extension. To enable the **Reliefs** to co-exist together, the individual components are converted within the **Assembly** as **Triangle Mesh** models. ArtCAM can also import surface models (e.g. **iges**) directly into an assembly.

ArtCAM Projects (*.3DP)

To allow greater freedom and complex **3D design**, ArtCAM adopts a unique process of model making, where by all associated **files** or **components** are created and stored within a single **Project folder (* 3DP)**. The Project folder can be best described as a repository for all the finished components or **Assemblies.** Each **Assembly** within this Project Folder can then be freely positioned, combined and manipulated (e.g. shaded, scaled) in 3D space.

Assemblies

Each of these **Assemblies** is created from **ArtCAM** model or imported as a **triangular mesh replica (*.3da, *.stl, *.obj, *.dmt)** or alternatively **imported** directly as a **surface model** (all major 3D modeling formats including *iges, *3dm, *dgk).

Providing that a replica mesh has been created from an ArtCAM model stored as part of the same project, it also **hosts a link to the ArtCAM model file from which it originates**.

A single assembly hosts any number of replica meshes and/or gems or further assemblies along with their own associated replica meshes and gems. You can create a relief layer in an open **ArtCAM** model directly from a replica mesh, or an assembly providing that it has an associated replica mesh.

Assemblies are useful for a number of reasons. Firstly they are very useful for visualization, as they allow you to view both the front and back surfaces of a piece simultaneously. In addition, they can be replicated, scaled, positioned and rotated. Although an assembly can be manipulated in three-dimensional space, you cannot edit the actual shape of the assembly itself.

The main advantage of using this system of creating and storing is that it allows **assembly** of separate components. For example, gems, settings and a ring shank can be created separately but then assembled in the Project Folder to create a finished piece. This finished piece can then be machined as a whole using the powerful **Multi-Sided Machining** Wizard.

Design

ArtCAM Reliefs (*.rlf) or simply the 3D models are created from **2D vectors** or **bitmaps**. These **vectors** (2D artwork) and **bitmaps** (images) can be generated within ArtCAM or imported from other systems. **ArtCAM** can generate reliefs from an imported model.
When dealing with bitmaps and Reliefs it is important to understanding **Resolution**, which will influence the overall surface detail of the relief and ultimately the final piece.

Manufacture

The final stage for most **ArtCAM Projects** is to manufacture the 3D relief as a real object. Currently there are two major routes to production: via **CNC** machining or **Rapid Prototyping**. **ArtCAM** can realise its models using either method.

ArtCAM can calculate the **toolpaths** required to machine the individual relief or final assembly. The calculated toolpaths can be then sent directly to the machine *(*via post-processing*)* ready for cutting.

Most Rapid Prototyping machines require a specific type of 3D model. These models are made up of a small triangular mesh, which defines its whole surface shape. This type of file is commonly known as an **STL,** file format. **ArtCAM** allows you to export the final assembly or relief in the **STL** format, ready for manufacture.

Mouse buttons application

Each of the **three mouse buttons** performs a different operation in **ArtCAM JewelSmith 3D View (F3)**. By using the **ALT**, **Ctrl** or **Shift key** on your keyboard, these operations can be extended as the following details explain.

Left mouse button: Picking and selecting

This button is used for selecting items off the **main pull down** menus, inputting data and selecting parts of the model.

Middle mouse button or wheel: Dynamics

Zooming:

Scroll the **middle mouse** to Zoom IN/OUT of the model. This applies to the 2D and 3D view. Alternatively, Select the **SPACE BAR and Right mouse button** together and move the mouse to Zoom IN/OUT. This option applies to the 3D view only)

Panning:

Hold down the **Left and Right mouse buttons** and move the mouse, to move the view across the component.

Rotating/Twiddle:

Hold down the **middle button/wheel** and move the mouse. Alternatively Select the **SPACE BAR and Left mouse button** together and move the mouse. This option applies to the 3D view only).

2. Generating Vectors

Introduction

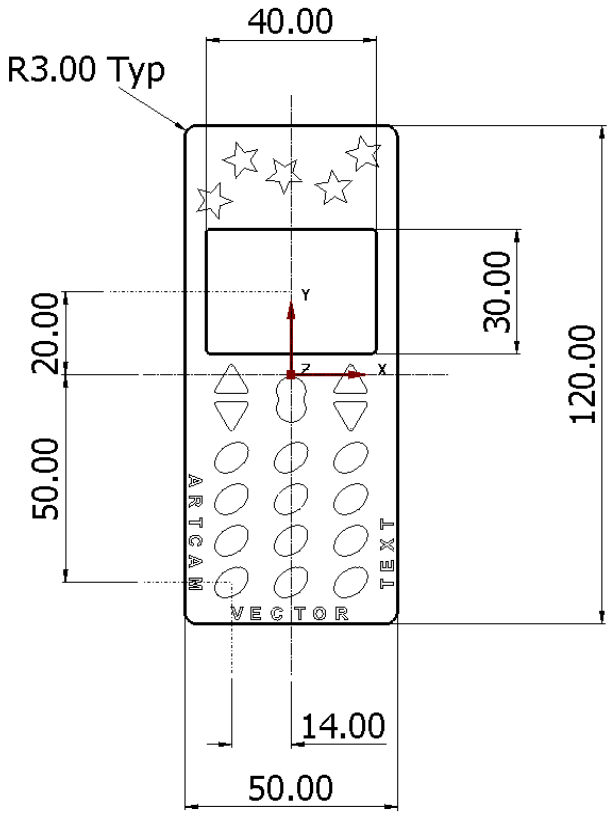
Vectors are mathematically defined shapes consisting of a series of points (nodes), which are connected by lines, arcs or curves (spans) to form the overall shape.

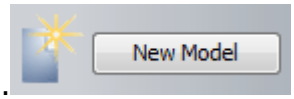
They can be:

- Generated directly within **ArtCAM** by using the **Vector Tools** in the **Assistant** page;
- **Rectangles**, **Squares**, **Circles**, **Polylines**, **Ellipses**, **Polygons**, **Stars** or **Text** that can be edited if necessary to generate the final **vectors** to create a **Relief** from;
- Imported from another drawing package, using the **File – Import** menu option, or copied and pasted from another package using the standard **Windows** commands.

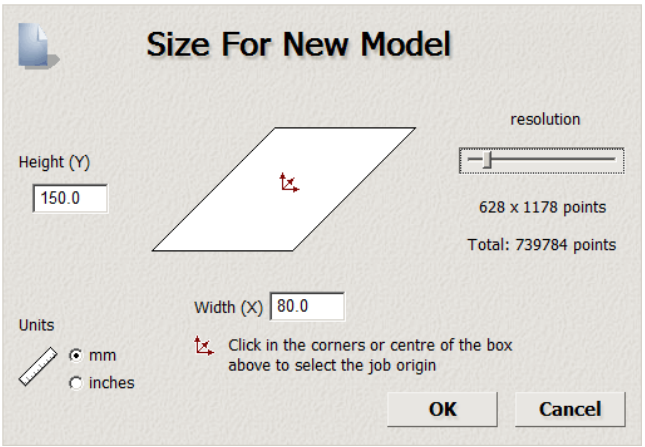
Mobile Phone Cover Exercise

In the following exercise you will generate a **Mobile Phone Cover** using the **Vector Tools**.
Below is a drawing of the item including basic dimensions, so that you can get an idea of how the final product should look before working through the ‘step by step’ instructions.



- Select **New Model**. 

- Enter a **Height** of **150mm**, a **Width** of **80mm**.
- Set the **Origin** to the **centre** of the model and a **resolution** of approximately **628x1178 points** (by moving the slider).

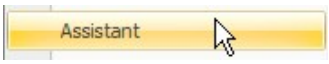


- A **new** ArtCAM Model (sheet) is generated based on the parameters defined above.

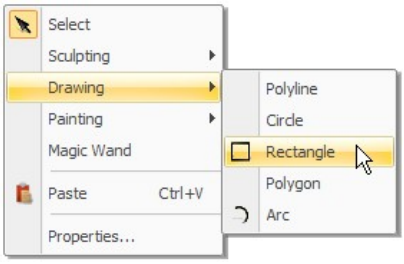
The vector creation tools (any many others) can be accessed in several ways.

1. The default **Design Tools toolbar** on the left hand side.

2. Activate the **Assistant Tab** by **right mouse selecting** in the **grey border**.

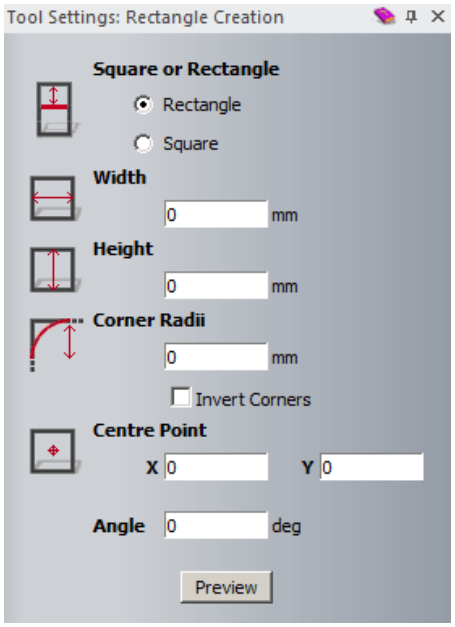


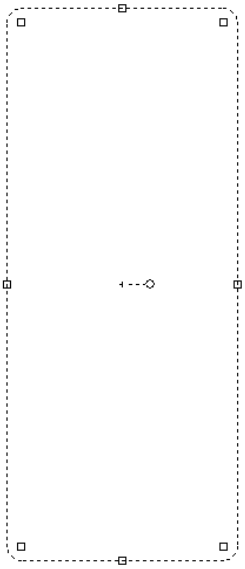
3. **Right mouse select** in the white model sheet and select the **Drawing** options.



- Using a method outlined above, select **Create Rectangle** .
- The **Rectangle creation** form appears in the **Tool settings** form.

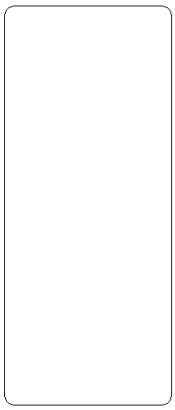
- Enter a **Width of 50mm**, a **Height of 120mm**, **Corner Radii of 3mm** and a **Centre Point of X 0 and Y 0**.
- Select **Preview** to view the proposed shape (represented as dashed lines)





- To **create the shape**, single left mouse click in the view area.

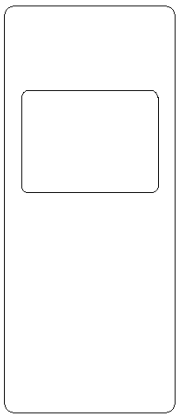
The rectangle is created on the model page whilst keeping the rectangular creation form open. This can be utilised to create a new shape.
Note: A single right mouse click would create the shape, but close the vector creation form.



The outer **shape** of the phone **cover** is created.

- In the Rectangle Creation form, change the **Width to 40mm**, **Height to 30mm**, **Corner Radii to 1mm** and the **Centre Point to X0 and Y20**.

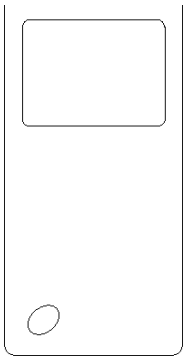
- To create the shape, **single right mouse click** in the view area (and close the form).



This second **rectangle** will represent the display window.

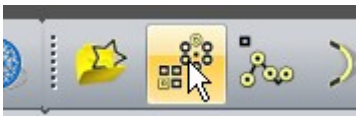
- Select **Create Ellipse**.
- Enter a Start Point of **X –14 Y –50** with a **Height of 7mm, Width of 10mm** and an **Angle of 140 degrees**.

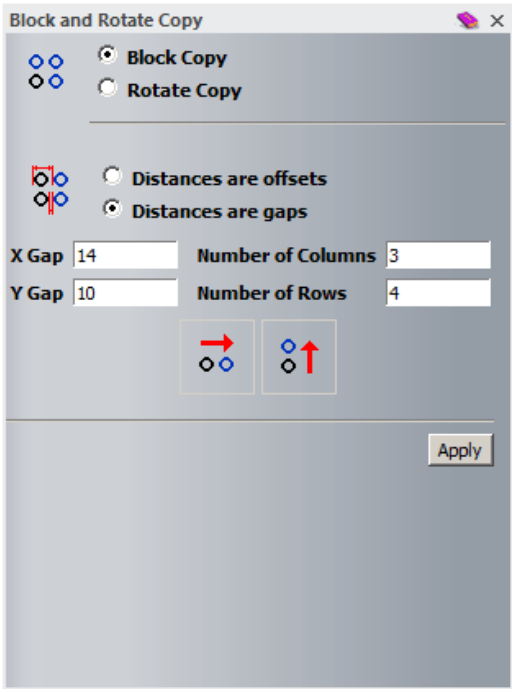
- **Right mouse click** to create the shape.



A **block pattern** of this single **Ellipse** can be created quickly to complete the keypad.

- With the **Ellipse** selected, click on the **Block Copy / Rotate** icon from the **Vector Tools** area on the **Assistant**'s page **or** top of the screen.

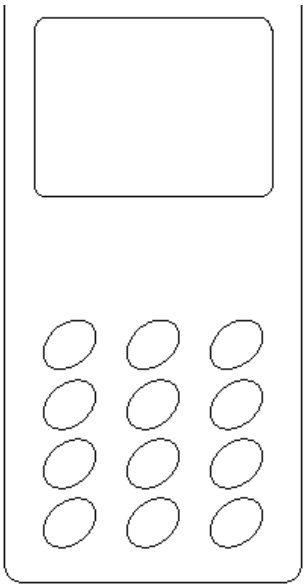




The **Block and Rotate Copy** allows you to create a **block copy** in **X** and **Y** or a **rotated copy** around a point.

The distances can be set as an offset value or by a gap value between each item.

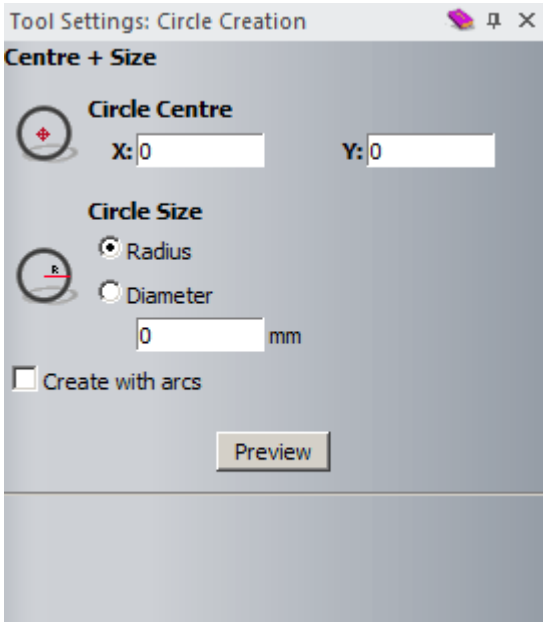
- Select **Block Copy** and **Distances are offsets** options.
- Select an **X Offset of 14mm**, with **Number of Columns** as **3.**
- Select a **Y Offset** of **10mm**, with **Number of Rows** as **4.**
- Select **Apply**.



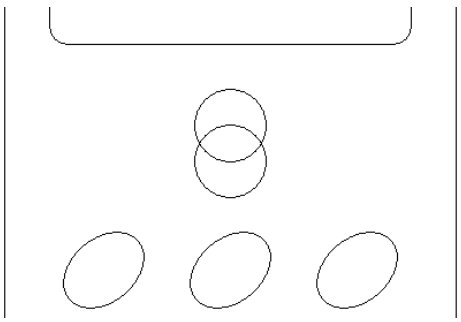
The keypad is created.

A centre 'menu' button will be created from two combined circles.

- Select **Create Circle** .



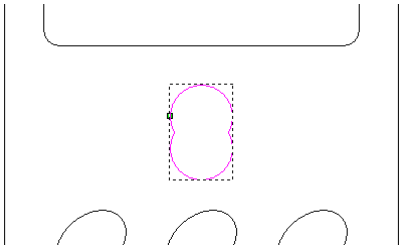
- Create a circle with centre at **X0 Y–4**, **radius as 4mm**.
- Create a second circle or **radius 4mm** but with centre at **X0 Y–8**.



The **Circles** will now be ‘merged’ into one.

- Select **both circles** and select the **Weld** button from the **Position**, **Combine**, **and Trim Vectors** area on the **Assistant**’s page.

By **welding** the two **Circle** vectors, a new single vector is created.

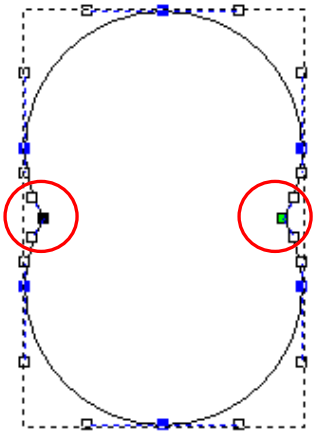


Note: The **Weld** command only works on two selected closed **vectors**.

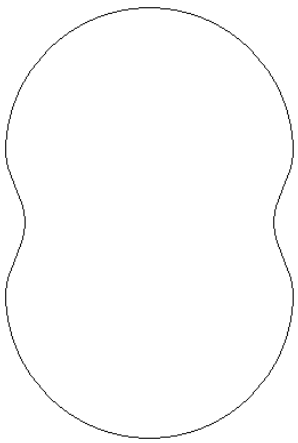
- **Zoom in** to see the vector more clearly.

Zoom either using the tool or middle mouse cursor.

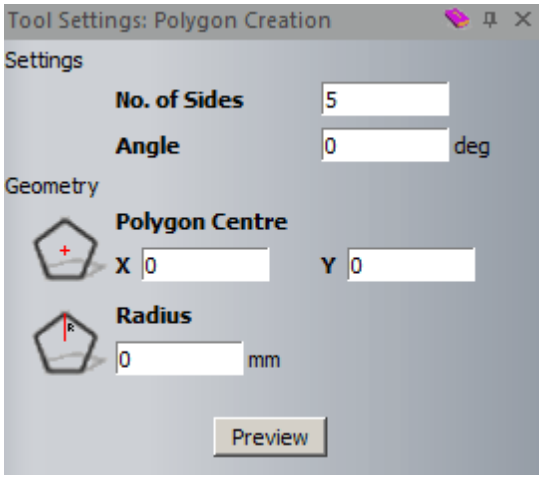
- With the new vector selected, select Node Editing.
- Hover the mouse over a **left black node**, press the **right mouse button** and from the side menu select **Smooth Point** (or press **S** on the keyboard).



- Repeat for the other side to provide a shape with smooth inner corners.
- Press **N** to return to **Select** mode and click away from the vector.

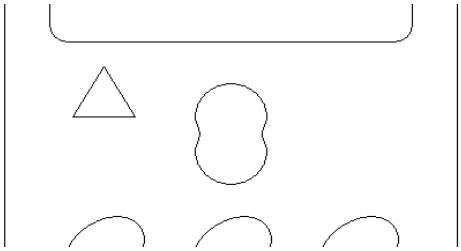


- Select **Create Polygon** .

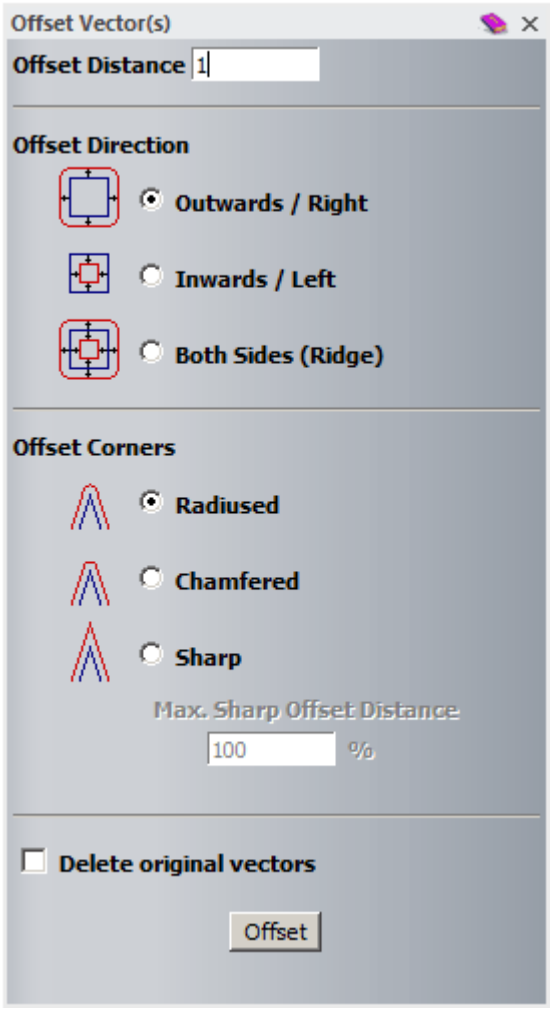


- Enter **No. of Sides to be 3**, **Angle 0**, **Polygon Centre at X –14, Y –2** with a **Radius of 4mm**.

- Create the triangle shape (left/right mouse click)

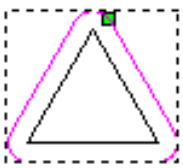


- With the Triangle vector selected, select **Offset Vector(s)** .



- Select an **Offset Distance of 1mm**, **Offset Direction as Outwards** and **Offset Corners as Radiused.**

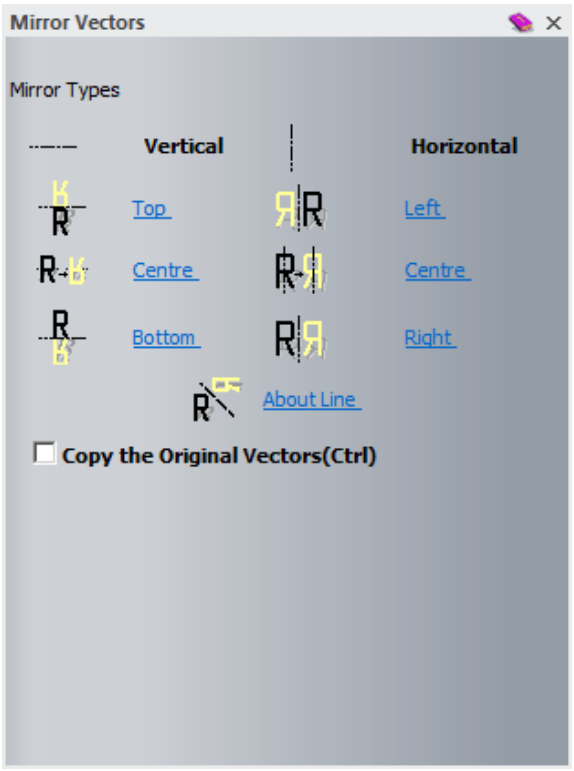
- Select **Offset** to create the new shape.



The new **vector** is **Radiused** at the corners.

- Select the **original inner vector** and press **Delete** on the keyboard.

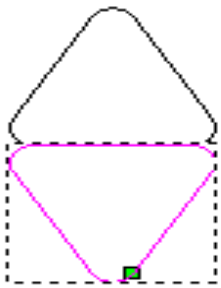
- Select the **new vector** and select **Mirror Vectors** .



The **Mirror Vectors** page allows you to mirror the selected **vectors** about themselves or about a selected line.

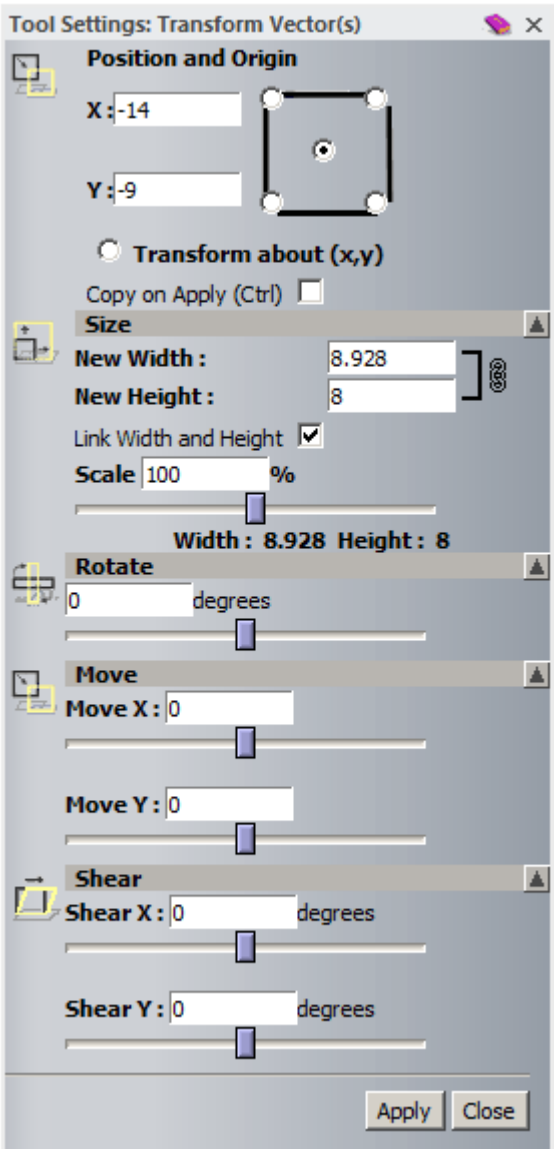
Note: You must select the **mirror line** first before applying the **Mirror Vectors - About Line** option.

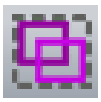
- Select **Copy the Original Vectors (Ctrl)**,
- Select **Bottom** to create the mirrored triangle.



The **new vector** will be moved downwards. It can be nudged using the **down arrow** or moved more accurately by a value using the **Transform Vectors** command.

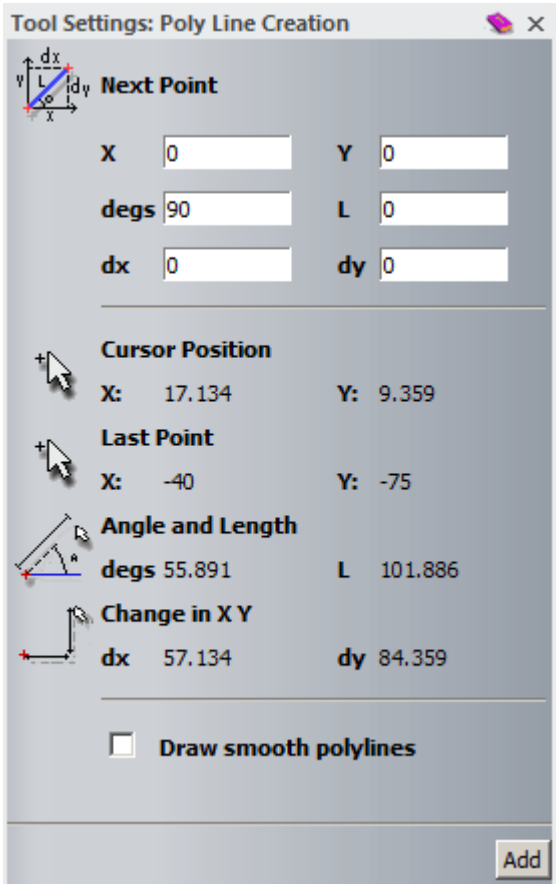
- Select **Transform Vectors** (or hit **T** twice on the keyboard).



- Enter **Move Y** as **–1**, select **Apply**.
- Select both **Triangular vectors** and then select the **Group** button. 

The two items can now be treated as one.
A **polyline** will be created to use as a mirror line for this grouped feature.

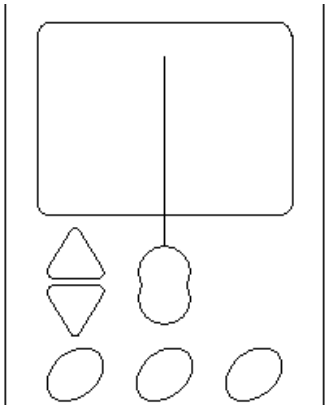
- Select **Create Polyline** .



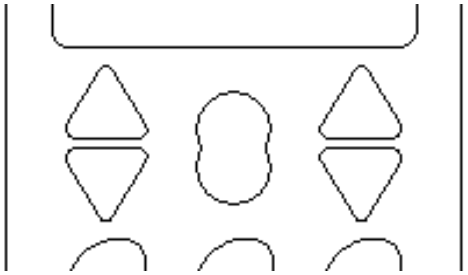
Polylines can be generated by entering **absolute co-ordinates** in the **X** and **Y** area, by angles and line length, as **relative co-ordinates** using the **dx** and **dy** (distance from last point) or by clicking with the cursor.

Note: **Polylines** can also be created dynamically in the graphics area either by holding down the left mouse key while freehand sketching a curve, or by using the left mouse key to click individual points along the required route.

- Select **Add** (enters a point at 0, 0).
- Enter **30** in **dy** (**30mm** in **Y** direction), select **Add** and then **Close**.



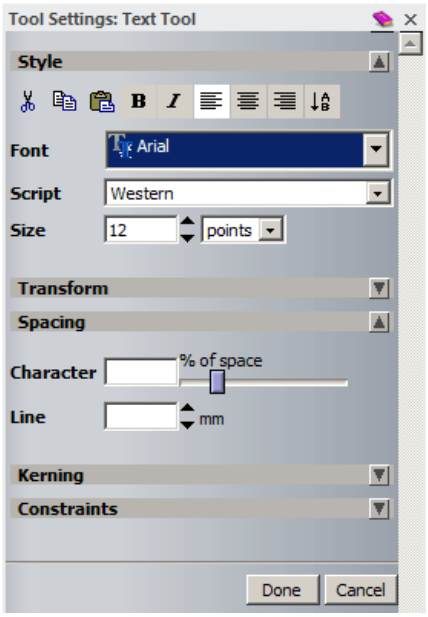
- Select the **Polyline** first and then **shift select** the **triangle group**.
- Select the **Mirror** button.
- Select Copy the Original Vector option.
- Select **About Line** to create the mirrored feature.
- Delete the **Polyline**.



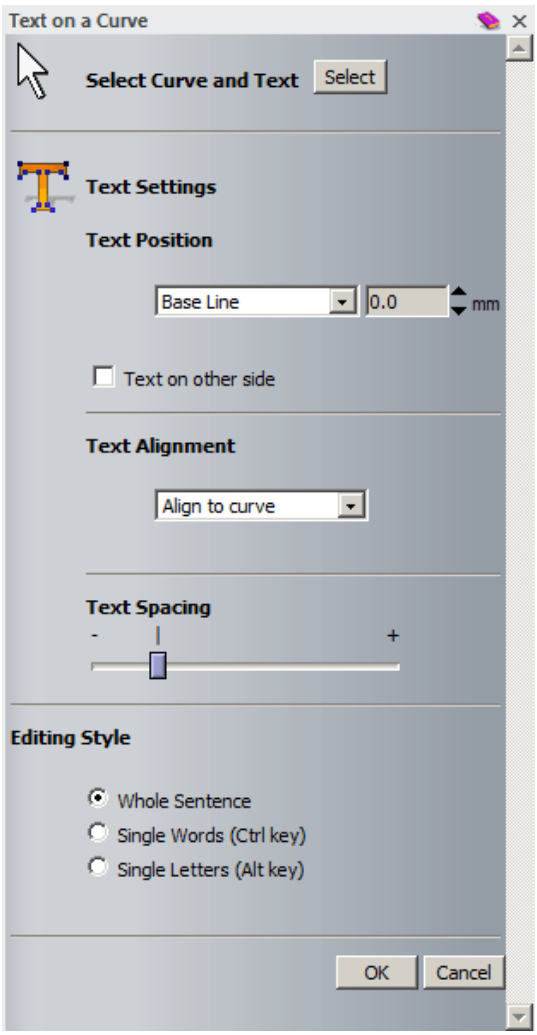
- Select **Create Vector Text** .
- Select **Font** as **Arial**, **Script as Western** and **Size** as **3mm**.

- Click at the bottom of the **2D View** and type **ARTCAM VECTOR TEXT**.
- Select **Done**.

This **Text** can be wrapped around the **outer vector**, with the text inside, using the **Wrap text round a curve** option.



- Select **Wrap text round a curve** .



The **Text on a Curve** page appears, which allows you to align an existing **Text Vector** to a **Curve Vector**.

Text Position includes options that control the relative, position of the **text** across the curve.

Text on other side puts it on the other side of the curve.

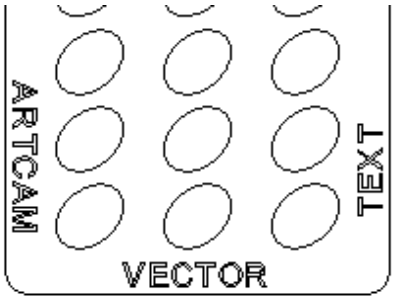
Text Alignment includes options that control the flow of the **text** along the curve.

Text Spacing allows you to vary the spacing between the individual characters.

Editing Style allows you to set individual **Words** or **Letters** to be repositioned around the curve independently.

- Select the **Text** and shift select the **outer vector** and press **Select** in the **Text on a Curve** page.

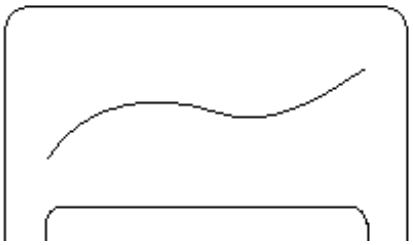
- Select the **Text Position** option as **Specify** and enter **1mm**.
- Tick the option **Text on other side** (if text is on the outside).
- Select the **Editing style** option as **Single Words**.
- **Dynamically Move** the **text** using the **cursor** to align on the **three sides as shown below.**
- Select **OK**.



The **Text** is now **wrapped**.

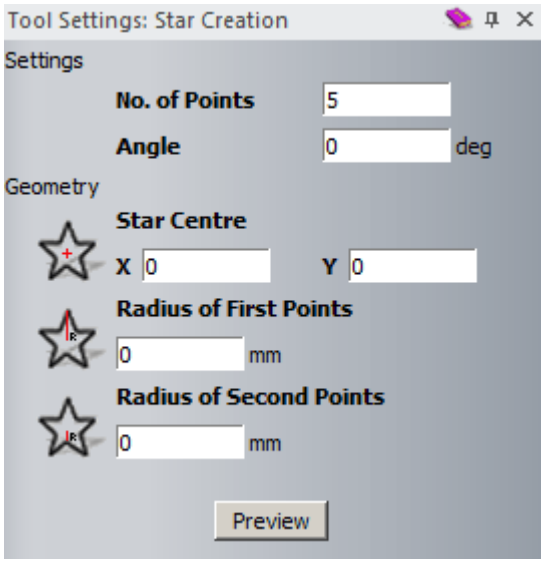
- Select **Create Polyline** and in the form select the option **Draw smooth polylines**.

- Left mouse click **5** suitably positioned **points** to create a **Smooth Polyline** similar to the one shown below.



You will use this **Polyline** to **paste vectors along**.

- From the **Vector Tools** area, select **Create Stars**.

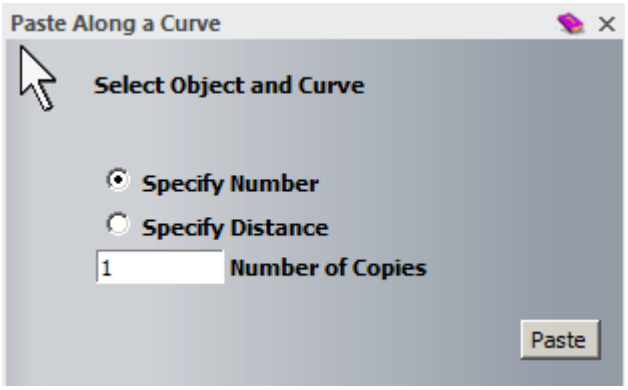


- Enter **No. of Points as 5**, **Star Centre as X –28**, **Y 62**, **Radius of first Points as 4.5mm** and **Radius of second Points as 2mm**.

- **Preview** and **create** the star.

- Select the **Star** vector and **shift select** the sketched **Polyline**.

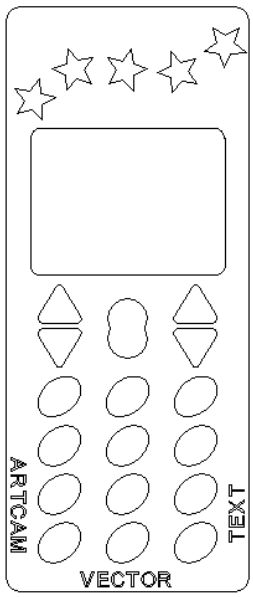
- From the **Vector Tools** area, select **Paste along Curve** .



The **vector** is pasted incrementally along the curve either by dividing the curve equally (**Specify Number**), or by a fixed distance, leaving any surplus at the end of the curve (**Specify Distance**).

- Select **Specify Number** and enter **Number of Copies** as **5**.
- Select **Paste**.

- Delete the original **Star** vector and the sketched **Polyline**.



- Select **File - Save As**, browse: …\COURSEWORK\ArtCAMJewelSmith-Jobs and enter as **File name** - **training-phone-cover**.
- Select **File** - **Close Model**.

3. Vector Editing and Layers

Vector Editing

The following chapter will introduce several **Vector Editing** options.

Shield Design Exercise

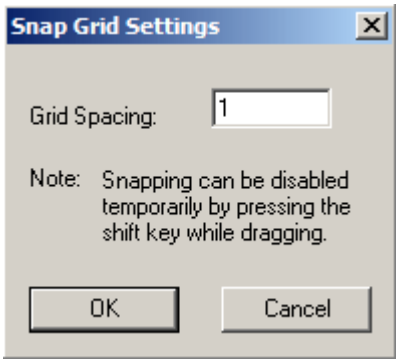
- Create a **New Model** with a **Height** of **20mm**, **Width** of **20mm** and a resolution of approximately **1002 x 1002 points**.
- Set the **Origin** to the **centre** and select **OK**.

Note:

You can move the origin position by using the option **Set Model Position**.
This allows you to position the **zero datum** to the **Centre**, one of the **4 corners** or a typed **coordinate position**.

Vector input by snapping to a Grid

- From the top file menu, select **Bitmaps – Views - Snap Grid - Snap Grid Settings…**

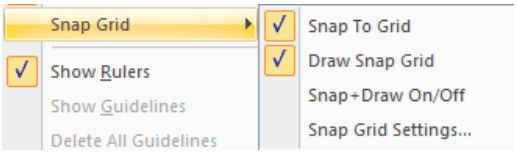


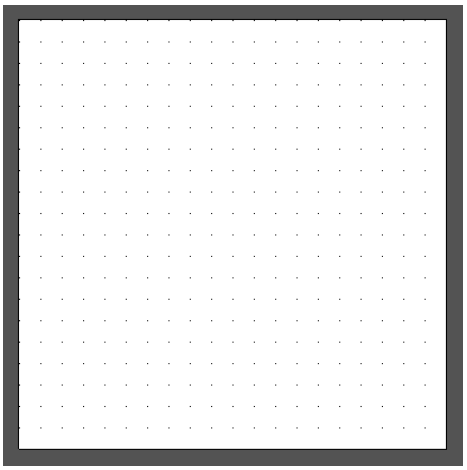
Grids provide **snap points** to assist in dynamically defining vector points. They are available from the **Bitmaps - Views** pulldown menu.

The selected grid spacing value is mainly dependent on the size and complexity of the component to be produced.

- Set the **Grid Spacing** to **1** and select **OK**.

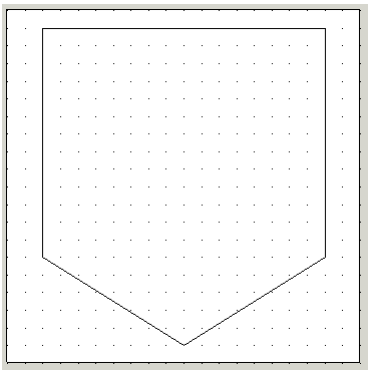
- From the same top file menu, switch ON the options **Snap to Grid** and **Draw Snap Grid**.





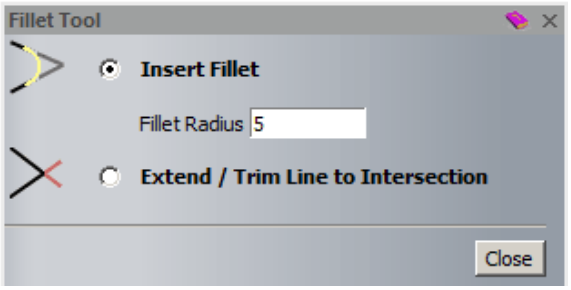
A grid is displayed in the view, with an even point spacing of 1mm.

- Select **Create Polyline**.
- Snap to the same **Grid points** as shown in the image below.



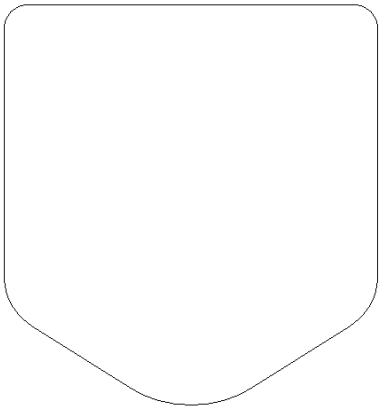
Note: The best position to **Snap** in a **vector point** is just to the lower, left of a **Grid point**.

- Select **File** - **Save As**: **D:\users\training\COURSEWORK\ArtCAMJewelSmith-Jobs\train-shield**.
- Switch **OFF** both **Snap to Grid** and **Draw Snap Grid**.
- Select **Fillet vector with an arc** .



The **Fillet** is generated at a node point or from two **Polylines** that would intersect.

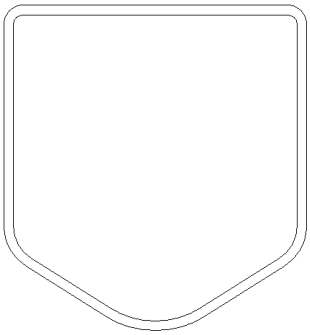
- Enter a **Fillet Radius** of **5mm** and select line **either side** of the **bottom point** to generate the fillet.
- Change the **Fillet Radius** to **1mm** and create a **Fillet** at the **top two corners**.
- Change the **Fillet Radius** to **2.5mm** and create a **Fillet** at the **bottom two corners**.



The main shield **vector** is as shown.

- Close the form.
- With the **vector** selected, select **Offset Vector.**
- Set an **Offset Distance of 0.5mm**, select **Inwards** and **Radiused.**
- Select **Offset**, followed by **Close**.

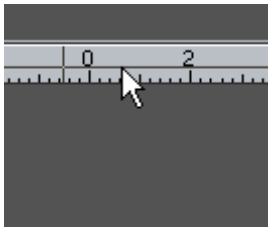
Vector input by snapping to Guidelines



You've created a constant **Offset**. For the middle part, instead of using **Grid lines**, **Guidelines**, you will input actual values.

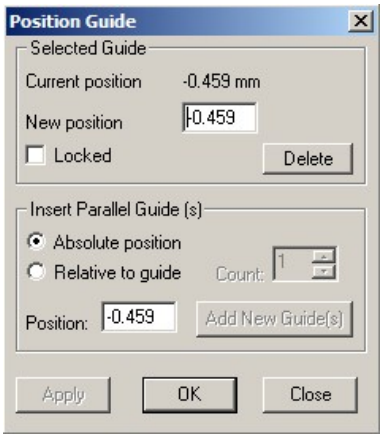
Guidelines are pulled from within the rulers located around the border of the model. For accurate positioning they can be snapped direct to **Grid points** or if the **Grid** is switched off once created they can be precisely positioned via a **Position Guide** form.

- Hold the **left mouse button down** within the **top ruler** (as shown) and drag down a horizontal Guideline.



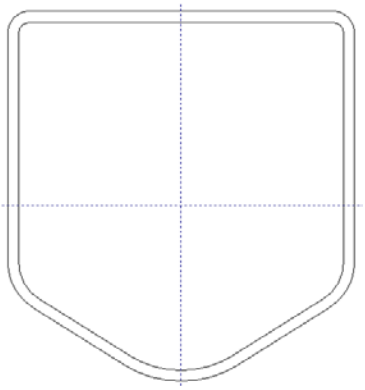
- Release the **left mouse button**, when it is **near** to the **centre** of the model.

- Right mouse click on the **Guideline** to activate the position guide.



This form allows the guideline to be accurately positioned, deleted or further guides to be inserted.

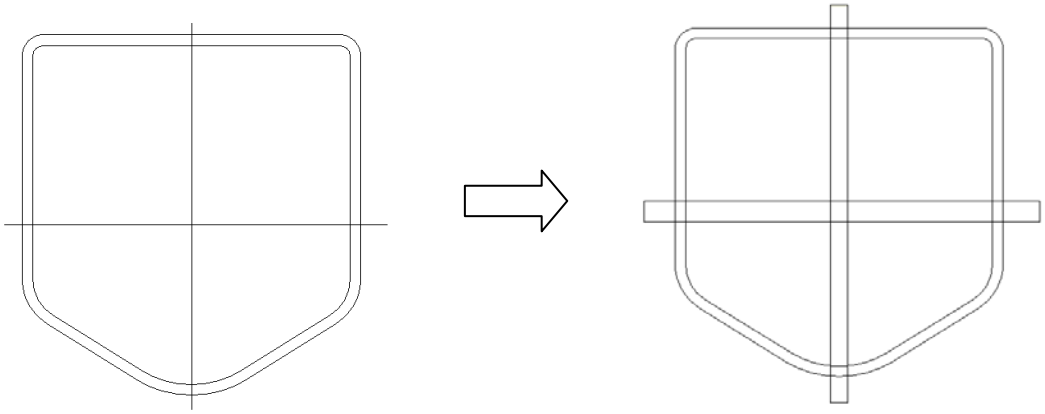
- Enter a **New Position** of **0** and select **Apply**.
- Repeat the process to generate a **vertical Guideline** at **0** (by dragging it from within the **left ruler**.)



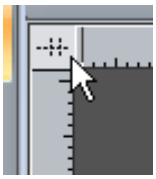
The two guidelines **intersect** at the origin. These guidelines can be snapped to, when creating or moving vectors or nodes.

You can show or hide these Guidelines by clicking on the Guidelines icon in the top left corner of the rulers.

- Select **Create Polyline**.
- Snap on the Guidelines to create horizontal and vertical centrelines.



- Pick the top left corner icon in the **2D View** to **switch off Show Guidelines**.

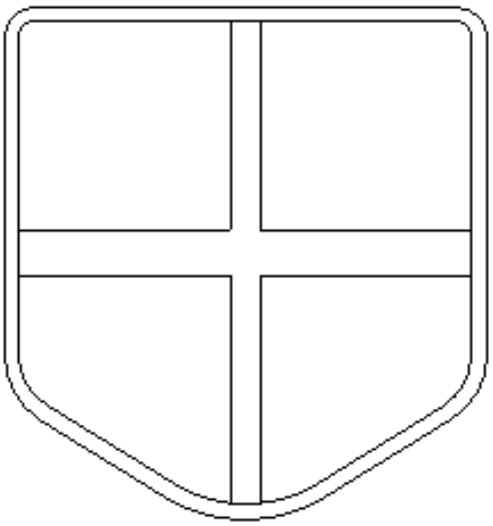


The **two new Polylines** will be used to create **Offset Copies** by setting the on **Both Sides (Ridge)** option.

- Offset the horizontal Line vector **both sides by 0.5mm** selecting the **Both Sides (Ridge)** option.
- Offset the vertical Line vector **both sides by 0.4mm**.

- Delete the **original Polylines** (if the **Delete original vectors** option was not set during the offset operations).

- Select **Trim vector to intersections** and trim the **Polylines** to fit within the shield.



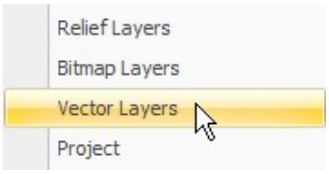
The completed **vectors** for the shield design are as shown.

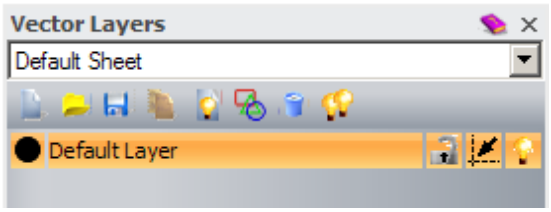
- Select **File** - **Close Model** (do not save)

Vector Layers

Vector Layers provide a more ordered method of managing the **selection** and **display** of selected groups of **vectors**. In default mode **ArtCAM Pro** assigns all **vectors** produced to
a layer named **Default Layer** (which cannot be **renamed or deleted**). Any additional **Vector Layers** can be **Renamed**, **Deleted** and **Merged** together. As new **Layers** are created specific **group of vectors** are assigned to them as required. The layers Tab also allows the user to **Open (Import)** and **Save (Export)** vector data.

The **Vector Layer Toolbar** can be **activated** by right mouse selecting in the **Grey border** (Right hand side) and selecting **Vector layers**.

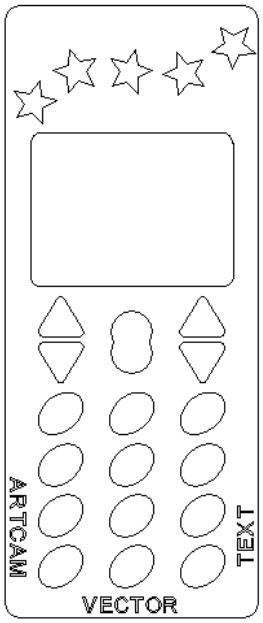




Vector Layers are controlled by this toolbar. The **default layer** is **highlighted** and any generated or imported vectors will be displayed, providing the layer in switched on (light bulb).

Phone Cover Exercise

- Open the model **training-phone-cover.art** from **D:\users\training\COURSEWORK\ArtCAMJewelSmith-Jobs**.



This exercise will show how to **import** vectors and also **move** or transfer existing vector data to other layers.

- Select the **stars vector** group.

Layers need to be generated before vectors can be placed into them. It is good practise to give the layer a sensible name.

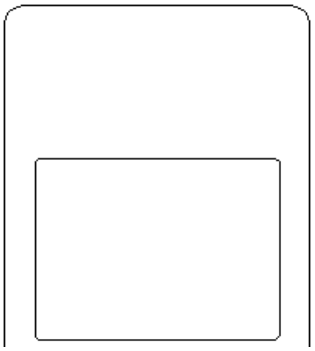
- Select **New** on the **Vector Layers toolbar**.

New Vector Layer 1 has been created. By double-clicking on the name itself, the name can be changed.

- **Double click** on **New Vector Layer 1**, overwrite as **stars** and select **Enter** (or mouse click away from the name) to confirm.

The **new level** is now named and switched on (denoted by the light bulb icon) .

- **Right** mouse click on the selected **star vector** group and select **Move Vectors To… > stars**.
- Switch off the **Layer stars** by clicking the **light bulb**.

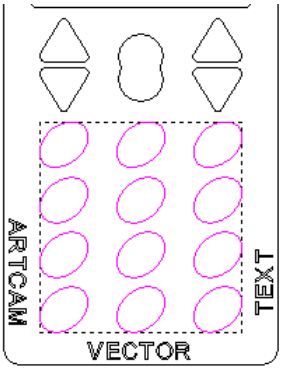


The **star vectors** are now **hidden**. The other vectors on the default level are still displayed.

Note: When a **Layer** is current (highlighted in colour) any vectors that are pasted are automatically placed on that layer.

- Create a **new Layer** and change the name to **buttons**.
- Create a **new Layer** and change the name to **holes**.

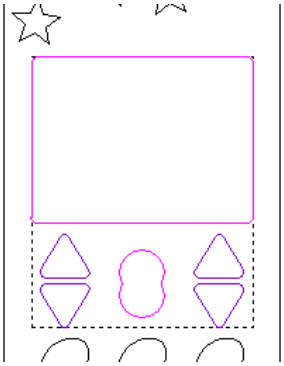
- Select the **12** Ellipse vectors.



The **selected vectors** will be transferred to another **Layer**.

Note: Layers can have the snapping facility switched on or off. For example if you had vectors close together and wanted to be sure you snapped to the correct vector on a layers, then you would switch snap off for all the other layers.

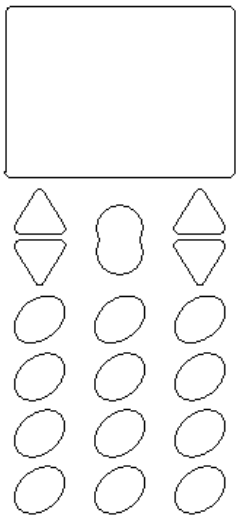
- Right mouse click on the selected **button vector group** and select **Move Vectors to…..> buttons**.
- Select the **other shaped vectors** as shown.



These selected vectors will be placed on another **Layer**.

Note: Layers can be locked, so any vectors on that layer cannot be moved or edited until the layer is unlocked .

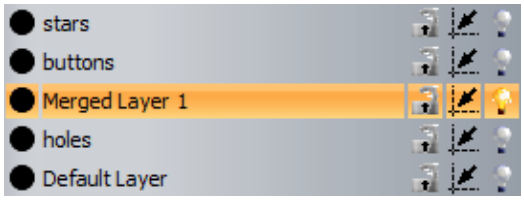
- Right mouse click on the selected vector group and pick **Move Vectors to….. > holes**.



- Switch **off** the **Default Layer**, leaving **on** the layers **buttons** and **holes** .

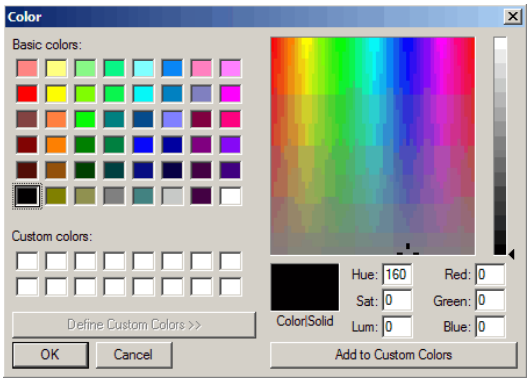
The vectors displayed are going to be combined into the one current layer **Merged Layer 1**.

- Select **Merge Visible** .



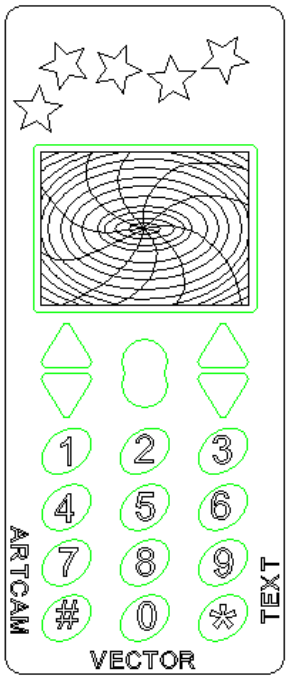
A **new Layer** called **Merged Layer 1** has been created with the visible data combined. The vectors on the layers can be coloured for identification.

- Select the **black circle** to the **left** of the **Layer** name **Merged Layer 1**.



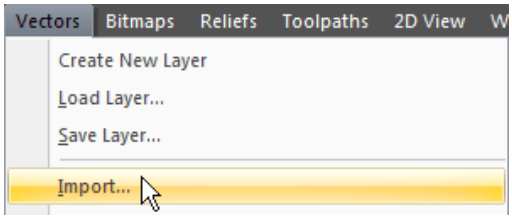
The colour form appears. This allows you to select the colour for the vectors on that layer.

- Select any suitable colour and then **OK**.
- Switch on all the **Layers** using the **Toggle All Visibility** .
- Select **Open** from the **Vector layers toolbar**.
- From **ArtCAM Data**, select the file **tel-insert.eps** and select **Open**.

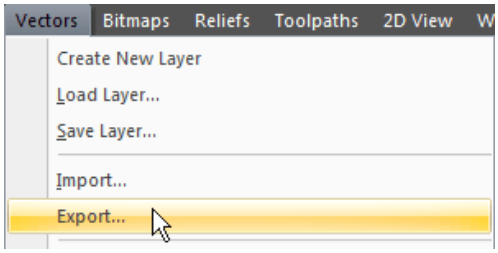


The vectors are **imported** as a group on a **new layer (same as filename)**, so to use them individually, they need to be **ungrouped** .

Vectors can also be **imported** from the main menu by first highlighting the required vectors and then selecting **Vectors – Import…** from the top menu.



Similarly, vectors can also be exported by selecting the desired vectors and then selecting **Vectors - Export….** from the top menu.



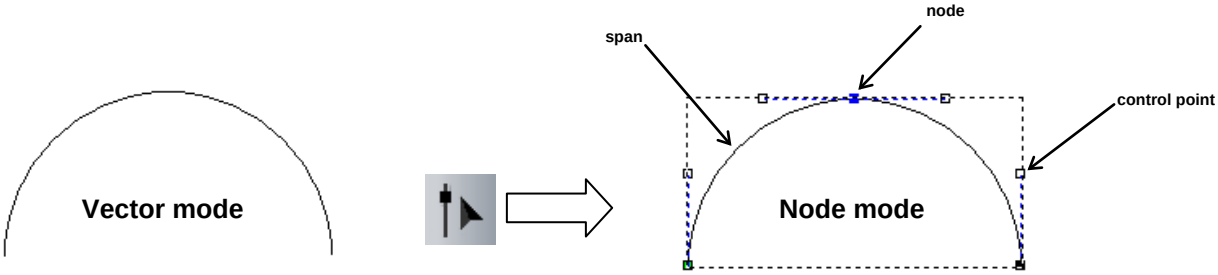
Selecting from the **Vector layers toolbar**, will **export all vectors on that layer**.

- Select **File** - **Save**.
- Select **File** - **Close Model**.

Node Editing

The structure and appearance of a vector can be changed using the **Node editing options Vectors** are made up of **nodes** and **spans** which are displayed only when ArtCAM switches to **Node Editing Mode** .

Upon **selecting a Vector**, **Node Editing can be entered** by selecting from the **Design Tools Toolbar** on the left hand side, the **Right mouse select menu** or simply selecting **N** on the keyboard.



The following example illustrates the different options available for editing **nodes, spans** and **control points** within selected vectors.

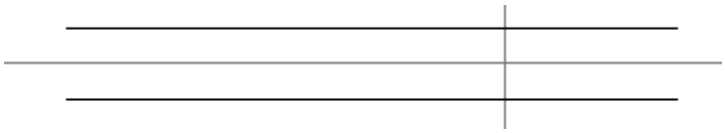
Enamel-Pin Exercise

- Create a **New Model** with a **Height** of **20mm** and **Width** of **60mm** (Origin in centre).
- Create a **Guideline** at **X 0** and **Y 0**.

- Select **Create Polyline** .
- **Untick** the **Draw smooth polylines** option .
- Enter **X** as **–25mm**, **Y** as **1mm** and select **Add**.
- Enter **dx** as **35** and select **Add**.

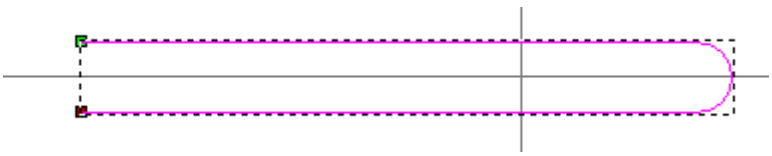
- Select **Create Polyline**.
- Enter **X** as **–25mm**, **Y** as **–1mm** and select **Add**.
- Enter **dx** as **35** and select **Add**.

Note: Selecting the Spacebar will stop the Polyline creation at the last point. A new start point can then be created.



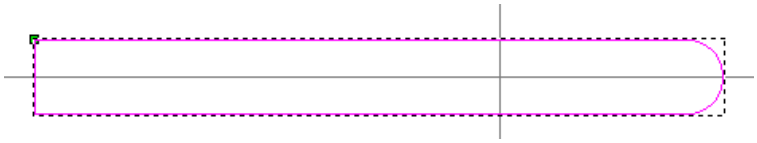
You can join these **two vectors** together with either an **arc**, **straight line** or by **moving** the **end points**.

- Select both vectors.
- Select **Join Vectors With A Curve** .



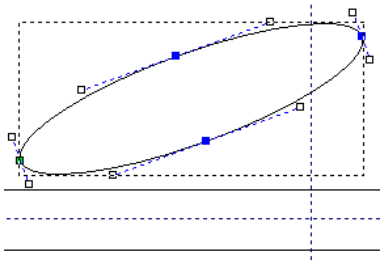
You've **joined** the **two vectors** together to make a **new vector**. You will **close** the **open vector**.

- Select the **new vector**.
- Select **Close vector with a Line** .



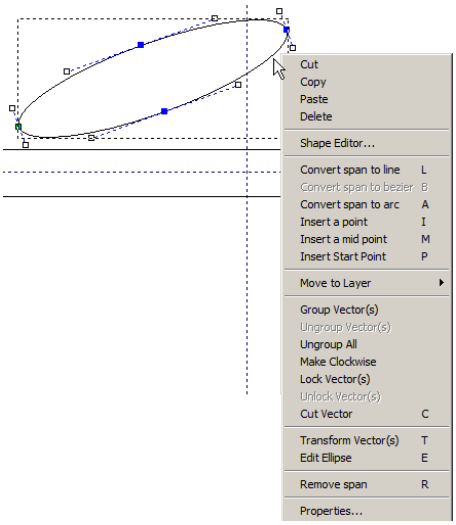
The vector has been closed. You will now modify an **Ellipse** to produce a **leaf shape**.

- Select **Create Ellipse** .
- Enter a **Start Point** of **X -4mm Y 4mm**, an **Ellipse Height of 3mm** and **Width of 12mm** with an **Angle** of **340 degrees**.
- Create the **Ellipse shape** (single mouse click on model sheet)
- **Select the Ellipse** and then Select **Node Editing** .



By pressing **N** on the keyboard on a selected vector, you will switch between **Node Editing** mode and **Select Vectors** mode.

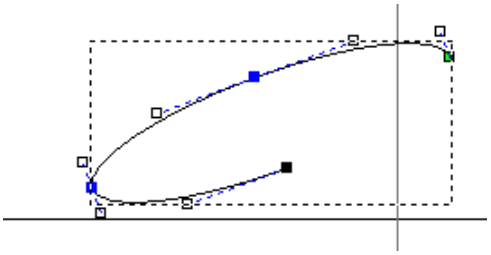
You will open up the **Ellipse** halfway by removing spans using the **right mouse button** menu.



The part of the vector between two node points is called a **span**. If a **span** was removed, the vector will become **open**.

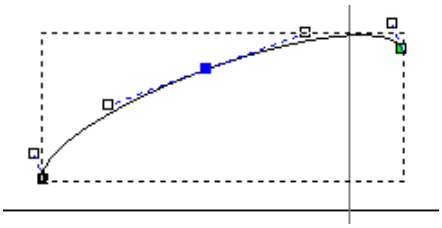
In **Node Editing** mode, if you move your mouse over a **node point** and click the **right mouse button** a local set of menus appears.

- **Right mouse click** over the **right bottom span** of the **Ellipse** and select **Remove Span** from the menu. (The span mode is indicated by **~**)



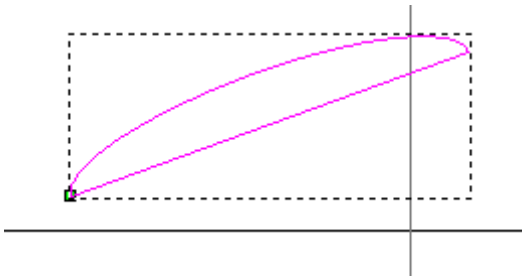
The **Ellipse** vector is opened at the required area. You'll need to delete the other lower span.

- **Right mouse click** over the **left bottom span** of the **Ellipse** and select **Remove Span** from menu.



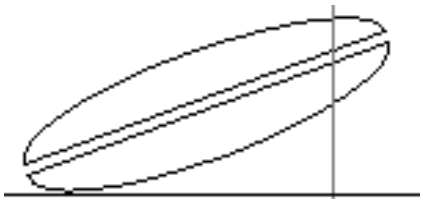
Only half of the original **Ellipse** remains. You will **close** this half **Ellipse** with a **line** in the **Select Vectors** mode.

- Select **Select Vectors** .
- With the vector selected, select **Close Vector with a Line** .



The vector is now closed. You will now create a **Polyline** to mirror the vector across.

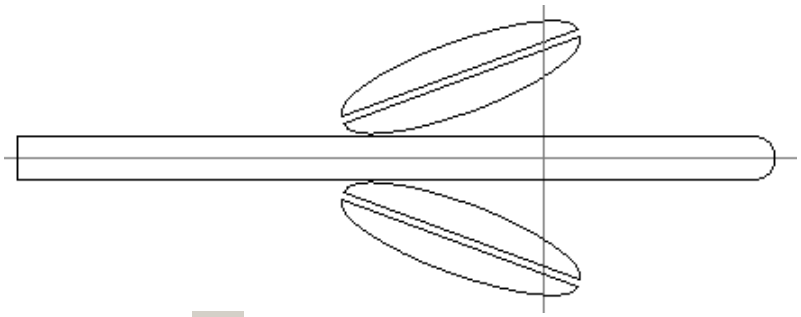
- Select **Create Polyline** .
- Enter **X** as **–10.3mm**, **Y** as **1.5mm** and select **Add**.
- Enter **X** as **3.6mm**, **Y** as **6.6mm** and select **Add**.
- **Shift-Select** the **Polyline, the leaf shape** and then **Mirror Vectors** .
- Tick the **Copy the Original Vectors option** and select **About Line** .
- **Close** the form.
- Select the **Polyline** and select **Cut** .



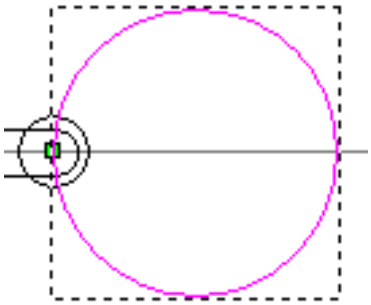
The leaf shape has been generated. This will now be mirrored to the other side.

- Select **Create Polyline** .
- Snapping to the **horizontal Guideline**, create a single line across the model.
- Select the **new horizontal vector** and the **leaf shapes**.

- Select **Mirror Vectors** .
- Select **Copy** the **Original Vectors** and the **About Line option** .

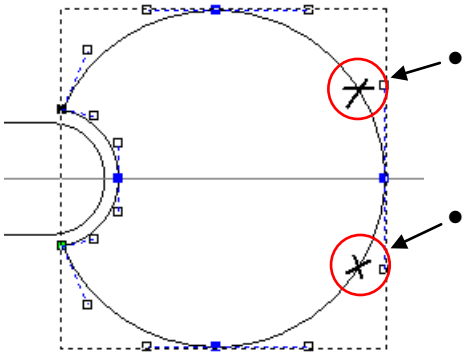


- Select **Create Circles** .
- Set the **Circle Centre** as **X 10mm Y 0**, select **Radius** and enter **1.5mm**.
- Deselect **Create with arcs**, before **creating the circle**.
- Create a new **Circle** with **Centre** at **X 16mm Y 0**, and **Radius** of **6mm**.
- Select **Create** followed by **Close**.

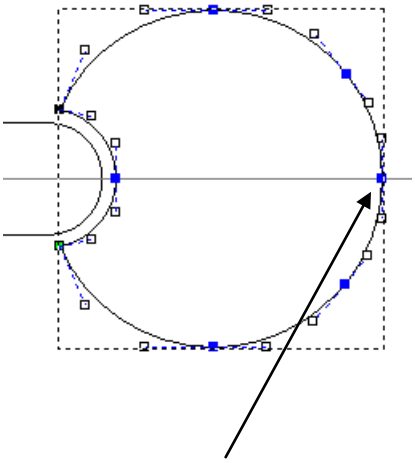


The **smaller circle** will be subtracted from the **larger circle**.

- Select the **larger circle** and then **shift select the smaller circle**.
- Select **Subtract vectors** .
- Select **Node mode** .

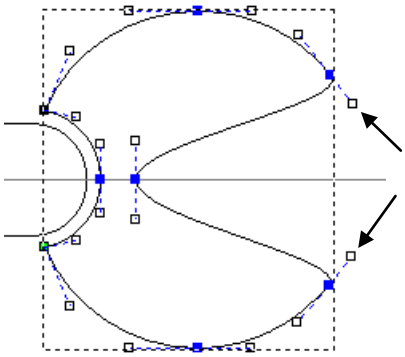


- Move the mouse over the **top marked area** and from the **right mouse menu** select **insert a point**.
- Move the mouse over the **bottom marked area** and from the **right mouse menu** select **insert a point.**



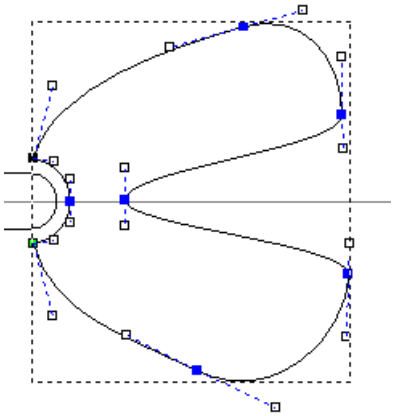
The addition of these extra node points will allow you to move the node point in between the new points and it will only stretch the vector within that region.

- Select the **middle node**.
- Drag the point **along the horizontal vector** (towards the origin) and **release** the mouse at a suitable position as shown in the image below.
- **Delete** the horizontal vector.



The **two control points** can be dragged to produce a more realistic curve.

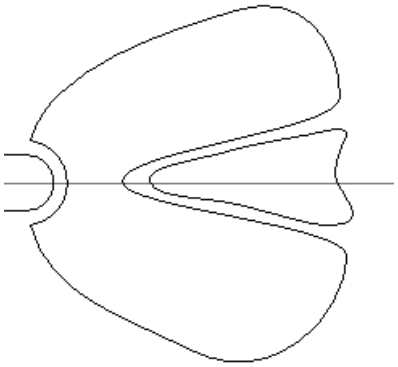
- Select each **control point** and move around as shown in the image below.



The shape is complete. You'll have to create another **Polyline** to build the inner part, using the smooth option.

- Select **Create Polyline** .

- **Tick** the **Draw smooth Polylines** option.
- Select **several points** on the model to make the shape roughly as shown.



The last point is not smoothed when it is joined. You can smooth it in the **Node Editing** mode.

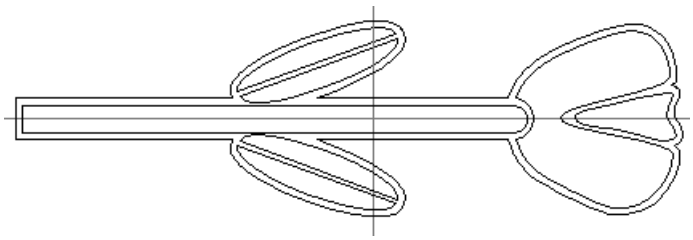
When you are in the **Node Editing** mode the smooth point shows as **blue** and a non-smooth point shows as **black**.

You can now **Offset** all of the **vectors**.

- Click on the **start point** to complete a single closed vector.

- Select Vectors .
- Select **all** the **vectors**.

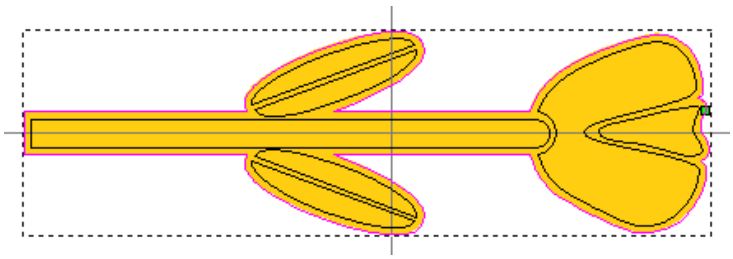
- Select **Offset Vectors** .
- Select an **Offset Distance** as **1mm**, **Offset Direction** as **Outwards/Right** and **Offset Corners** as **Radiused**.
- Select **Offset**, followed by **Close**.



The design is complete.

You can fill in the **closed vectors** with **bitmap colour** to give an idea of what the design will look like before the **Relief** is made.

- With the **new offset vector** highlighted, **select** the **gold coloured square** from the palette at the bottom of the **2D View** with the **left mouse button**.
- Select **Flood Fill Vectors**.

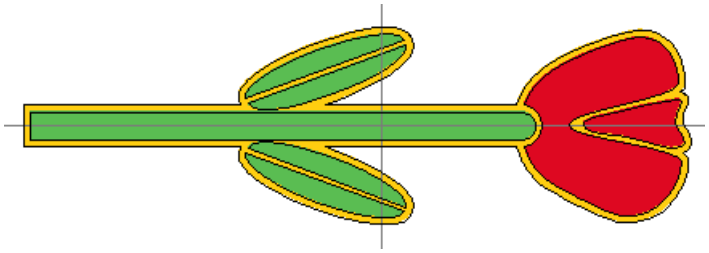


The whole inside of the vector is filled with the selected colour. (The colour is a bitmap). You can select other vectors and fill them in to overwrite the colour.

- Select the **leaf and stalk vectors** and select the **green coloured square** at the bottom of the **2D View**.
- Select **Flood Fill Vectors** .

- Select the **petal vectors** and **select** the **red coloured square** at the bottom of the **2D View**.

- Select **Flood Fill Vectors** .

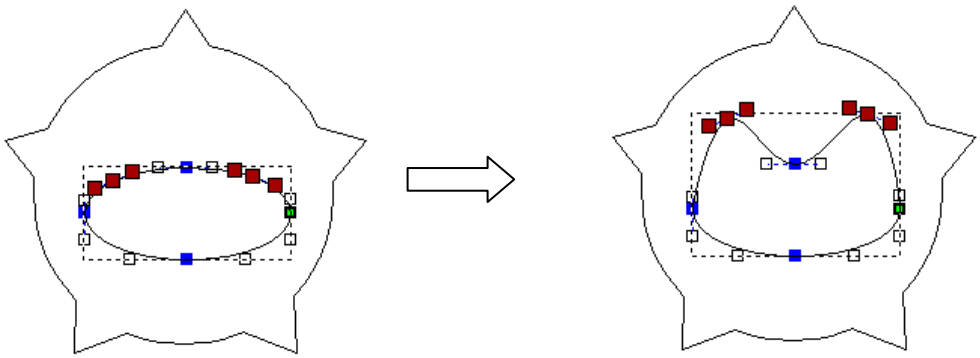


If the vectors were altered, the colours need to be recreated.

- Select **File - Save As** with the **File name** - **train-flower** in **D:\users\training\COURSEWORK\ArtCAMJewelSmith-Jobs**.

Selected Node Editing

When a node is selected it turns red and can be moved dynamically. Shift and select allows the user to select several nodes in a curve, ctrl and select allows the user to pick individual nodes, to be moved simultaneously.



Selecting **X** on the keyboard edits the selected points with the **X** coordinate of the last node.

Selecting **Y** on the keyboard edits the selected points with the **Y** coordinate of the last node.

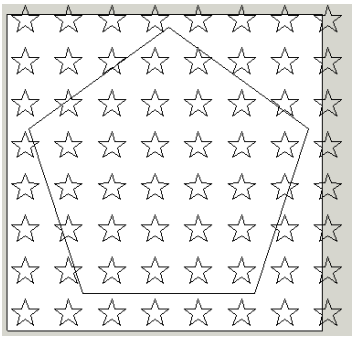
Vector Clipping and Slicing

Vector Clipping is used to trim a **group of vectors** within a defined **vector**.

Vector Slicing is used to split a **vector** across a selected cutting **vector**.

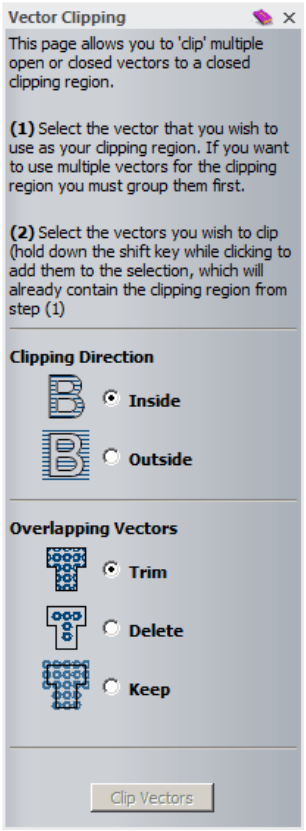
Vector Clipping Exercise

- Create the following vectors in a **New Model** of size **100 x 100** and **Origin** at the centre.



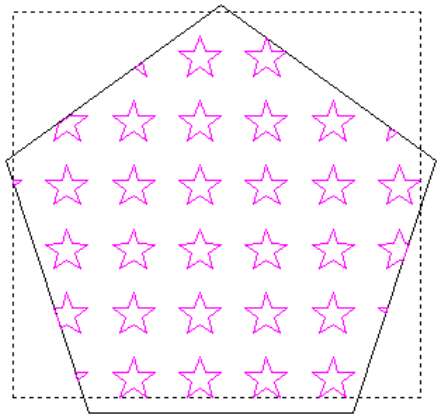
The sizes do not really matter as long as there are a few stars within the pentagon.

- Select **Vector Clipping**.



The vector clipping form appears with instruction on how to use the command and the different results available with the options given.

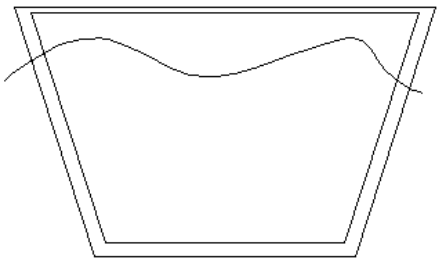
- Select the **Polygon** and then **shift – select all** of the other **vectors** (can drag a box).
- Select **Clipping Direction** as **Inside** and **Overlapping Vectors as Trim.**
- Select **Clip Vectors**.



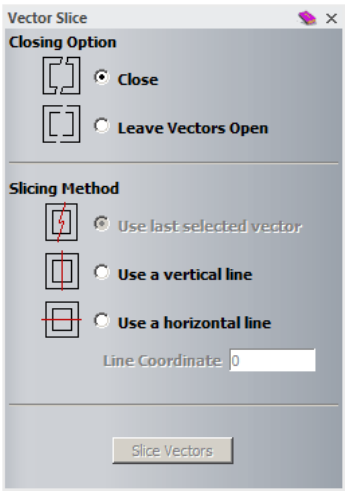
The stars that are whole within the polygon are retained and those that cross the polygon are trimmed back as shown.

Vector Slicing Exercise

- In a **New Model** of size **100 x 100** and **Origin** at the centre sketch the following **vectors**.

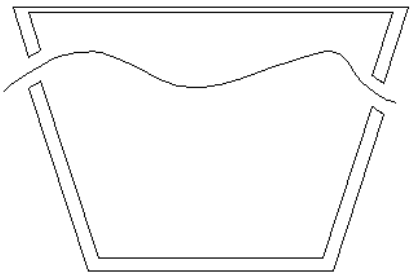


- **Shift - Select** both the closed vectors followed by the open (slicing) vector.
- Select **Slice Selected Vectors**.



The **Vector Slice** page appears displaying the options available. The **Use last selected vector** option is only available when more than one vector is selected. Otherwise it will be greyed out.

- Select the options **Close** and **Use last selected vector**.
- Select **Slice Vectors**.
- Nudge the **two new vectors up** and **down** using the keyboard up and down arrow keys to see the result.

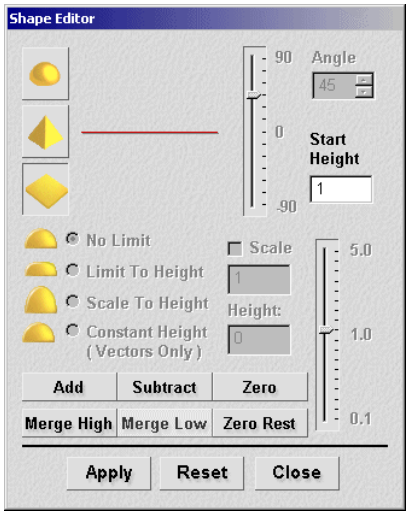


The vectors have been sliced and rejoined.

4. Generating a Relief

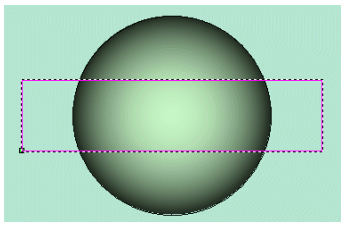
Introduction

A **Relief** is the **ArtCAM 3D model** created either from **vectors**, **bitmaps**, imported **CAD surface models** or existing stored **Reliefs**. One set of options operates by building a **Relief** from one or more **closed vectors** using the **Shape Editor**. **Double clicking** on the selected **vector/s** or pressing the **F12 shortcut key** will open the **Shape Editor** form.



There are three main **3D** forms: **Domes**, **Pyramid**s and **Flat Planes**. By selecting one of the **3D Relief** icons the relevant options become active in the form. The **Relief** form can only occur within the defined **model area** and is effectively formed by the individual bitmap squares (**Resolution**) moving up or down in **Z**. The **Shape Editor** is the original method for creating a **Relief**. As **ArtCAM** has evolved, a selection of more specialised and advanced options have been added to the **Relief Tools** area of the **Assistant**.

There are 6 options to control how the **Relief** is combined with the existing **ArtCAM** model. These comprise **Add**, **Subtract**, **Merge High, Merge Low, Zero** and **Zero Rest**.

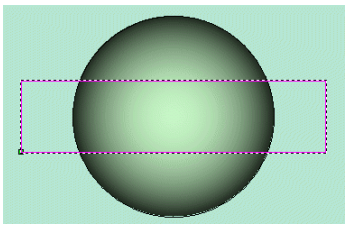


The **2D View** shows the **Dome Relief** already made from a **Circle** vector and the **Rectangle selected** for the **new Relief**.

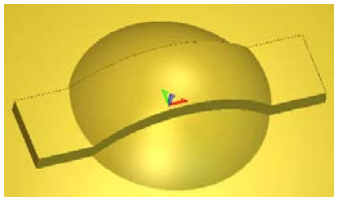
Add

This method **Adds** the **new Relief** on top of the **current Relief**, producing the result as shown right.

In this case a **Plane** of a **Start Height** of **1mm** was **added** to the **Relief**.

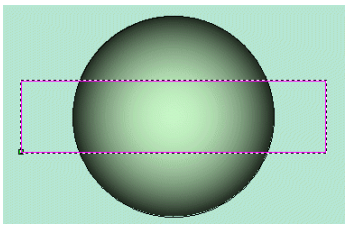


ADD

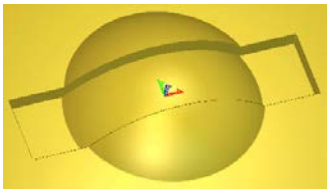


Subtract

This method **Removes** the new **Relief** from the current **Relief**, giving the following effect.
In this case a **Plane** of a **Start Height** of **1mm** was **subtracted** from the **Relief**.



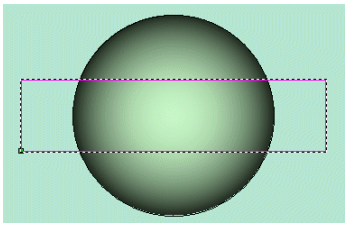
ZERO

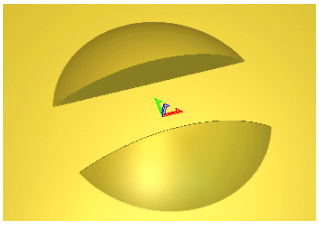


SUBTRACT

Zero

By applying **Zero**, the **Relief** inside the **vector** will have **Z height** of **Zero**.

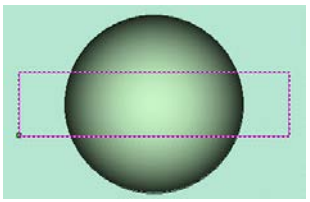


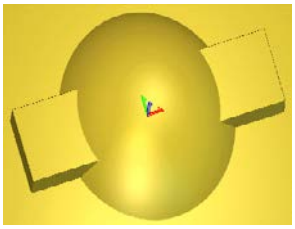


MERGE HIGH

Merge High

The new **Relief** is **Merged** along **Z** through the existing **Relief**.
In this case a **Plane** of a **Start Height** of **1mm** has been **Merged High** through the **Dome**.

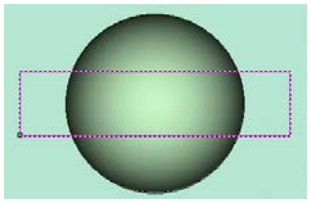


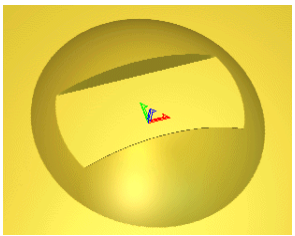


MERGE LOW

Merge Low

The new **Relief** is **Merged** through the existing **Relief** and any of the original **model** form above it is removed.
In this case a **Plane** of a **Start Height** of **1mm** was **Merged Low** through the **Dome**.

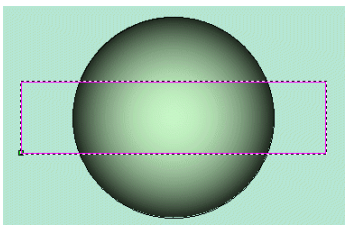


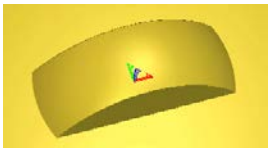


ZERO REST

Zero Rest

The new **Relief** is flattened to the **Zero plane** outside of the vector area.





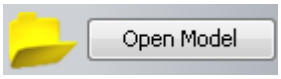
Note: with this option it does not matter which relief shape was chosen, the area outside the 2D rectangle area was zeroed.

Reliefs are displayed in the **3D View** and can be **Exported** from **ArtCAM** as individual (**.rlf**) file.

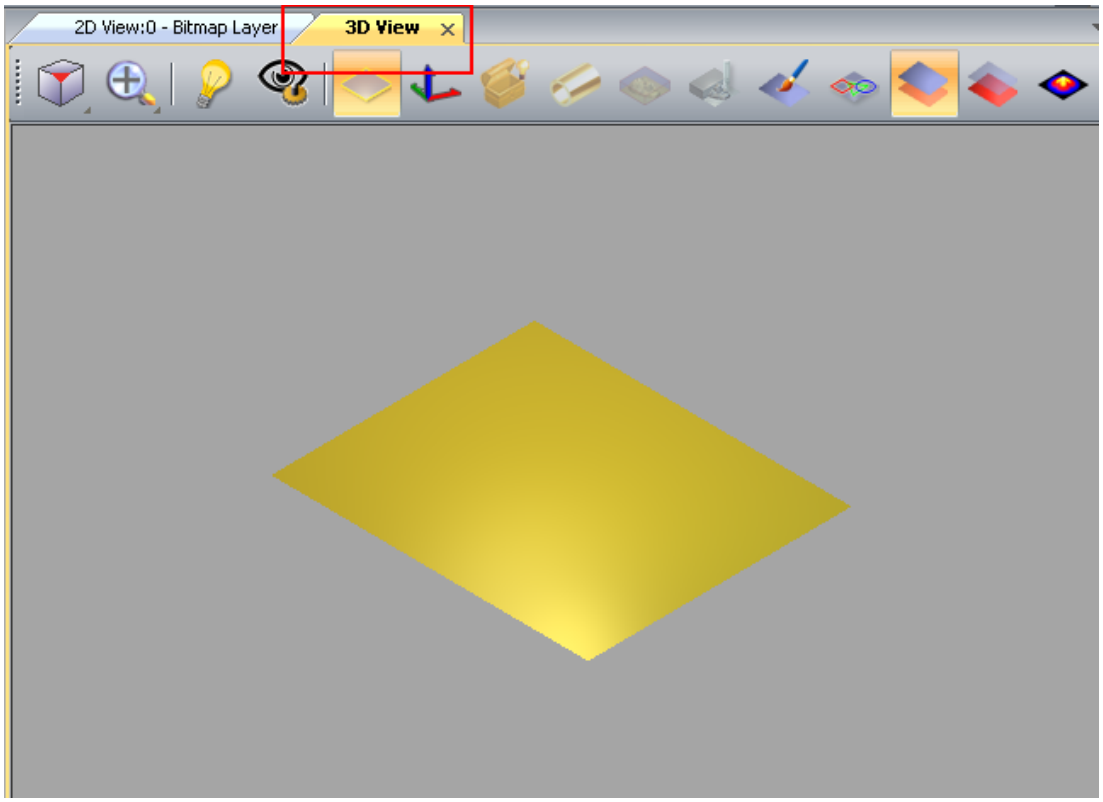
The smoothness of a **Relief** is dependant on the **Resolution**. An option exists at the top of the **2D View** to display the **Relief** as a shaded image. This shaded image can if required be used to create a **bitmap**, which in turn can be modified to exhibit photo realistic colours on the **3D Relief** model.

Reliefs can be calculated from vectors from the **2D View** or directly within the **3D View**.
The following examples show how to create a relief by selecting vectors within the **3D View**.

Anchor relief

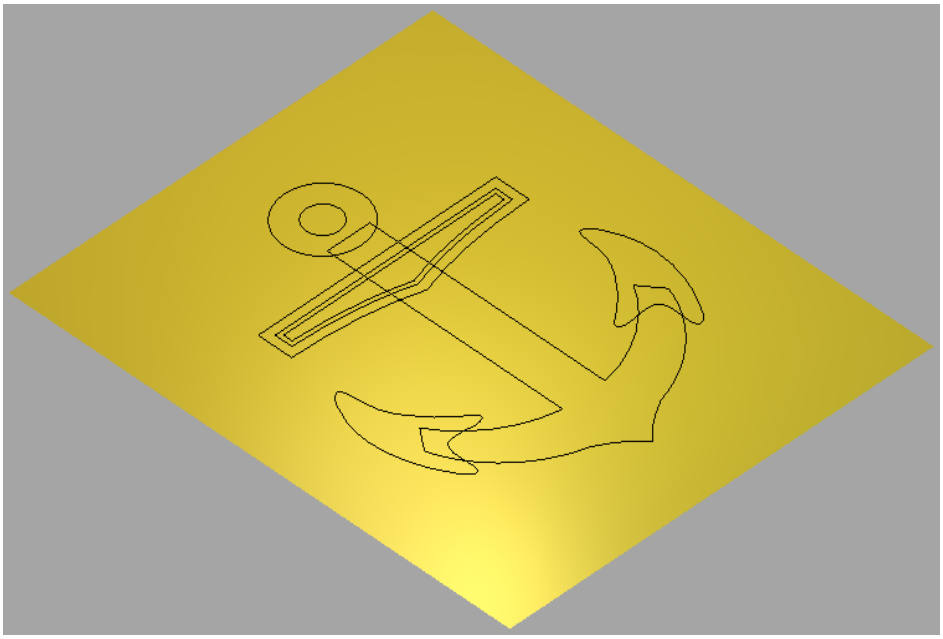
- Select **Open Model** 

.
- Open the model **anchor.art** from: **D:/users/training/ArtCAM Data**.

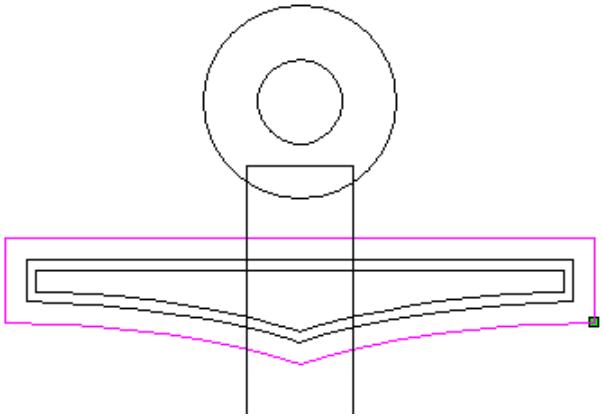


- Select the **3D View** tab or press **F3**.

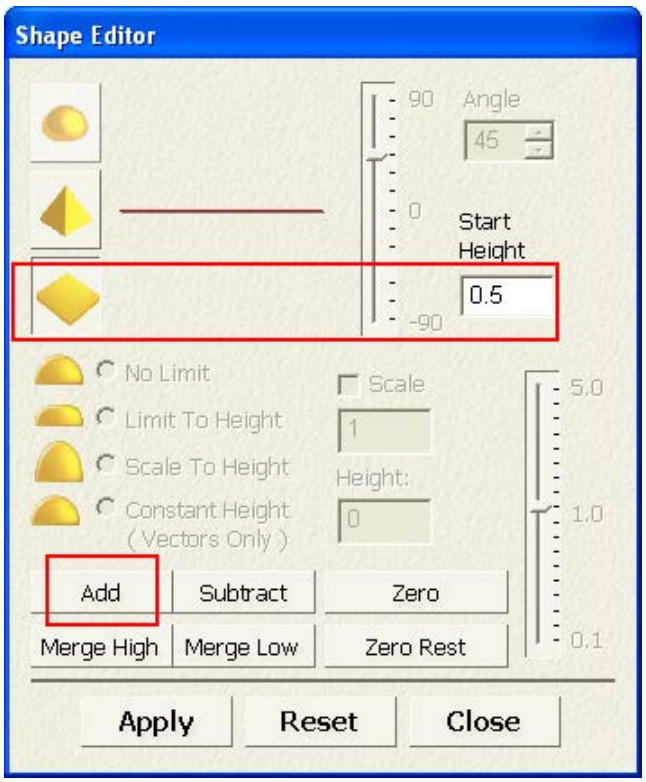
- From the **3D View** toolbar, select **Toggle Vector Visibility** .



The vectors are displayed on the **3D View**.



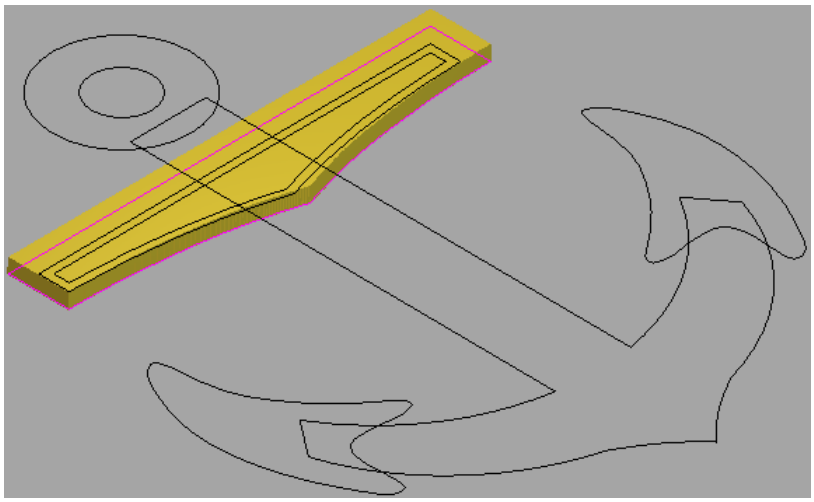
- Double left mouse click on the vector indicated by the arrow to raise the **Shape Editor** form.



A **Flat Plane** shape is selected with a **Start Height** of **0.5mm**. The **Start Height** indicates the very **top Z level** of the **Flat Plane**.

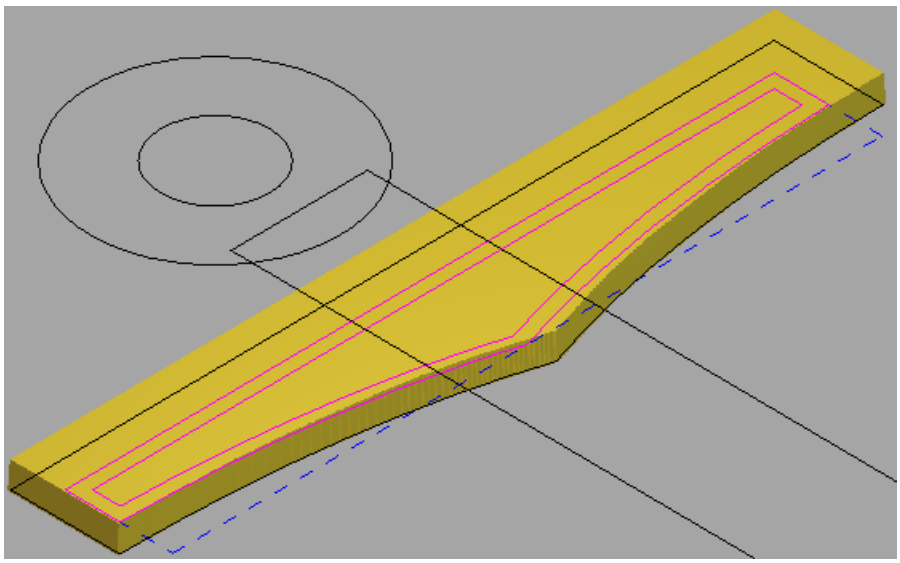
- Select **Add** from the **Shape Editor** form.

- Switch off the **Draw Zero Plane**.



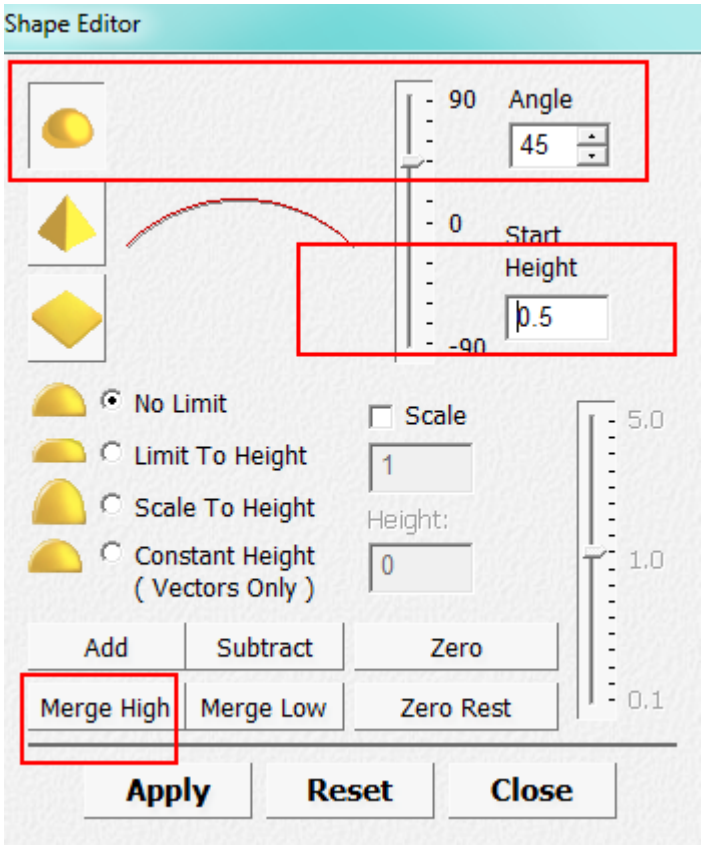
The bar is produced as shown. If you place the mouse on the **Relief**, the **Z height** at that point (**0.5mm**) will be displayed in the information box at the lower right of the **graphics area**.

- De-select the **bar vector**.



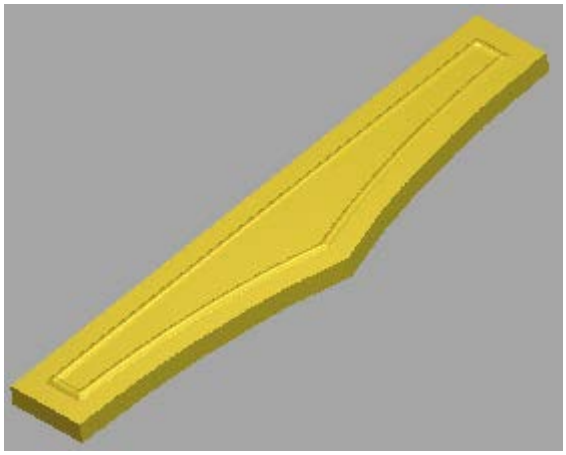
The **Relief** will be generated inside the two selected **vectors**.

- Hold down the **shift** key and select the **two vectors inside** the bar.
- Press **F12** on the keyboard to raise the **Shape Editor** form.

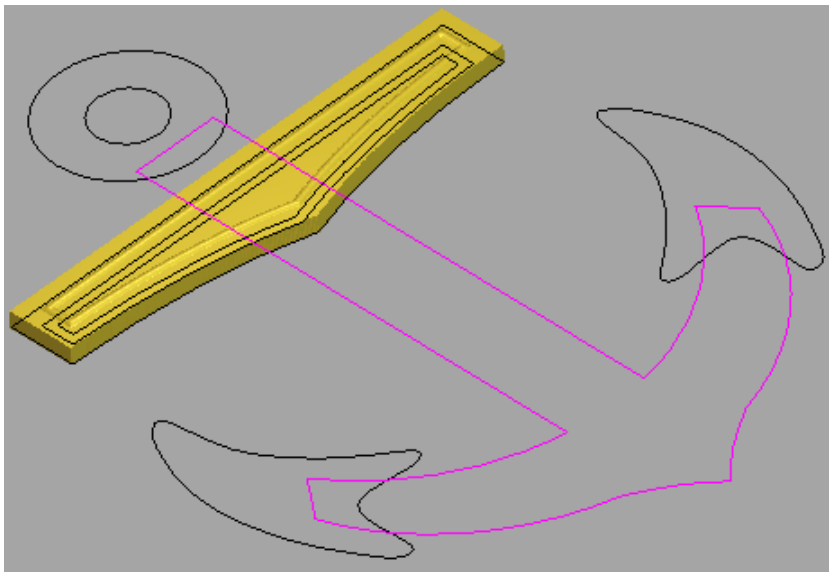


You've assigned a **Dome** shape to the selected **vectors** with a **Start Angle** of **45 degrees** and **No Limit** with regard to **overall height**. This means that the **Dome shape** will initially start to rise at **45 degrees** and gradually level out naturally as it passes across the **vector area**.

- With the **Dome** shape option selected, change the **Start Height** to **0.5** and select **Add**.

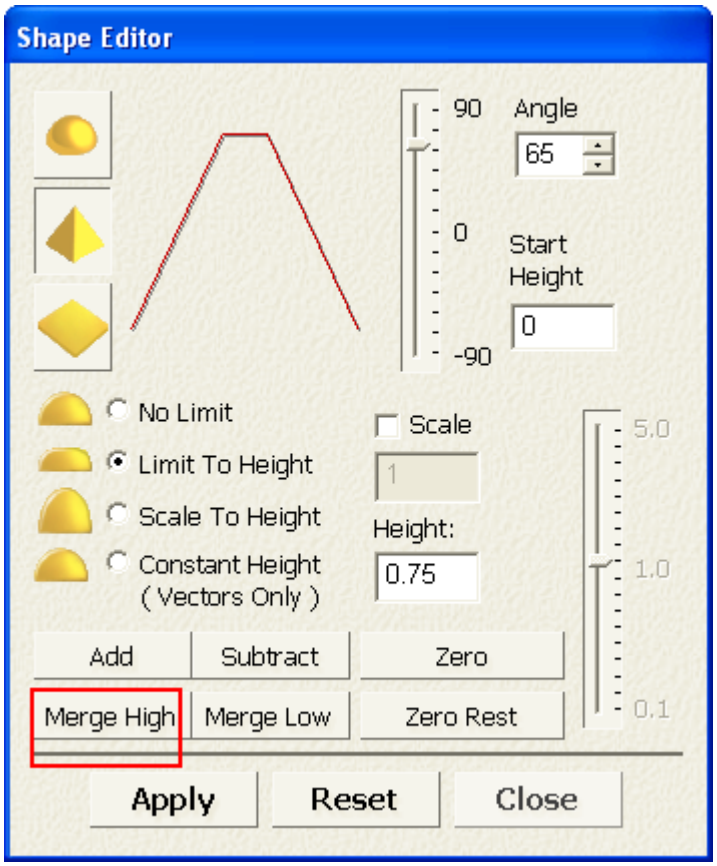


You've **added** the extra detail to the **Relief**.

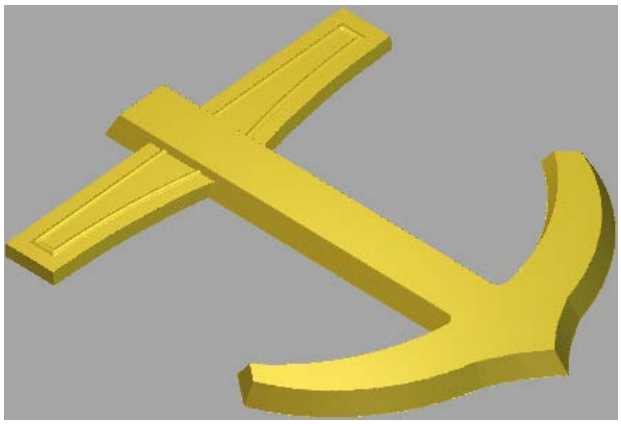


This vector will be **merged** into the **bar vector**.

- Select the **main anchor vector**.

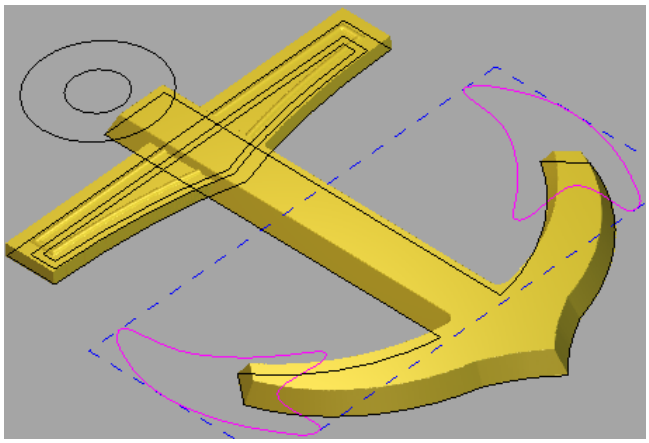


- Select **Merge High** from the **Shape Editor**.



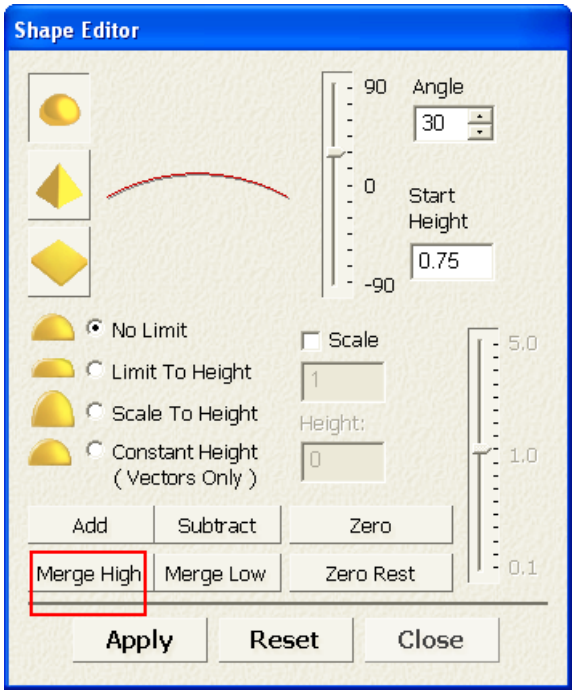
You've assigned a **Pyramid shape** to the **vector**, with an **Angle** of **65 degrees**. The **overall height** is constrained to be **Flat** at a **Height** of **0.75mm** by the **Limit to Height** option.

The **main anchor** shape is now **merged** with the **bar**.



You will **combine** these **vectors** with the current **Relief**.

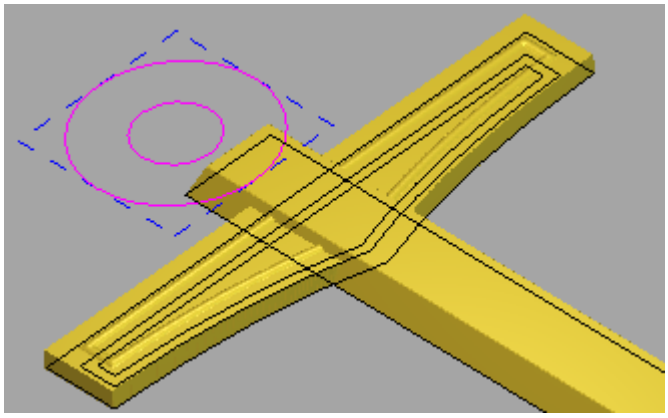
- Shift select the **hook vectors**.

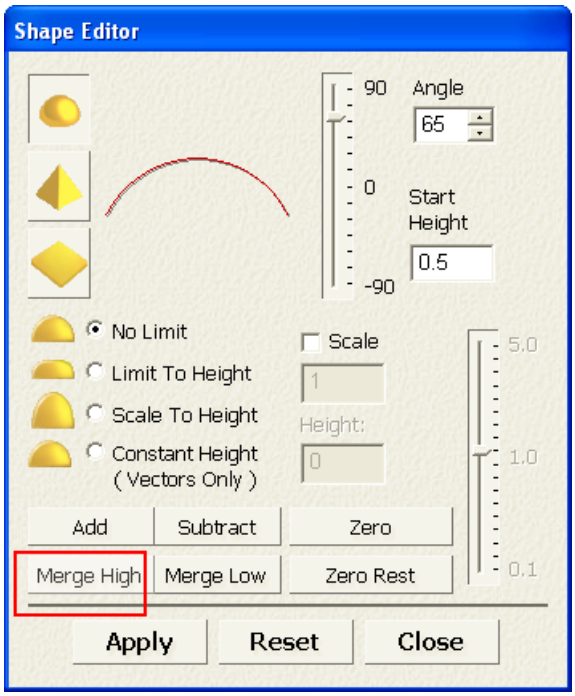


- Select **Merge High** from the **Shape Editor**.

These **vectors** have relatively shallow **Angle** of **30 degrees**, but the new **Dome Relief** shape will include an initial vertical wall as specified by a **Start Height** of **0.75mm**.

- Select the **ring vectors**.





You've assigned the **hook vector** with a **Dome** shape with a relatively **steep Angle** of **65 degrees**, and an initial **Start Height** of **0.5mm**.

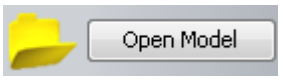
- Select **Merge High**, followed by **Close**.

- From the **3D View** toolbar, select **Toggle Vector Visibility** .

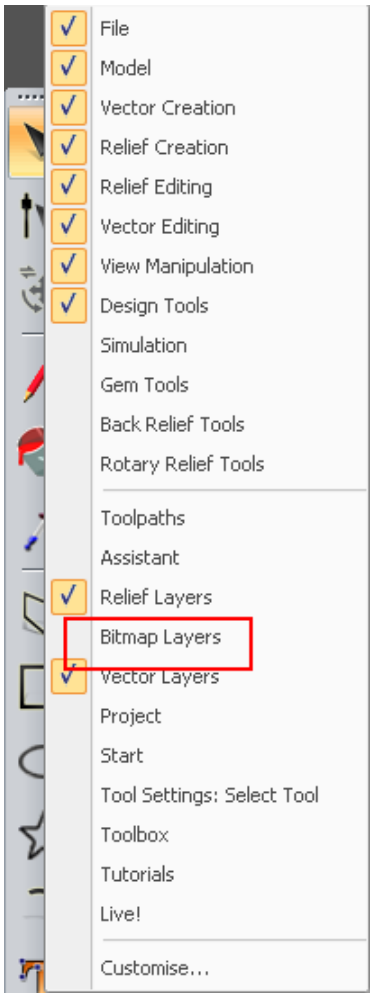
- Select **File** - **Save As** naming the model as **training-anchor** in: **D:\users\Training\COURSEWORK\ArtCAMPro-Jobs**.

- Select **File** – **Close Model**.

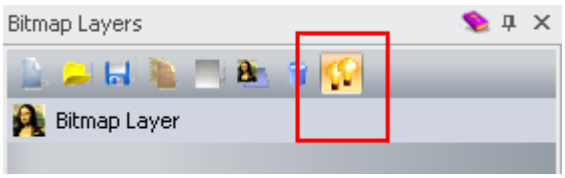
Tin Lid relief

- Select **Open Model** 

.
- Open the model **tintop.art** from: **D:\users\training\ArtCAM Data**.
- Right mouse click on the left hand corner of the graphics area.

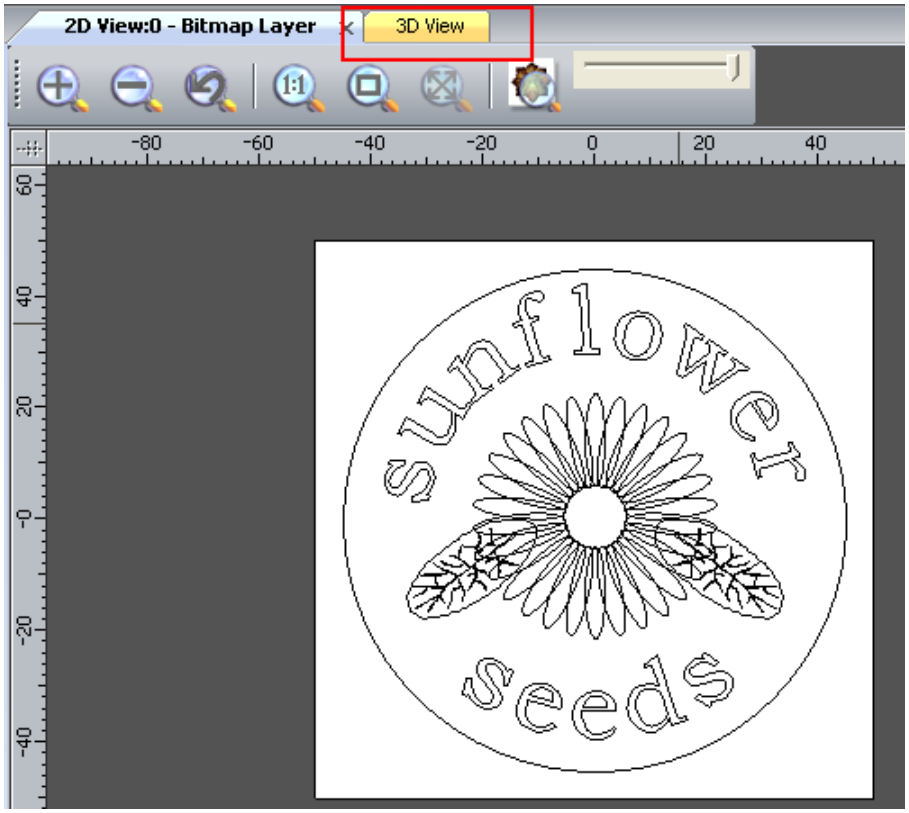


- Select **Bitmap Layers** from the menu.



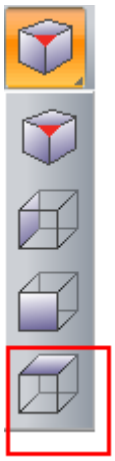
- Select **Toggle All Visibility** from the **Bitmaps** layer menu.

This switches off the **bitmap** so that any **vectors** can be seen more clearly and as a result will be easier to select.



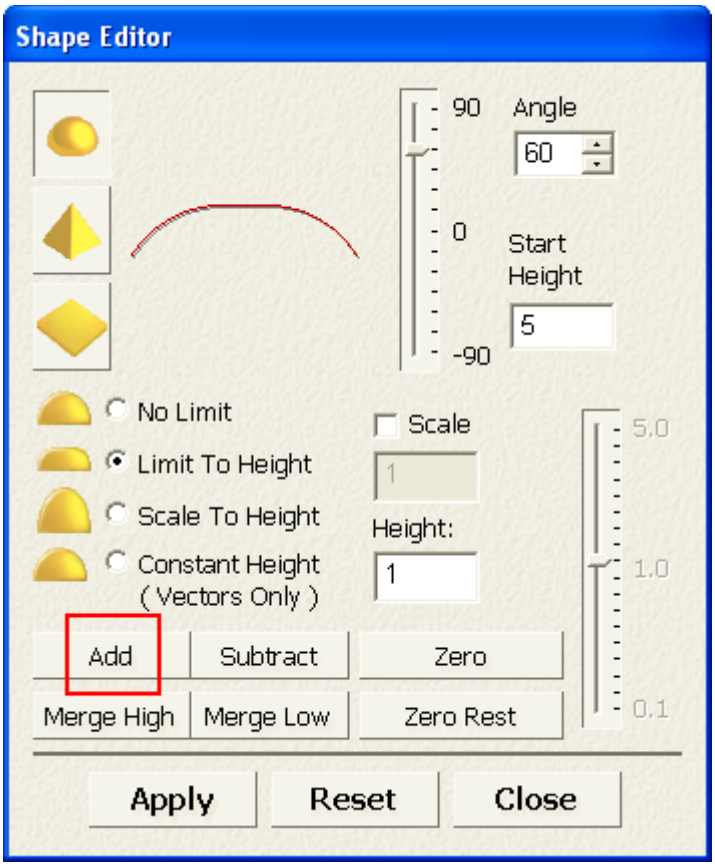
These **vectors** will be used to produce a **Relief** model of a tin lid, which will be **shaded** using the inherent model, **bitmap colours**.

- Select the **3D View** tab or press **F3**.
- Select and hold the left mouse button over the icon **Isometric View** to display the complete view toolbar.



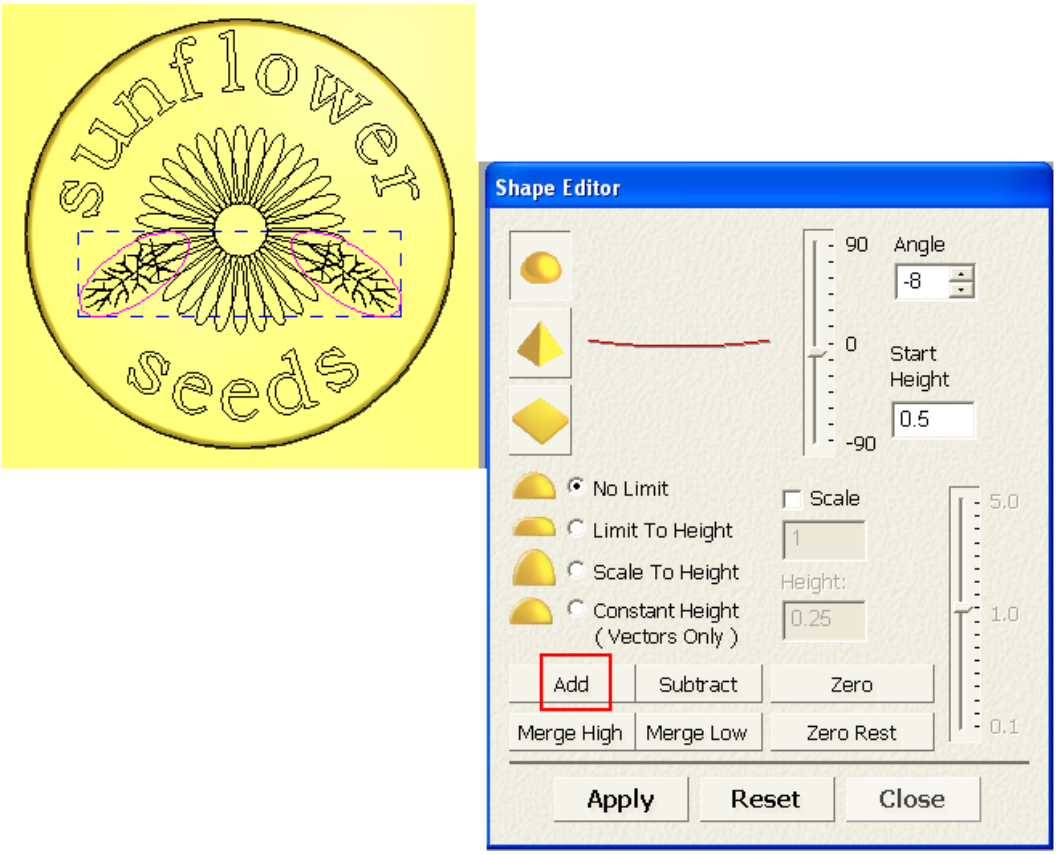
- Select the **View Along Z**.

- Select the option **Toggle Vector Visibility** .
- Select the **circle** vector and press **F12** to raise the **Shape Editor** form.

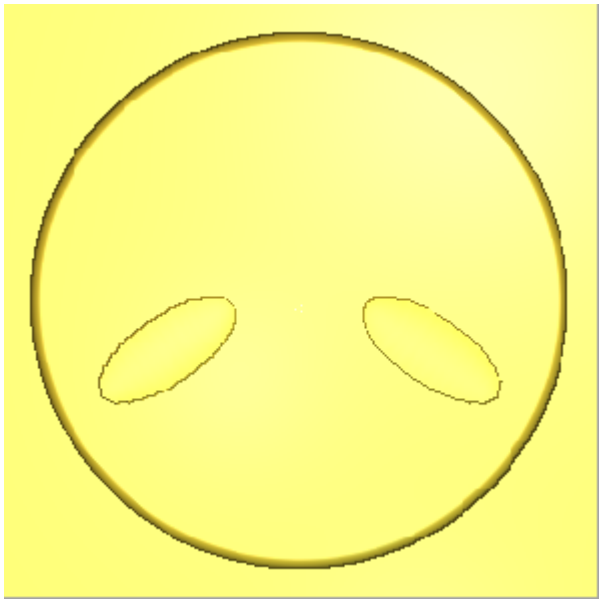


- Select **Add** from the **Shape Editor** form.

The **Relief** (overall height 6) is created as shown. A fillet runs around the outside, which blends flush with the flat top form but forms a tangency with the sidewall at a **Start Height** of **5mm**.

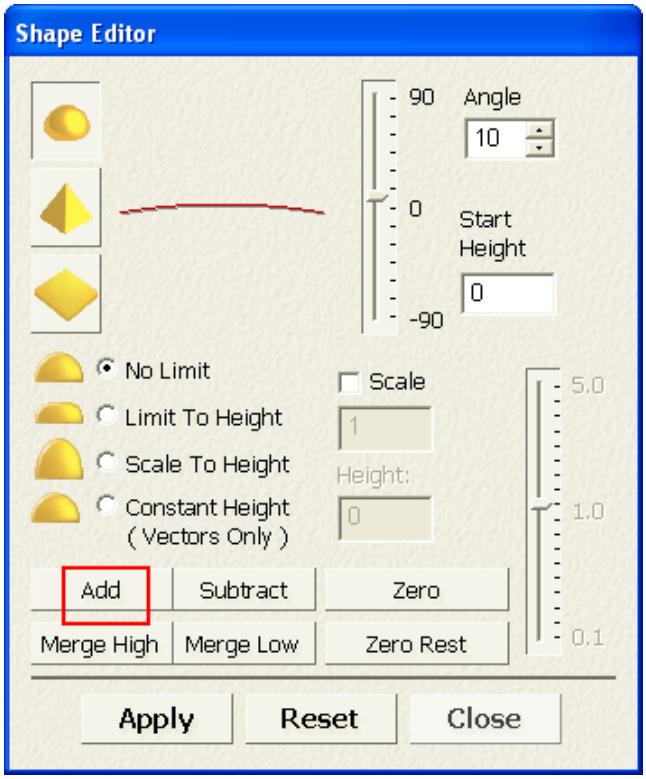


- Select both of the **leaf vectors**.
- Select a **Dome** shape with an **Angle** of **-8 degrees** and a **Start Height** of **0.5mm**.
- Select **Add** from the **Shape Editor** form.

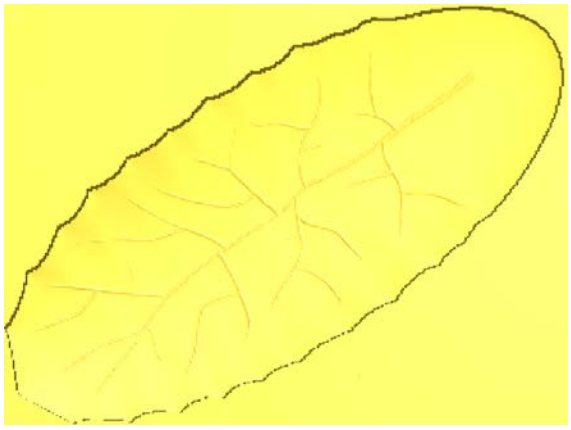


You've **added** the **leaf shape** on the **top** at a start height of **0.5mm**, which has then been scooped out by a **negative angle** to produce the **inverted leaf** shape shown.

- Select **both** of the **leaf vein vectors**.



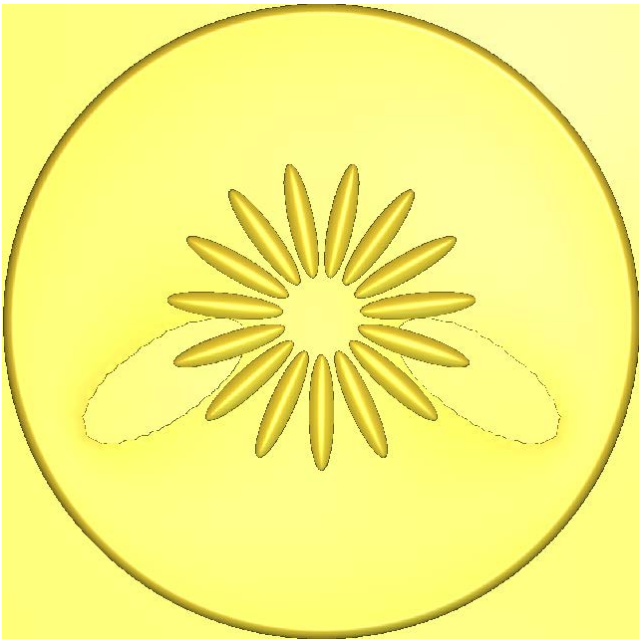
- Select **Add** from the **Shape Editor** form.



If you **zoom into** one of the **leaves**, you can see that by **adding** the **vein relief** it follows the shallow shape of the leaf.

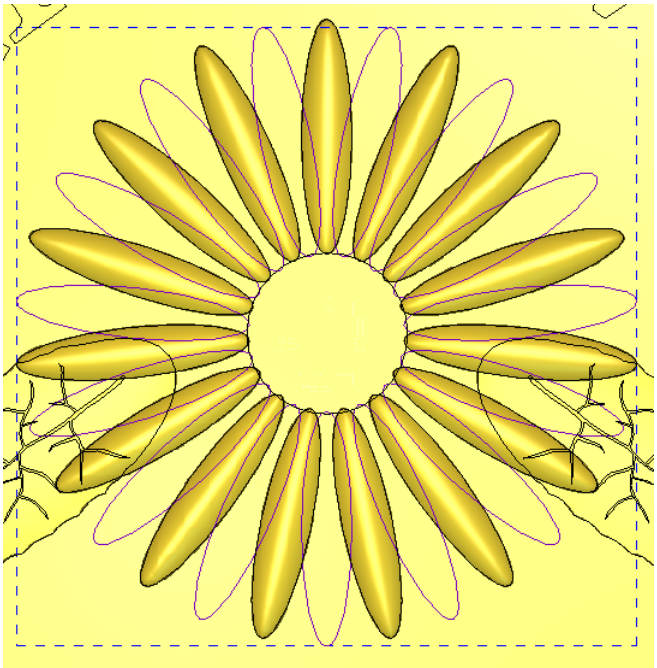
- Select the **petal** to the left of the highest petal to select the lower group.

- Select **Merge High** from the **Shape Editor** form.

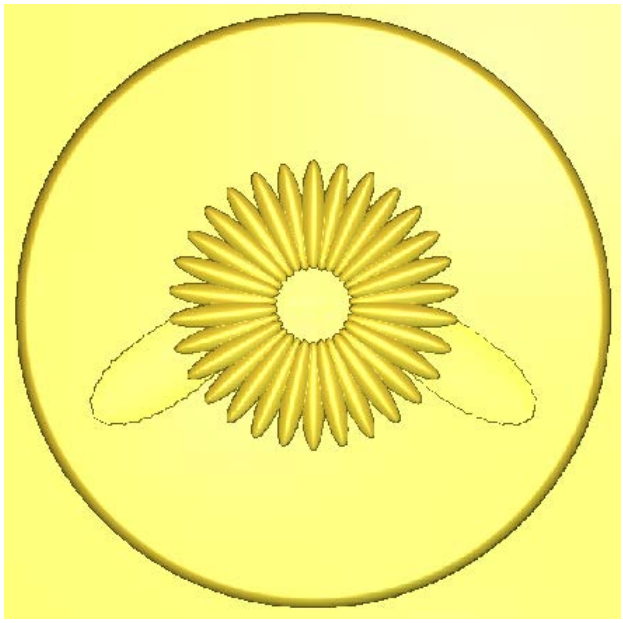


After applying **Merge High**, the **Start Height** value is the actual height from the **Z0** of the **Relief**. By setting the value higher than the leaves, the petal forms are raised above.

- Select the **highest petal** to select the **higher group**.

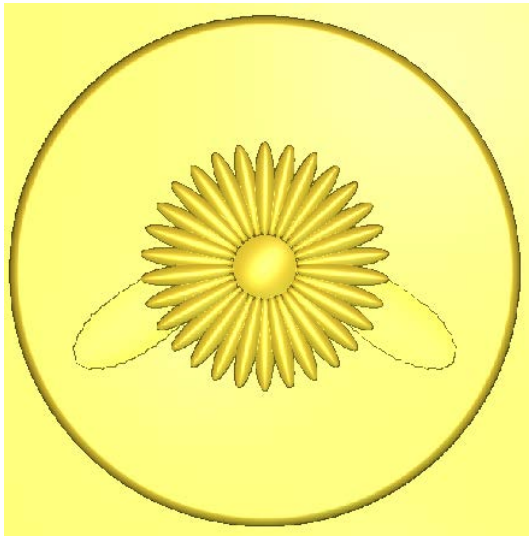


- Select **Merge High** from the **Shape Editor** form.



This **petal group** is higher than the other group, so that the petals in the front are full petals and the petals below are only **partial petals**.

- Select the **small circle vector** (in the centre of the flower).



The **centre of the flower** has been **merged** into the **petals**.
Next you will **add** the **Text**.

- Select **Merge High** from the **Shape Editor** form.

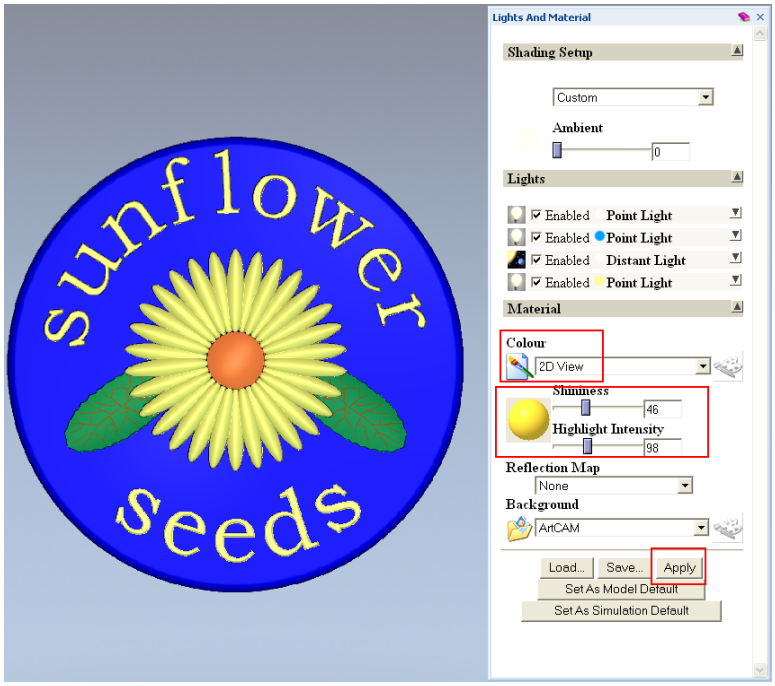
- Select both of the **text vectors**.
- Select **Merge High** from the **Shape Editor** form, followed by **Close**.

- Select **Toggle Vector Visibility** and **Draw Zero Plane**.

The **Text** has been produced with a **chamfered edge** and a **flat top** making it stand out.

The **Relief** can be shown in alternative **shaded colours** or the same as the **2D Bitmap** colours.

- From the top toolbar, select **Lights and Material** .



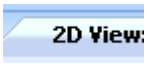
- Select the option **2D View** under the **Colour** area.
- Move the sliders to select the desired **Shininess** and **Reflection Map**.
- Select **Apply**.
- Close the form.

You can now observe the change in style on the **Relief** to reflect the **2D Bitmap** colour scheme.
The **relief** is overlaid with the same colour scheme as the **2D Bitmap** (this will override the settings in **Shading Setup**).
You can shade the whole **Relief** from a choice of colour schemes located in the **Shading Setup** or **Material** pull down menus.

- Select **File - Save As** and enter a **File name** as **train-tid-lid** in: **D:\users\training\COURSEWORK\ArtCAMPro-Jobs**.

Envelope Relief Distortion

In **ArtCAM** you can use a selected vector to distort the final **Relief**, allowing you to interactively shape the final **Relief**.

- Select the **2D View** 

tab.
- Select the outer **Circle** vector.
- Select **Relief Envelope Distortion** from the top toolbar.

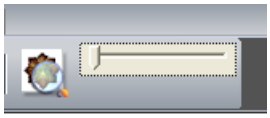
The **selected vector** is displayed within a special, gridded vector box (called the **Envelope**) with **Nodes** at the corners.

You can move the **Nodes** around with a view to **stretching** and **squeezing** the **Relief**.

You can add additional **Nodes** and the **Envelope vector** can be edited by using normal **vector commands**.

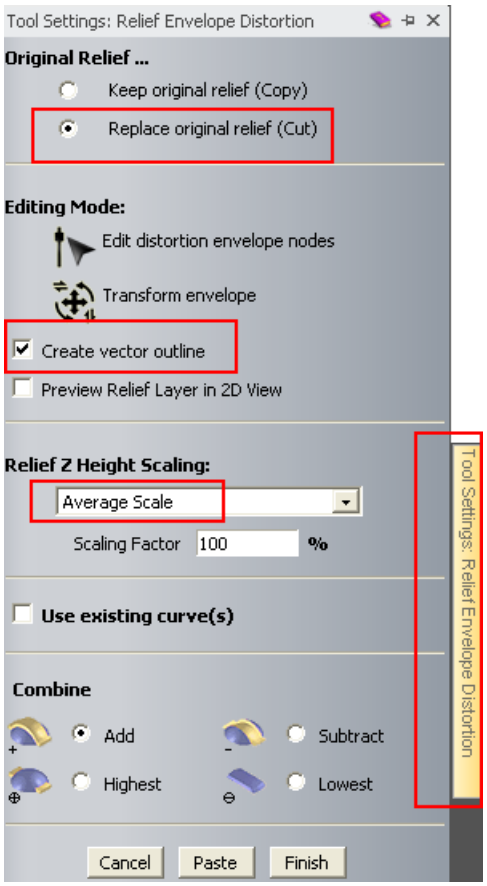
When a **Relief** is distorted, the **Z height** can be altered, if required or kept the same.

- Move the slider to the left to better see the vectors displayed.



You can clearly see the **Grid** in the **2D View**. You can also move individual **Nodes** around and change the angles.

- From the right toolbar, select the **Tool Settings** to display the **Relief Envelope Distortion**.

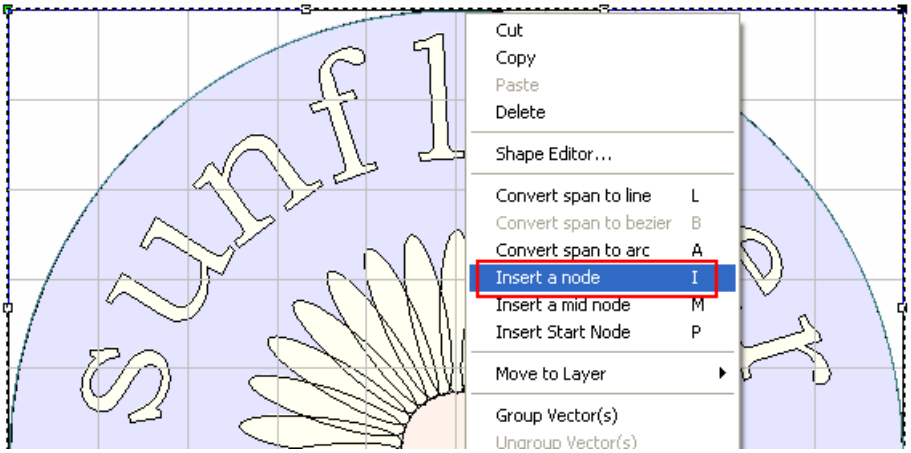


- Select the option **Replace Original Relief**.

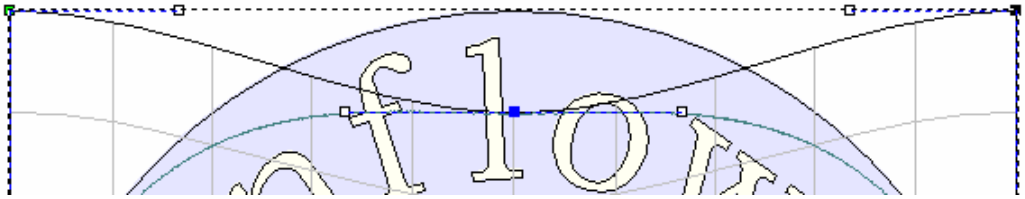
- Select **Create Vector Outline** and set **Relief Z Height Scaling** as **Average Scale** at **100%** (a Rectangular vector appears as the outer limit).

- Make sure the option

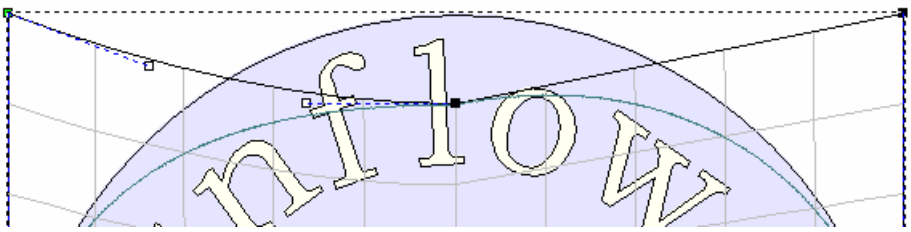
is selected.



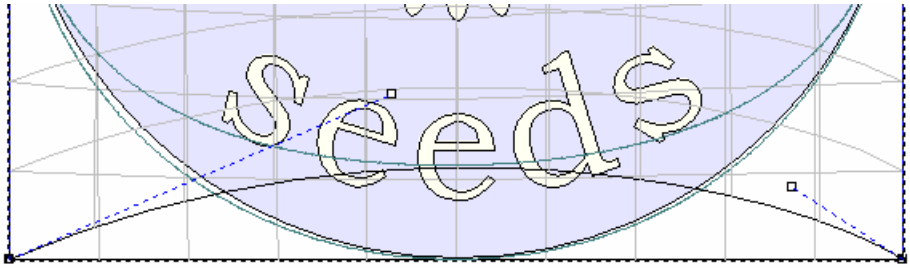
- Place the mouse in the middle of the top span, right mouse click and select **Insert Node** from the menu.



- Select the **new point** and **move it down** in the **Y** until it is **halfway** down the text letter **I**.



- Move the **left angle node** down.
- Select the **right span** across the top and press **L** to convert to a line.

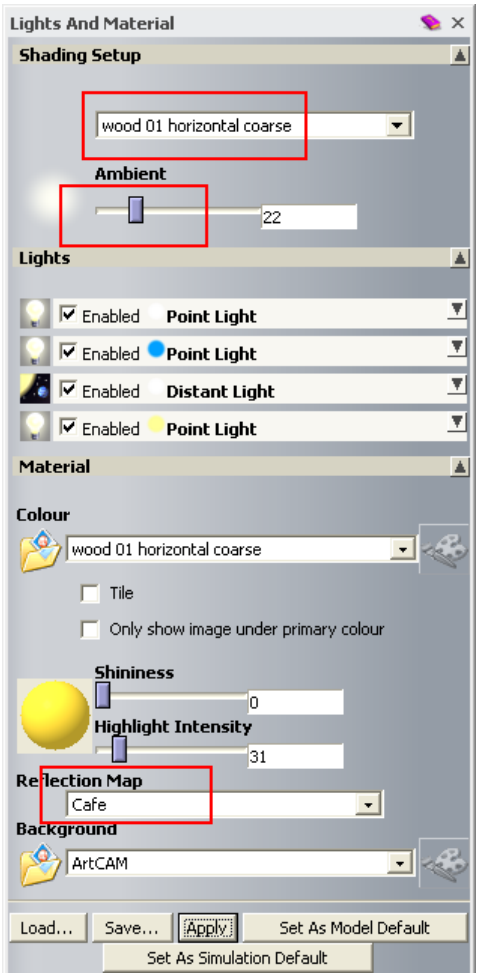


- Move the bottom **left angle node** until it snaps on the **letter e**.
- Move the **bottom right angle node** until it snaps on the letter **d**.

You can see the new shape of the **Relief** in outline.

- Select **Add** from the **Combine** area.
- Select **Paste** to recreate the **Relief** and **Finish** to accept.
- Press **F3**.

- Select **Lights and Materials** from the top toolbar.

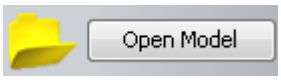


- Setup the options highlighted in red.
- Select **Apply**.
- Close the form.

- Select **File** – **Save**.
- Select **File** – **Close Model**.

Teddy Bear Relief

This example takes the user through the creation of a Teddy bear **Relief** model mainly using the **Shape Editor** in addition to the specialised **Angled plane** and **ISO-Form** lettering Relief options.

- Select **Open Model** 

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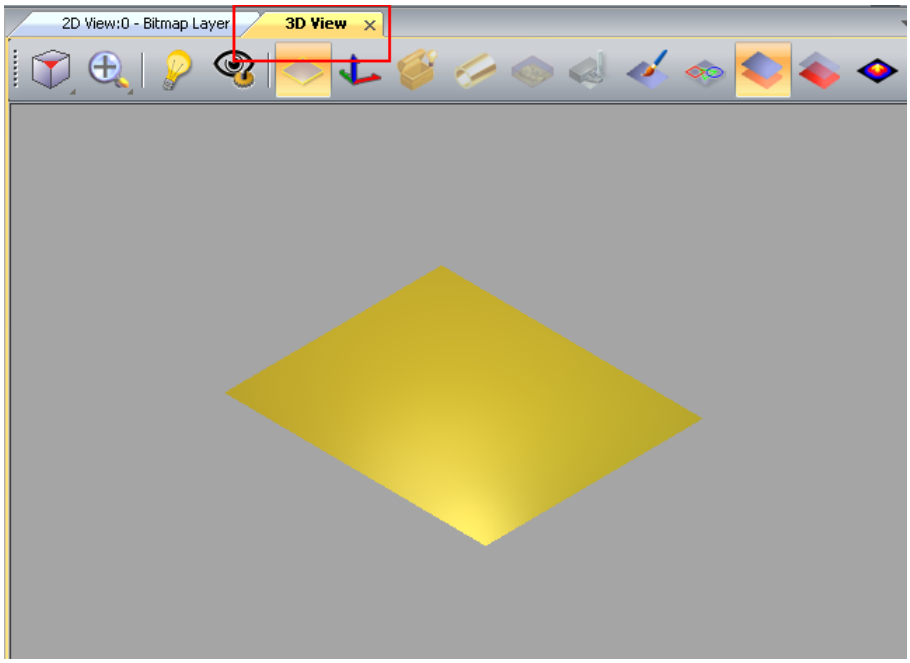
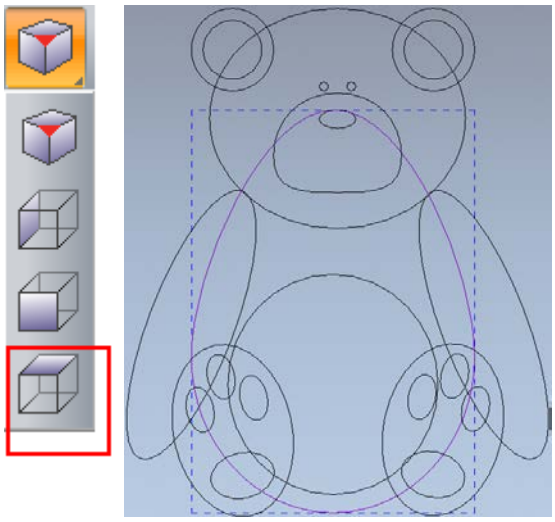
- Browse to: **D:\users\training\ArtCAM Data** and select the model **Teddy.art**.
- Select the **3D View** tab.

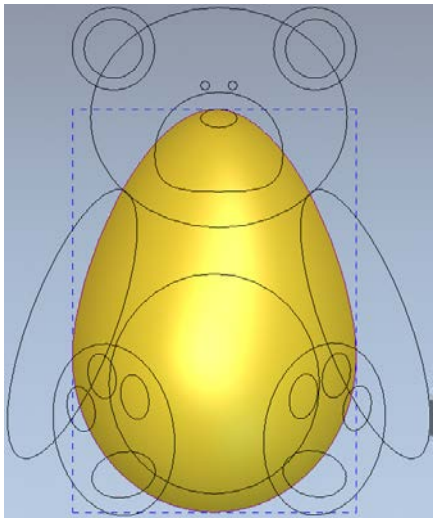


- Select the **Toggle Vector Visibility** option to display the vectors on the **3D View**.

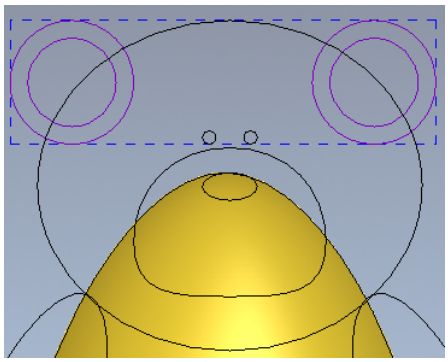
- Select **View Along Z**.



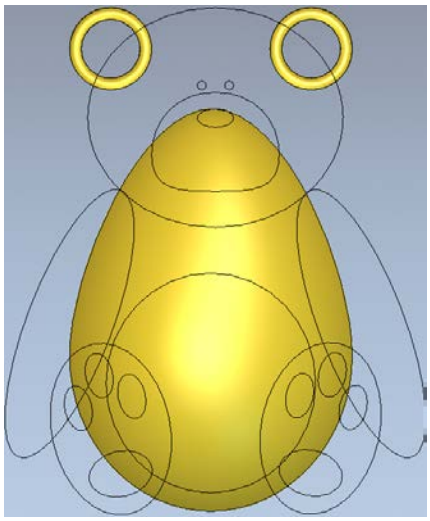
- Select the **body** vector using the left mouse button.
- Double click the **selected vector**.



- Select a **Dome** shape, with an **Angle** of **45 degrees** with **No Limit** followed by **Add**.

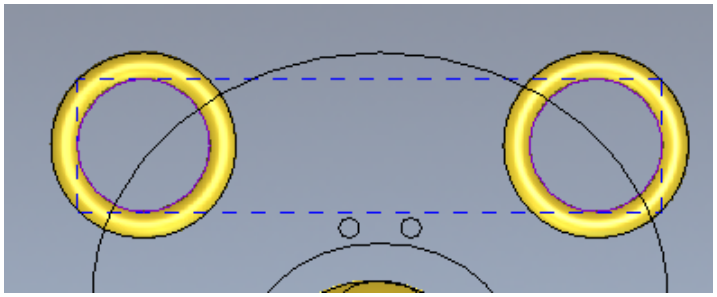


- Using the **left mouse button**, select the **outer ears vectors**, then hold down the **Shift** key and select the **inner ears vectors**.

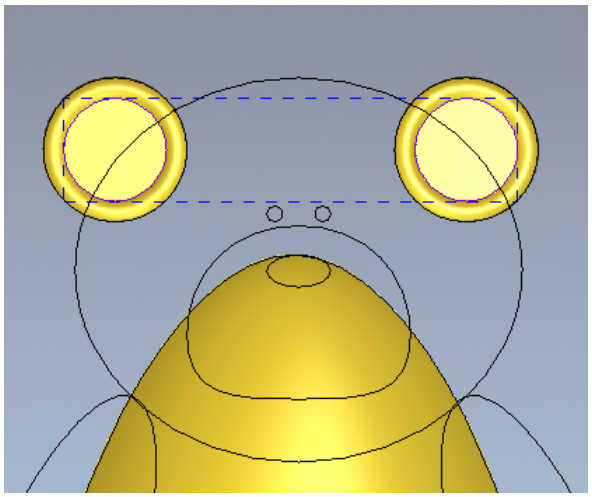


ArtCAM generates a shape for the area between the selected vectors.

- From the **Shape Editor** form, select a **Dome** shape with **No Limit**, an **Angle** of **45 degrees** with a **Start Height** of **0.5mm** followed by **Add**.

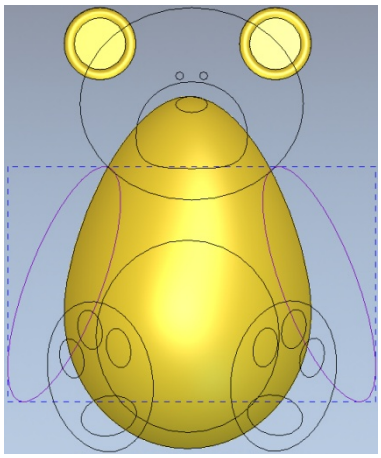


- Select only the **inner ear** vectors.

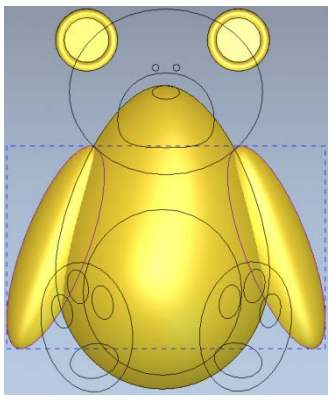


You've merged the **inner ears** with the **outer edge**.

- Select a **Flat Plane** with a **Start Height** of **0.5mm** and select **Merge High**.

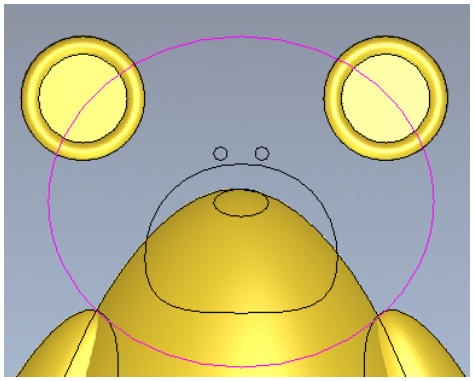


- Select the **arm** vectors.

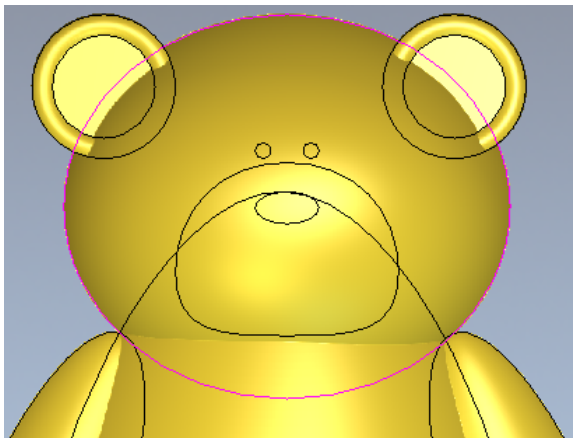


If the arms were added to the body, then a bulge would appear where the shape is added on the top of the body **Relief**.
The **arms** need to be **Merged High**.

- Select a **Dome** shape, with an **Angle** of **45 degrees** with **No Limit** and select the **Merge High** button.

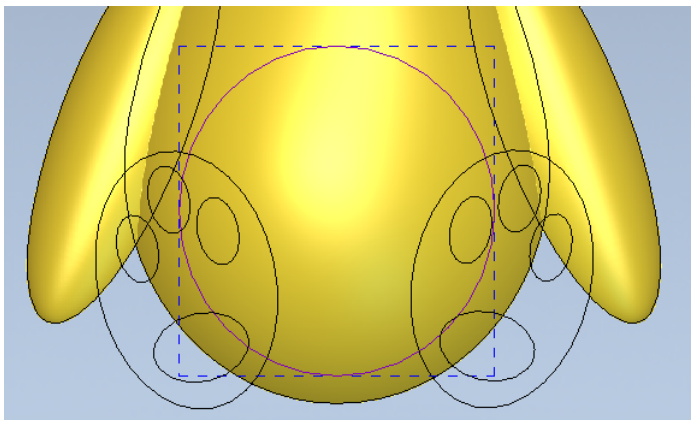


- Select the **face vector**.

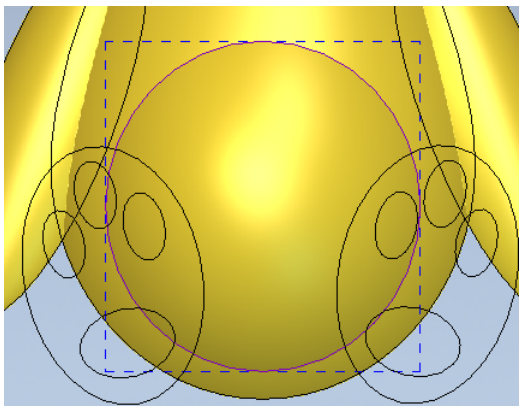


You will enter a **higher angle** to build a **rounded appearance** for the **face**. The face will be **merged** into the current **Relief**.

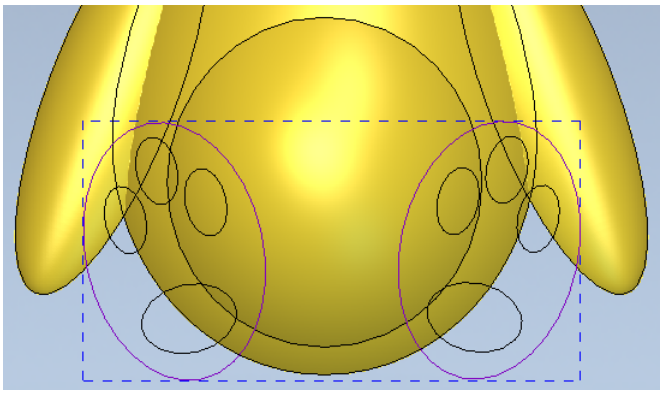
- Select a **Dome** shape with an **Angle** of **60 degrees** with **No Limit** and select **Merge High**.



- Select the **circle** vector.



- Select a **Dome** shape of **15 degrees** with a **Start Height** of **0**, **No limit** followed by **Add**.
- Close the **Shape Editor** form.



The **Relief** for the **feet vectors** will be generated using an **angle plane**. This will slope the feet at a specified angle making the toes point forwards and the heels lean back.

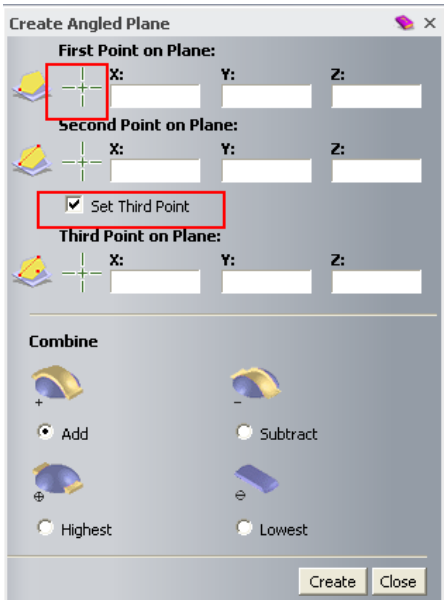
- Select the **feet** vectors.
- Select **Create Angled Plane** from the top toolbar.

- Select to display the **Help**.

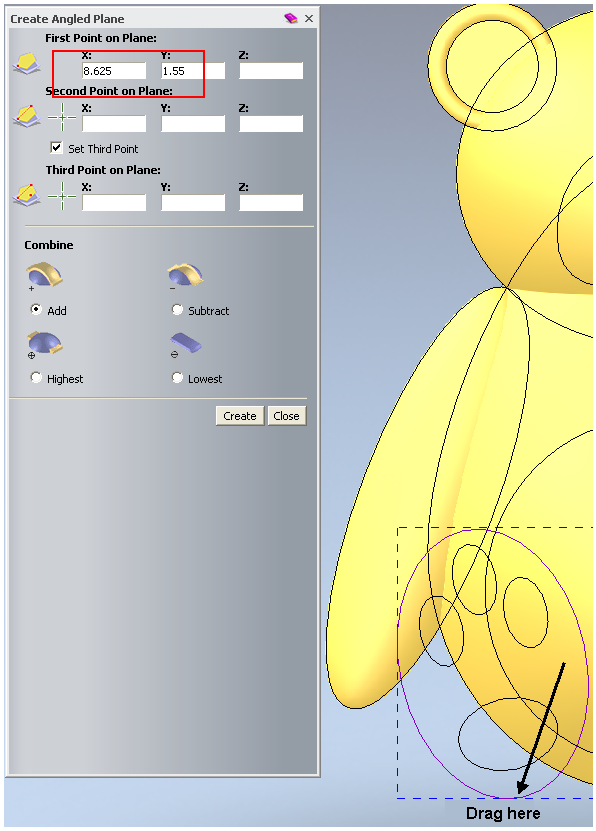
A minimum of two points must be selected to generate an **Angled Plane** at a fixed angle to the **XY** axes. You can use a maximum of three points for a plane aligned to a compound angle to the **XYZ** axes.

These points are often initially positioned in **X** and **Y** by snapping to **vectors**. Once you've picked all three points, then the **Z heights** of the points can be edited in the page.

Once you've defined the **Angled Plane** correctly in the page, the resultant **Relief** is generated with **Add**, **Subtract**, **Highest** or **Lowest**.

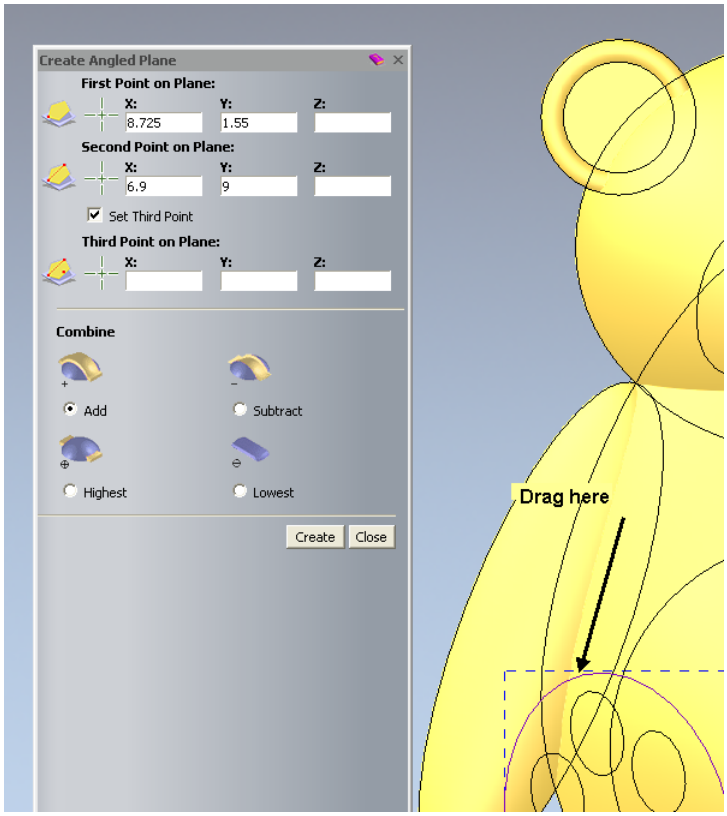


- Select the **Set Third Point** option.



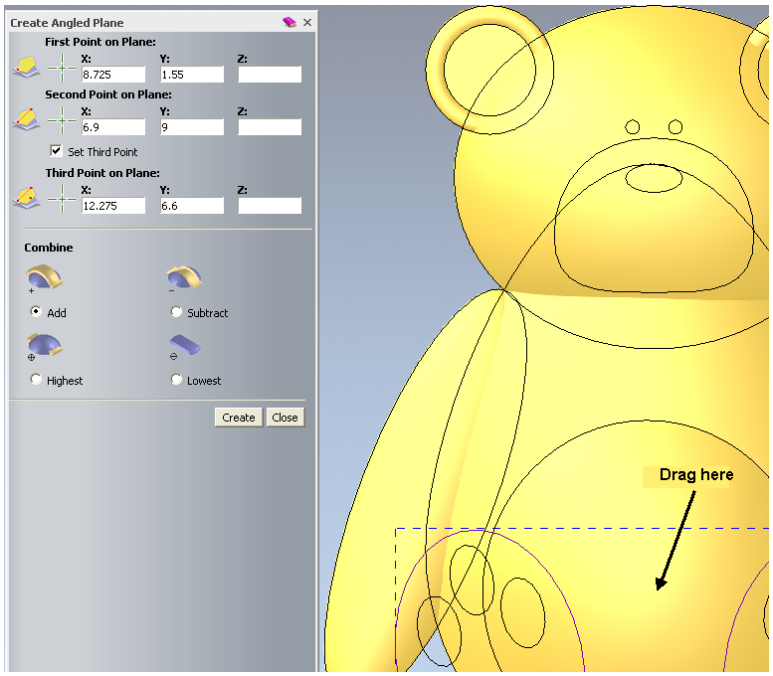
This will define the **X** and **Y** coordinates for the **first point** of the angled plane.

- Drag the icon under **First Point on Plane** with the left mouse button and drop it at the **bottom** of the **left foot** as shown on the image above.



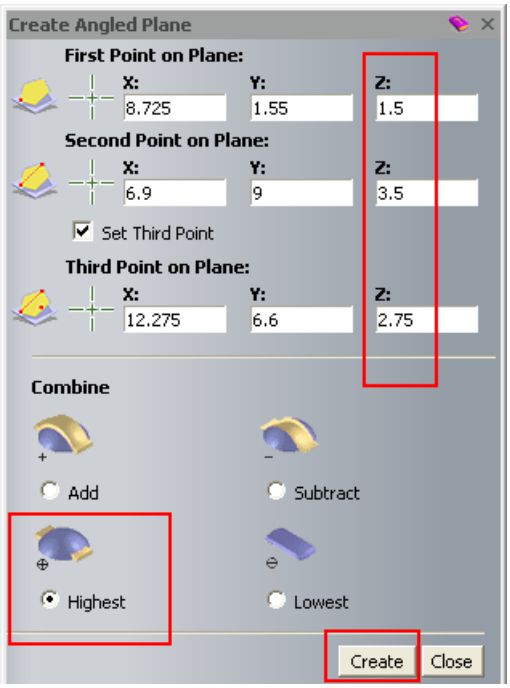
This will define the **X** and **Y** coordinates for the **second point** of the angled plane.

- Drag the icon under **Second Point on Plane** with the left mouse button and drop it at the **top** of the **left foot** as shown on the image above.

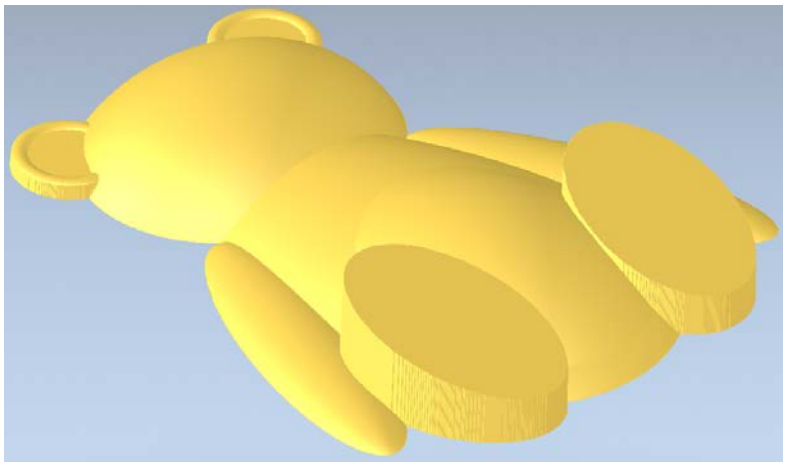


This will define the **X** and **Y** coordinates for the **third point** of the angled plane.

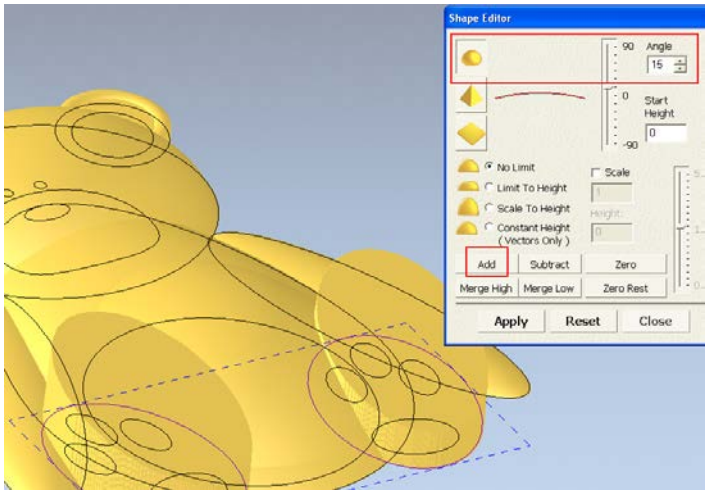
- Drag the icon under **Third Point on Plane** with the left mouse button and drop it at the centre of the Teddy's tummy as shown on the image above.



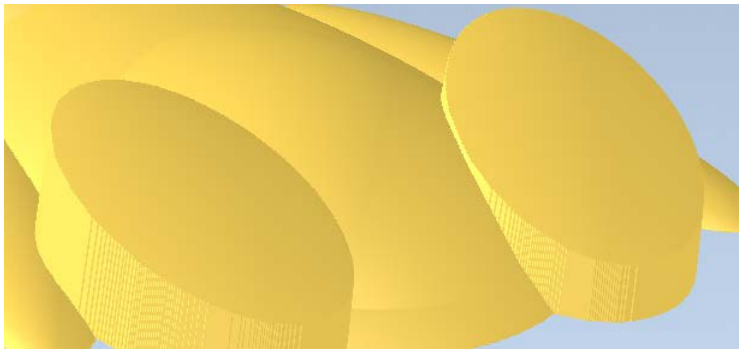
- Enter the **Z coordinates** for the **three points** as shown above.
- Select **Highest**, followed by **Create**.



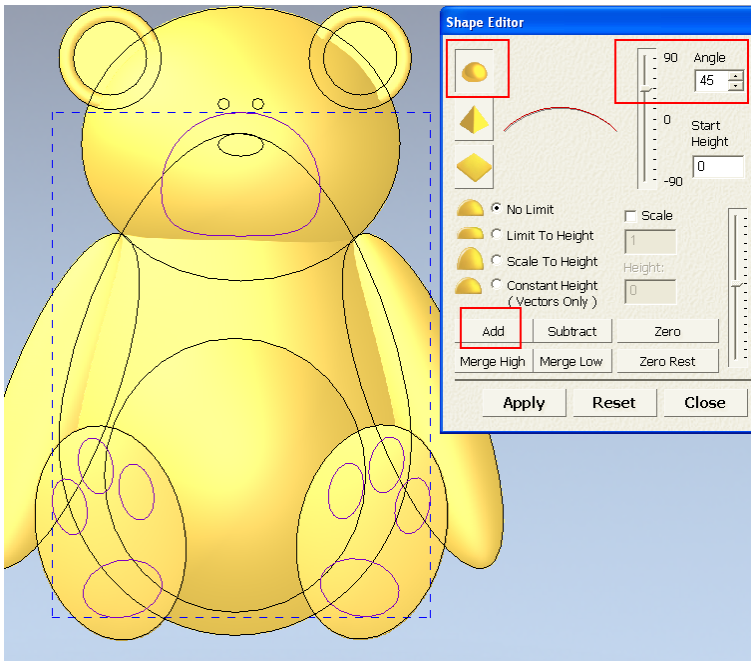
The **Angled Plane** gives the feet a slightly pointed look. You can still add further **Relief** onto these areas.



- Select the **feet vectors** and press **F12** on the keyboard to display the **Shape Editor** form.

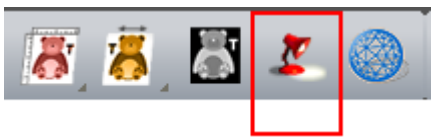


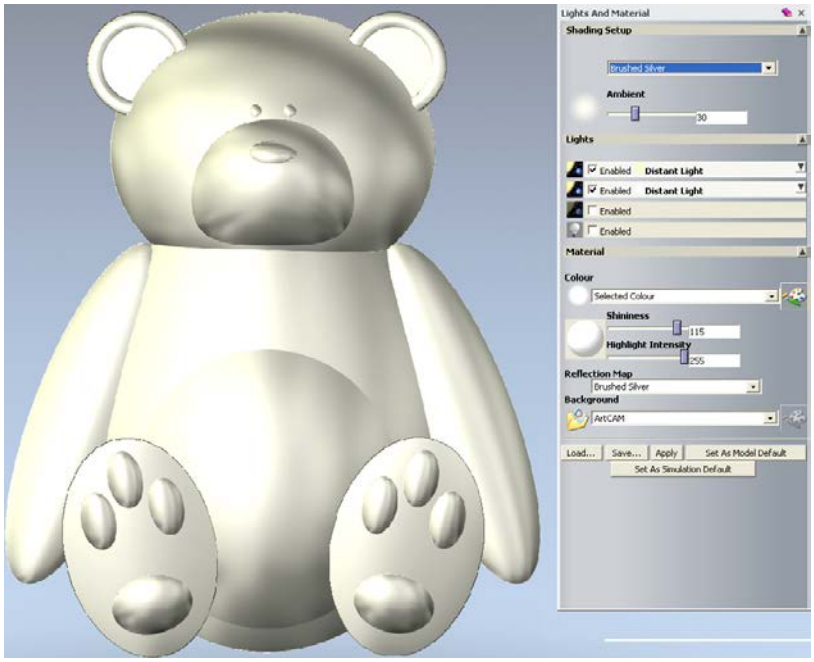
- Select a **Dome** shape with an **Angle** of **15 degrees**, **No Limit** and select **Add**.



- Select the **snout** and the **paw print** grouped vectors.
- Select a **Dome** shape with an **Angle** of **45 degrees**, **No Limit** and select **Add**.

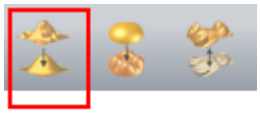
- Select the **eyes** and **nose vectors**.
- Select a **Dome** shape with an **Angle** of **45 degrees**, **No Limit** and select **Add**.
- Select **Close** on the **Shape Editor** form to dismiss it.
- Select **Toggle Vector Visibility** .
- Select **Lights and Material**.





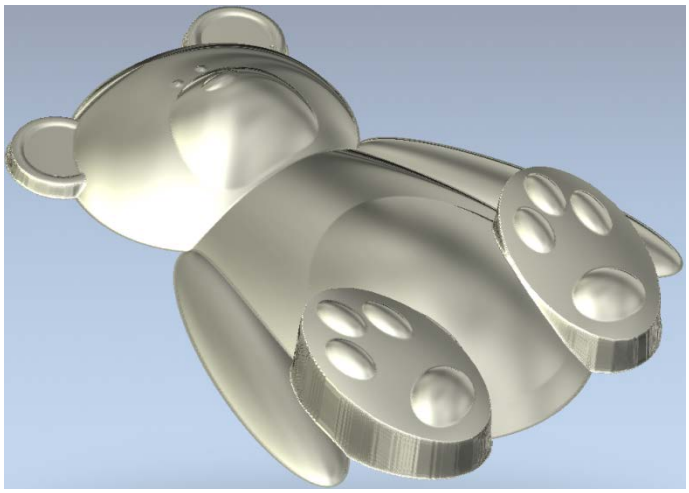
- Select **Brushed Silver** in the **Shading Setup** area.

To complete the **Teddy**, you will **smooth** the **Relief** to **soften** the **edges between each shape**.



- Select **Smooth Relief** from the top toolbar.

- Select **Whole Layer**, enter the number of **Smoothing Passes** as **3** and select **Apply**.
- Select **Cancel** to close the form.



The Teddy **Relief** is **smoothed** around the previously **sharp edges**.

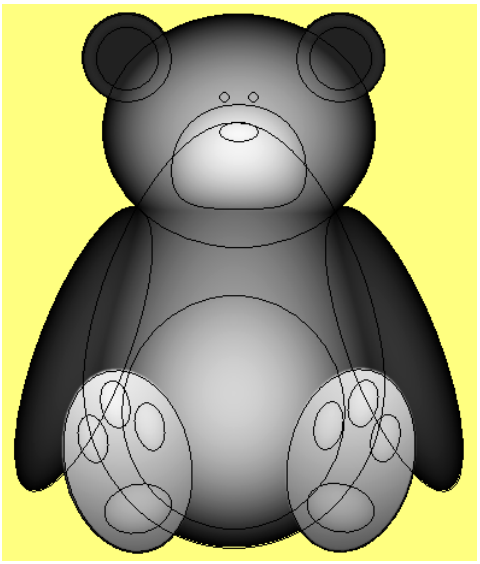
Constant Height Letters

Constant Height Letters have a constant height set by the user, whereas text created using the **Shape Editor** can result in thin parts of the letters being lower than the rest of the **Relief**.

Lettering will be added to the teddy's tummy, using **Constant Height Letters**. The **Greyscale** view of the **Relief** helps visualisation in the **2D View**.

- Select the **2D View tab**

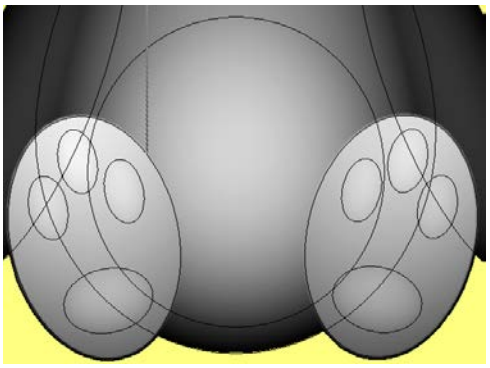
.



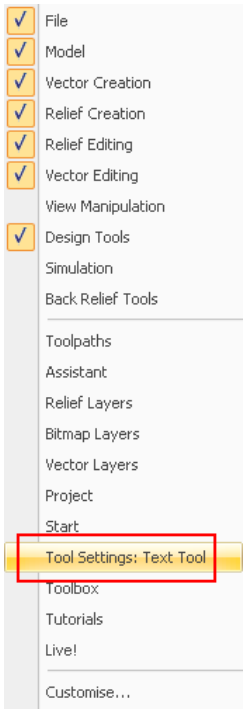
The **higher** the **Relief** the **whiter** it appears. This gives you a better picture of the shape of the **Relief** from the **2D View**.

- From the top toolbar, select **Greyscale From Composite Relief**
.

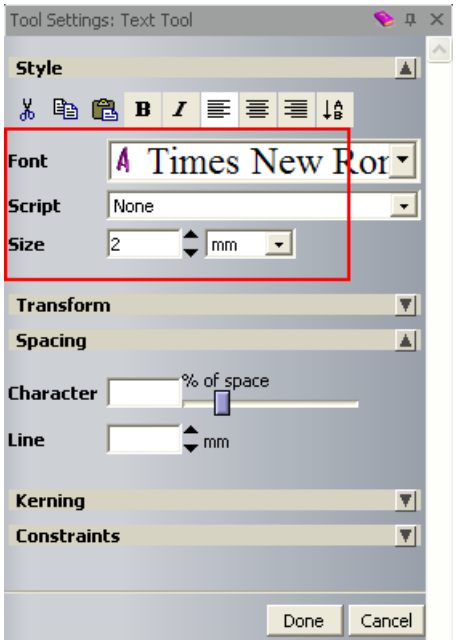
- Select **Create Vector Text** from the left toolbar.



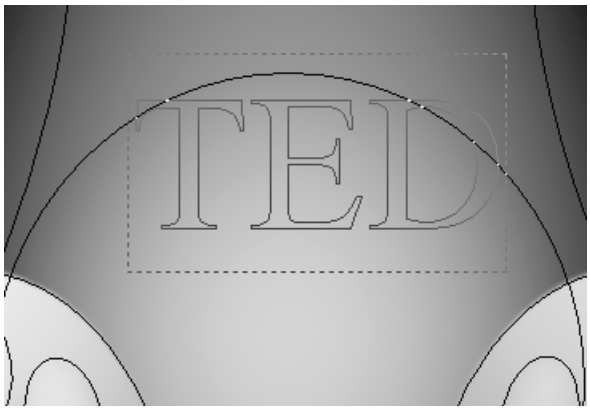
- Click on the **Teddy's tummy** as shown on the image above.



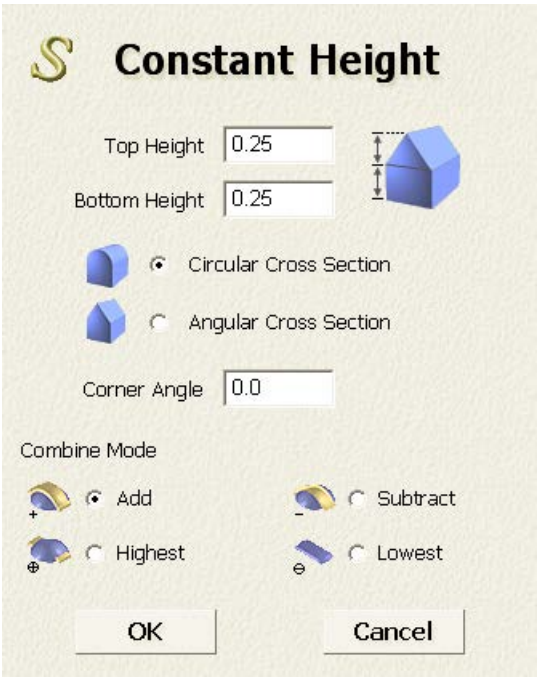
- On the right hand side of the screen, right mouse click to display the flyout shown on the image above.
- Select **Tool Settings**: **Text Tool** to display the **Text Tool** form.



- Set the **Font** as **Times New Roman** and a **Size** of **2mm**.



- Type the text **TED** on the Teddy's tummy. Position the text if needed.
- Select **Done** on the form when you finish positioning the text.
- With the **Text** highlighted, select **Constant Height Letters** .



- Set a **Top Height** of **0.25mm** and a **Bottom Height** of **0.25mm**.
- Select **Circular Cross Section**, followed by **Add** and **OK** to close the form.
- Press **F3** (**3D View**).

If you check closer the letters, you'll see that all the text is at a **Constant Height**.

- Select **File** – **Save As**.
- Browse to: **D:\users\training\COURSEWORK\ArtCAMPro-Jobs** and enter the name as **train-ted**.
- Select **File** – **Close Model**.

5. Pictures

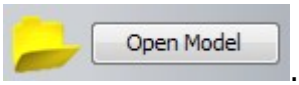
Introduction

Coloured Pictures can be generated or edited within **ArtCAM** using the **Bitmap toolbar** or they can also be imported using any of the following formats **bmp, .tif, .pcx, .gif, and .jpg**.

The coloured areas of a **Picture** can be used directly with the **Shape Editor** to create a **Relief** instead of using **vectors**. As with **vectors** the enclosed coloured area is formed of tiny squares, which are given a height. In this case the smoothness of the **Relief** is directly, dependant on the **resolution** of the **picture**. Where coloured areas are used the smoothness of the **Relief** is not improved by changing the **model resolution,** as the number of **bitmap** squares is inherent in the **picture**.
ArtCAM can also generate **vectors** around a **selected colour**. The **vectors** can in turn be smoothed using such techniques as **splining** and **Node Editing** after which the actual **model resolution** is used to control the smoothness of the **Relief**. **ArtCAM** has the power to temporarily link colours together, which enables the user to combine different coloured areas, without changing the original picture. This is called **Colour Linking**.

Colour linking - Spider Coin Exercise

In this exercise a bitmap has already been opened, modified and saved as an **ArtCAM** model.

- Select **File - Open** or 

.
- Load in the model **train-spider.art** from: **D:\users\trainingArtCAM Data**.

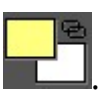
The picture is made up of several colours, displayed at the bottom of the **2D View**.

Similar to **vectors**, you can assign each **colour** a **shape**. **Colours** can be temporarily combined using **Colour Linking**. This is a temporary way of creating larger areas of similar colour that does not permanently change the original picture.
The Bitmap is loaded with the associated colours displayed on a palette at the bottom of the screen.

- Single **left mouse button** click on the **yellow square**.

Yellow has now been assigned as the **primary** colour .

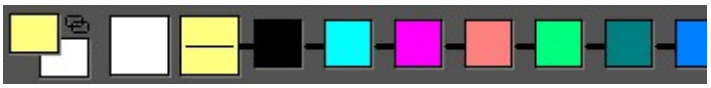
- Select the **white square** using the **right mouse button**.

This is now assigned as the **secondary colour**  .

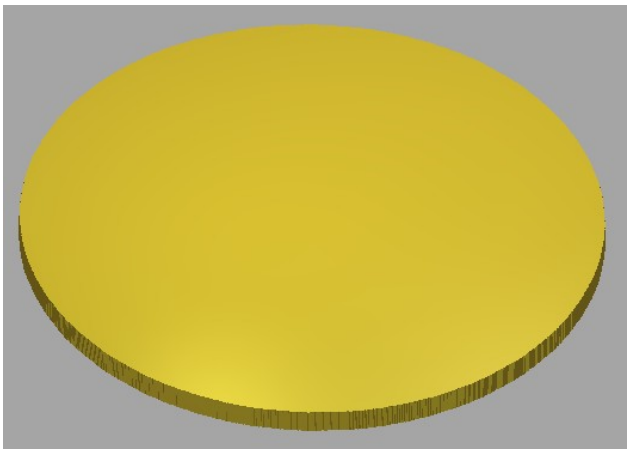
- From the top pull down menu, select **Bitmaps > Colour > Link All Colours**.

This will temporarily **change all colours to yellow** (except the **Secondary colour - white**).

This has reflected on the bitmap itself and indicated on the palette with smaller coloured icons and connected lines. The main area of the coin (yellow) can now be raised as one unit.



- Double click with the **left mouse button** the **yellow colour** in the **2D View**.
- In the **Shape Editor**, select a **Flat shape** with a **Height** of **1.5mm**, followed by **Add**. Select **Close**.



The ‘coin’ shape has been generated. To produce the Rim, the colours need to be unlinked and then re-linked to include only the purple text.

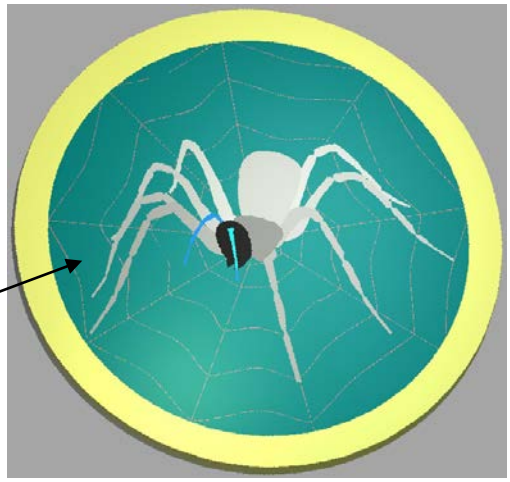
- From the top pull down menu, select **Bitmaps > Colour > Reset All Links**.
- Double **right mouse click** on the **dark purple** square at the bottom of the **2D View**.

Double clicking with the **right mouse button** makes the colour become the secondary, and links it to the primary. So in this case the dark purple text becomes yellow.

- Switch to the **3D view** and from the **3D view toolbar**, toggle on **Colour shade** .

The bitmap image is applied to the Relief.

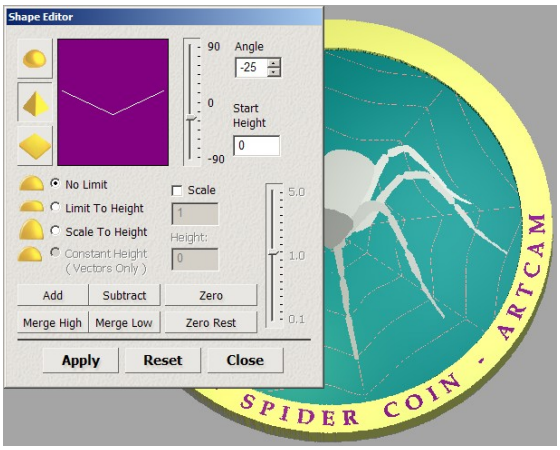
In addition to the colour palette, Reliefs can also be created from the colours selected directly from the Relief.



- Double left mouse click on the yellow colour in the **3D View**.

- In the **Shape Editor**, select a **Flat shape** with a **Height** of **2mm**, followed by **Merge High**. Select **Close**.

- From the top menu, select **Reset All Links**.



- Double **left mouse click** on the **dark purple** colour in the **2D View** and the **Shape Editor** will display it.

- In the **Shape Editor**, select a **Pyramid** shape with an **Angle** of **–25 degrees**, **Start Height** of **0**, followed by **Add**. Select **Close**.

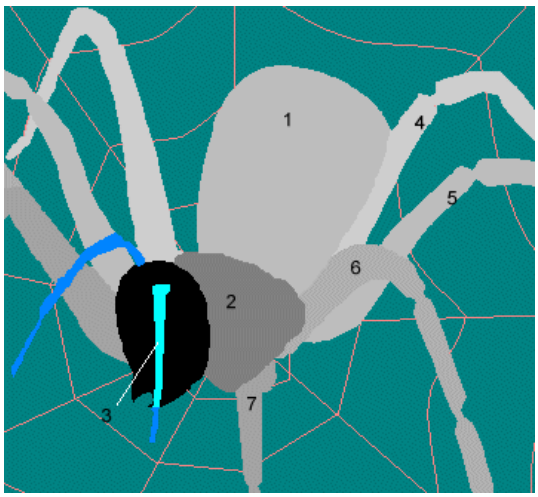
- Select **Toggle Colour shade** to switch **OFF** the bitmap.

The raised rim edge and ‘V’ grooved text is clearly shown on the coin.

- Double left mouse click on the dark green colour in the palette.
- In the **Shape Editor**, select a **Dome shape** with an **Angle** of **–10 degrees**, **Start Height** of **0**, followed by **Add**.
- Select **Close**.

The **Relief** now includes curved indentations between the web detail and the spider outline. You will now **add** the actual **spider** and **web detail** to the **Relief**.

The following steps will apply a relief to the areas indicated by a number as shown.



Note: The antenna is currently made up of two colours (light blue and purple). These colours will be combined (linked) so the area (3) can be treated as one.

- Select **Toggle Colour shade** to switch **ON** the bitmap.

- Double **left mouse click** on colour **1**.
- In the **Shape Editor**, select a **Dome** shape with an **Angle** of **24 degrees**, **Start Height** of **0**, followed by **Add**.

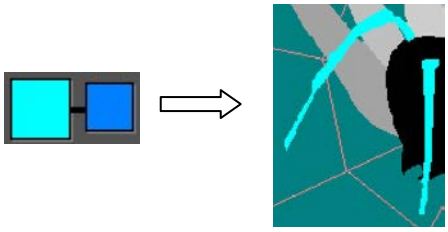
- Double **left mouse click** on the colour **2** in the **2D View**.
- In the **Shape Editor**, select a **Dome** shape with an **Angle** of **24 degrees**, **Start Height** of **0,** followed by **Add**. Select **Close**.

The **black** will be linked with the light blue to provide a single coloured area for the whole of the head.

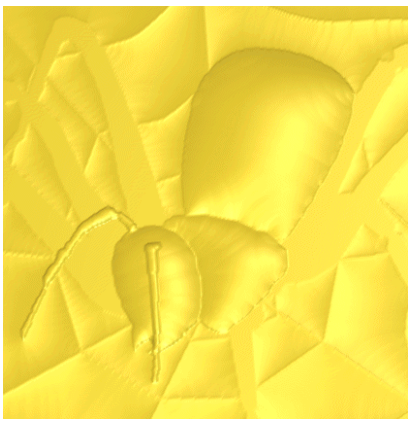
- **Single left mouse click** on the **black** area in the **2D View** to assign as the **primary**.
- Double **right mouse click** on the **light blue** square at the bottom of the **2D View** to link it to the **primary black colour** .
- In the **Shape Editor**, select a **Dome** shape with a **Start Height** of **0**, an **Angle** of **30 degrees**, followed by **Add**.
- Select **Close**.
- From the top menu bar, select **Reset All Links**.

Link the **dark blue** with the **light blue**, to make all of the antennae area have the same colour.

- Single left mouse click on the dark blue area in the **2D View**.
- Double **right mouse click** on the **light blue** square at the bottom of the **2D View**.



- In the **Shape Editor**, select a **Dome** shape with an **Angle** of **45 degrees**, **Start Height** of **0**, followed by **Add**.
- Select **Close**.



The antennas are **added** to the current relief.

- From the top menu select **Reset All Links**.
- Double **left mouse click** on the area labelled **4** in the **2D View**.

- In the **Shape Editor**, select a **Dome** shape with an **Angle** of **45 degrees**, **Start Height** of **0,** followed by **Add**. Select **Close**.

- Repeat the process for areas labelled **5**, **6**, **7** and the **pink** area (webbing).

The coin is now complete.

- Select **File** - **Save As Coin** in: **D:\users\training\COURSEWORK\ArtCAMJewelSmith-Jobs**.

Bitmap to Vector - Toucan Link Exercise

Colour linking can be used to **highlight areas** to **obtain vectors**, using the **Bitmap To Vector** feature. This allows you to calculate the **vector boundary** of the selected **primary colour** in the **bitmap image**.

The following exercise will show the application of this feature.

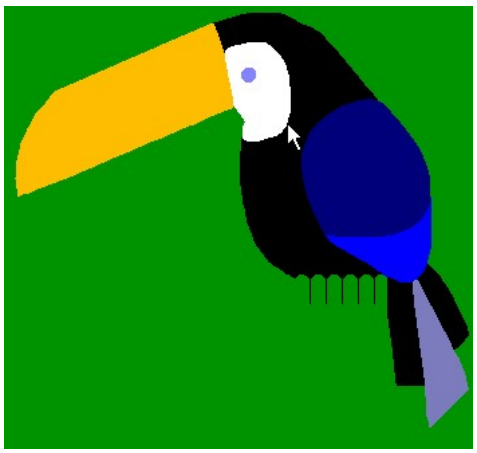
- Select **Open Model**

.

- Select the folder: **D:\users\training\ArtCAM Data**, and change **Files of type**: to **Bitmap Files**.
- Select the file **toucan.gif**, followed by **Open**.
- Leave the **Set Model Size** dimensions as **default**, and select **OK**.

- Left mouse click on the first green colour in the colour palette (make primary).

- **Double right mouse click** on the next **5 green colours** (to link to primary).
- Double right mouse click on the **red** and **yellow** colours.

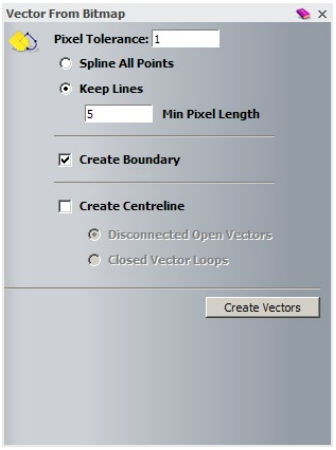


The **toucan** is now surrounded by a single **green colour**.

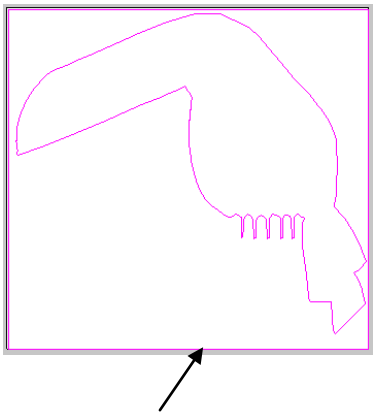
For the **body part** of the toucan, the **feet** and the **red beak** are not required, so they were also linked to the green.

A single **vector** from the **boundary** of the **Primary** colour will now be created.

- From the **Vector creation toolbar** at the top of the screen (or assistant tab) select **Bitmap to Vector** .
- Enter a **Pixel Tolerance of 1**, select the option **Keep Lines** and enter a **Min Pixel Length of 5** and select **Create Boundary**.



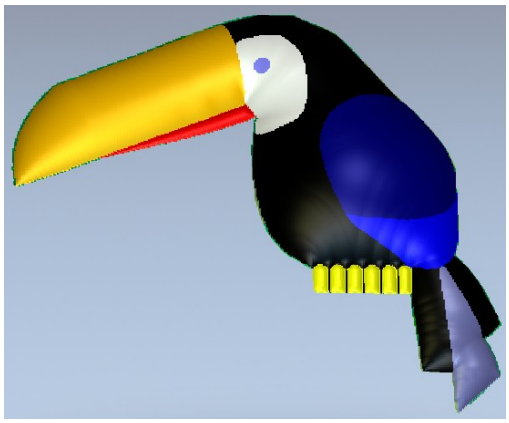
- Select **Create Vectors** and **close the form**.
- **Toggle Bitmap visibility** in the **Bitmap Layers Tab** to hide the Toucan image.



A single closed vector has been generated on the primary colour(s) boundary. **Adjusting the pixel tolerance** will define how close the vector will follow the primary colour boundary.

- Delete the square outside vector. Double left mouse click on the bird vector to open the Shape Editor.
- Select a **Dome shape** with an **Angle** of **45 degrees**, followed by **Add**. Select **Close**.
- Select **Reset All Links**.
- Select the **Yellow colour** using the left mouse button (make Primary)
- Select **Bitmap to Vector**, followed by **Create Vectors** (to create the feet).
- Select the **Red colour** using the left mouse button.
- Select **Bitmap to Vector**, followed by **Create Vectors** (to create the beak).

- **Toggle Bitmap visibility** in the **Bitmap Layers Tab** to show the Toucan image.
- Shift Select the new **toes** and **beak vectors**.
- **Select** a **Dome shape** with an **Angle** of **45 degrees**, followed by **Add**. Select **Close**.
- **View** the results in the **3D view**.
- **Select Colour shade** to apply the bitmap**.**



The example will be completed by **subtracting** the **white coloured area** to generate the **eye**. The **wing** will also be **added**.

- Double left mouse click **the white colour** directly from the relief.
- Select a **Flat** shape with a **Start Height** of **0.5mm** and select **Subtract**.

- Single mouse select the blue colour defined at the bottom of the main wing (to make primary).
- Double right mouse click the dark blue colour (in palette) defined as the top part of the wing.

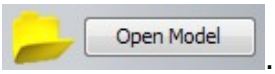
The two blue colours are linked to create a single colour for the wing.

- Double left mouse click the blue wing colour and set a **Dome** shape with an **Angle** of **25 degrees**.
- Select **Add**, followed by **Close**.

- Select **Toggle Colour shade** to confirm the results.

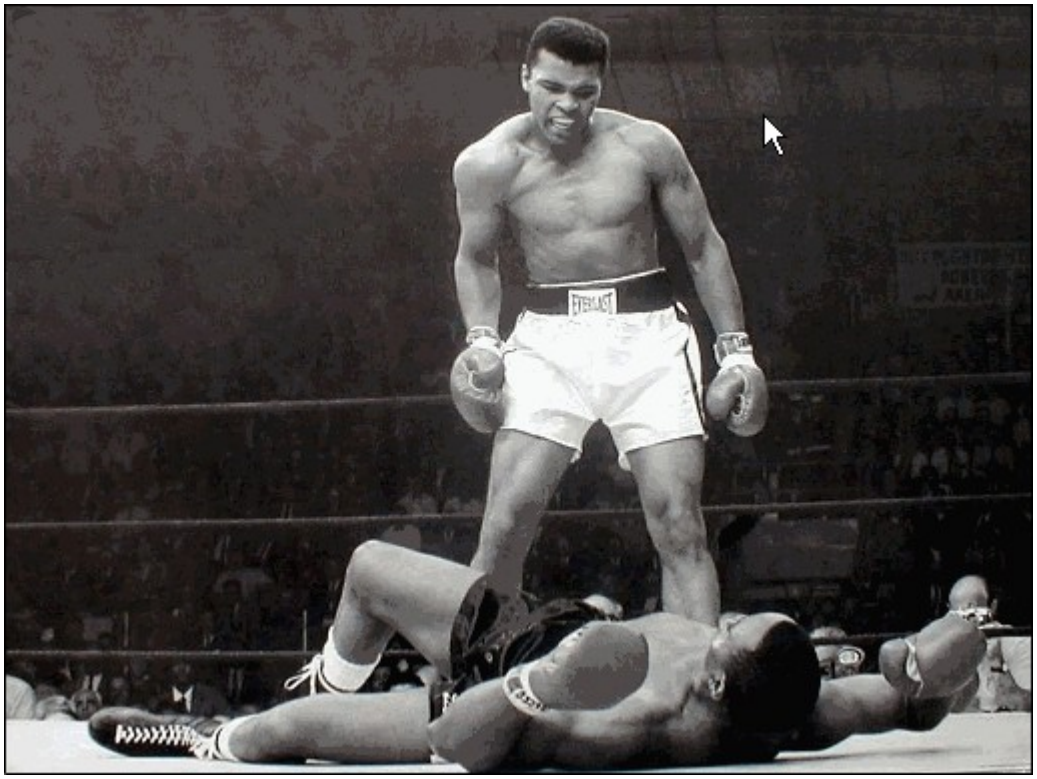
Create Relief Layer from Bitmap Layer

ArtCAM can create a **Relief layer** from an **Imported Image**.

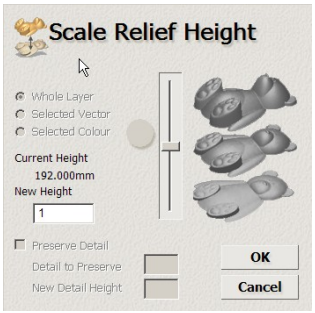
- Select 

.
- Select the folder: **D:\users\training\ArtCAM Data**.
- Select **Files** of type to be **Bitmap Files (*.gif)**.
- Select the file **Knockout.jpg**, followed by **Open**.
- Change the origin to the centre and leave the dimensions as default.
- Select **OK**.

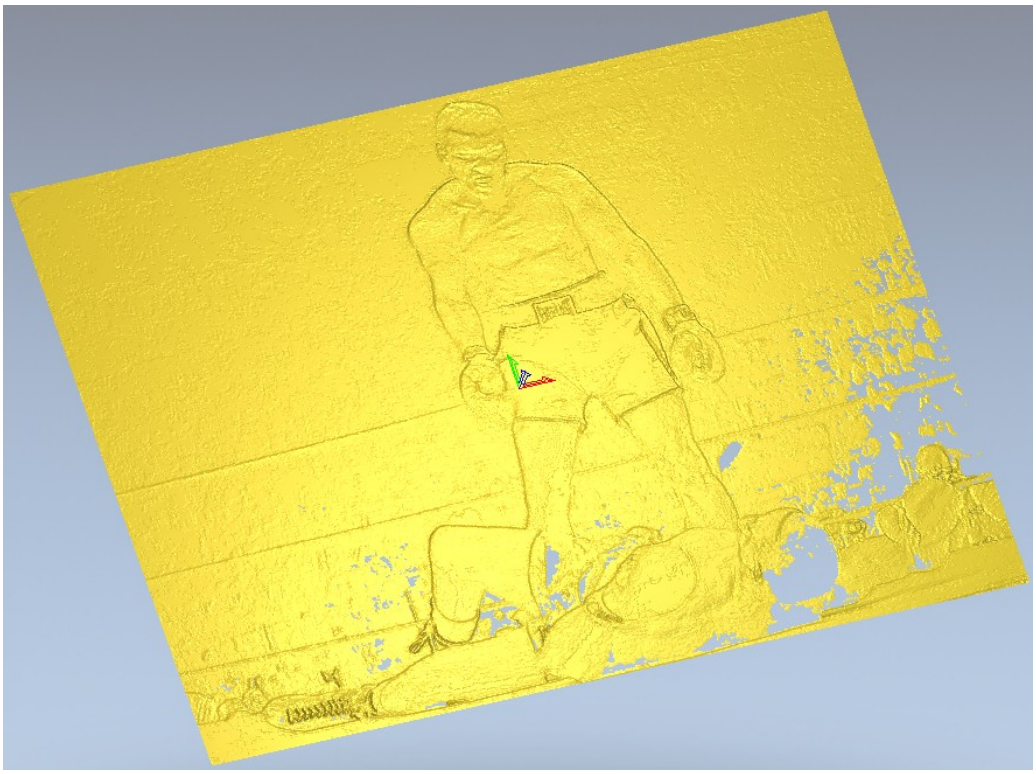
The option Scanned d.p.i. (dots per inch) allows the model size to be changed by defining the required resolution.



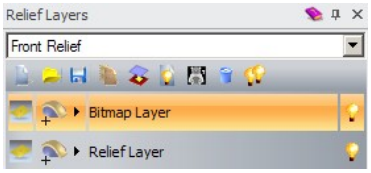
- From the **Bitmaps layers tab**, select **Create Relief Layer**.



- In the Scale Relief Height form, enter a **New Height** of **3mm**.
- Select **OK**.
- **View** the new **Relief** in the **3D View** window.



A new Relief layer has been created from this Bitmap named **Bitmap Layer**.



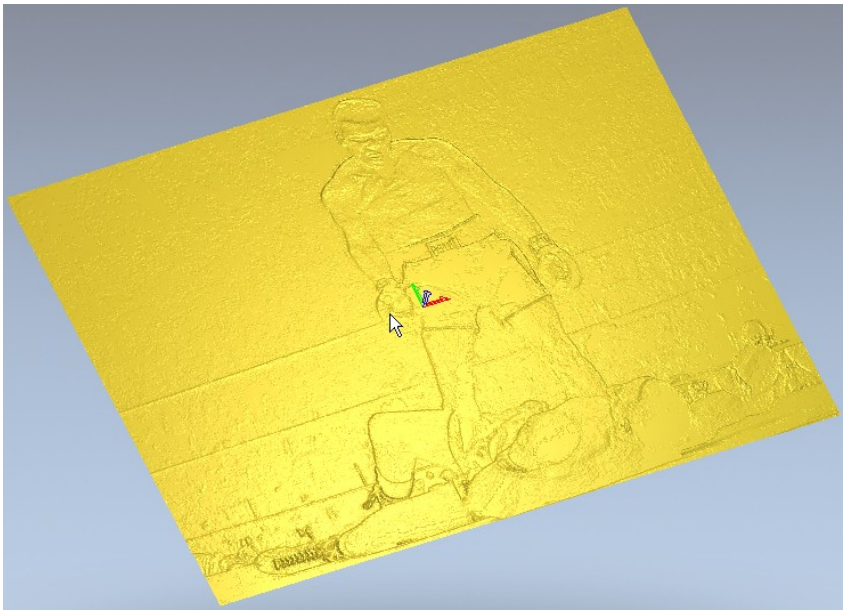
This **Scale Relief Height** has limited the height of the **Relief** to 3mm. The Relief generated varies in height according to the bitmap pixel colour below it. The relief height will be at the **highest level** in the **lighter** coloured areas and **lowest** in the **dark areas**.
The relief therefore varies in height between Z 0 and Z 3mm. Areas of no relief are evident as the bitmap in these areas are black in colour. **Note: Draw Zero Plane is off**.

- Create a rectangle of size of **Width 1024mm** and **Height 768mm** with **Centre Point** at **X0 Y0**.

This rectangle vector defines the border edge of the image.

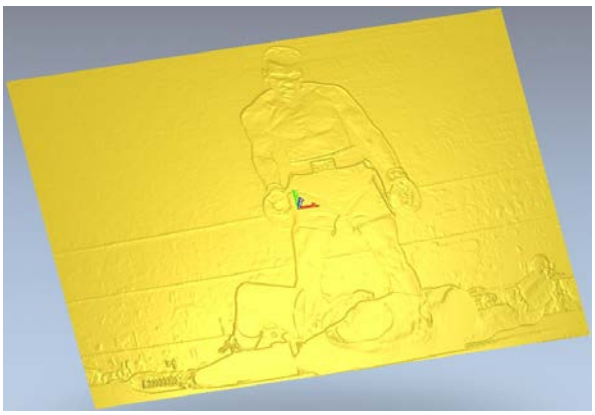
- In the **Shape Editor**, select a **Flat shape** with a **Height** of **1mm**, followed by **Add**. Select **Close**.

A 1mm base has been added to the Relief eliminating the zero relief areas. To complete the Relief a smoothing pass will be applied to reduce the surface irregularities.



- From the **Relief Editing Toolbar**, Select **Smooth Relief** .

- With the **Whole Layer** option ticked and **Smoothing Passes as 2**, select **Apply**.



The model is complete.

- Save the **Model** and close.

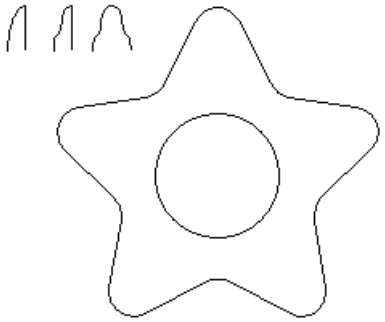
6. 3D Blend and Fade Relief

Introduction

The **3D Blend** creates the **Relief** form either inside a **closed vector** or **between two closed vectors**. The **height** and **shape** across the void is controlled by a series of standard, **cross sectional forms** or a user defined **Z modulation curve**.

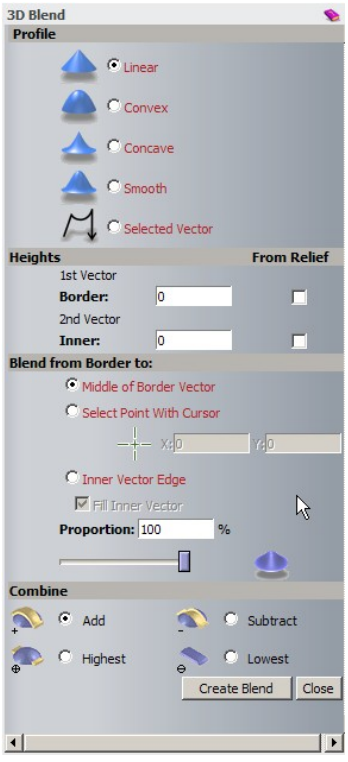
Star Exercise

- Open the model **star-blend.art** from: **D:\users\training\ArtCam Data**.



This model contains various vectors to demonstrate the **3D Blend Relief** options.

- In the **Relief Tools** area, select **Create 3D Blend**.

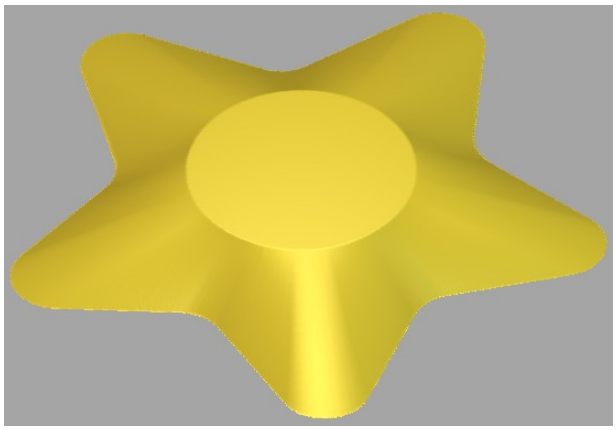


The **3D Blend** assistant page appears providing a comprehensive range of the options. The **3D blend Relief** is either generated from a single **vector** to a **central** or **user defined** point, or across to an inner **vector** using one of the **Profile** types, displayed in the page.

The final shape of the **Relief** is controlled by a combination of the type of **Profile** and **Height** definitions selected.

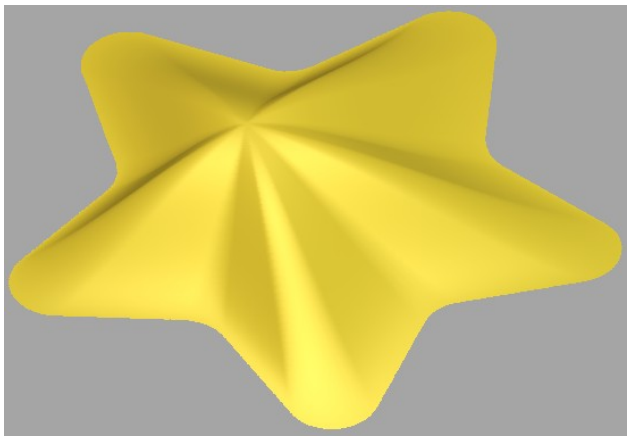
The above options combined with **Add**, **Subtract**, **Highest** and **Lowest**, provides you very powerful commands.

- Select the **Star vector** and shift and select the **Circle** as well.
- Select the **Linear Profile** option.
- Enter a **Border Height of 0** and an **Inner Height** of **5mm**.
- Select **Inner Vector Edge** and select the option **Fill Inner Vector**.
- Select **Add**, followed by **Create Blend**.
- Press **F3** to view in 3D.



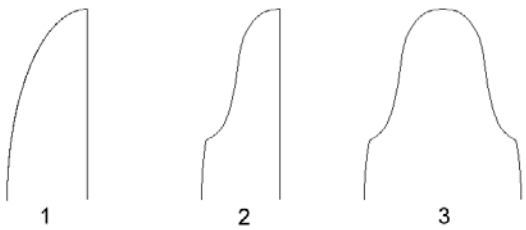
The **Relief** has a **Linear** blend from the **outer** to the **inner vector**. It then continues at constant height (5mm). across the area inside the **inner vector**. If **Fill Inner Vector** was unchecked, the circle would be open (no relief).

- Select **Undo** (Ctrl + Z).
- Select the **outer star vector <u>only</u>** with the **Smooth Profile** option selected.
- Select the option **Select Point With Cursor** and enter **X0** and **Y10**.
- Select **Add**, followed by **Create Blend**.



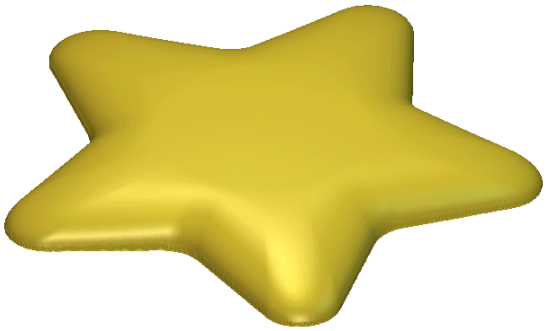
A **smooth blend Relief** is produced with an **offset vector blend** producing an **offset centred star shape**.

The next part of the chapter will compare the addition of different cross sectional, **Selected Vectors** numbered **1** to **3** as shown.



Each vector will produce a different shape when scaled across the relief to the defined heights. The **Selected Vector** is always picked last.

- Select **Undo** (Ctrl + Z).
- Select the **outer** followed by the **inner vector** and with the **3D Blend** page open, select the **Profile** option **Selected Vector**.
- Hold shift and select the cross section **vector 1** from the **2D View** window.
- **In Blend from Border to**: set **Inner Vector Edge** and tick the box **Fill Inner Vector**.
- Select **Add**, followed by **Create Blend**.



A new **Relief is created** from cross section, **vector 1** scaled between the **inner** and **outer vectors**. It then continues at constant height (5mm) across the area inside the **inner vector**.

- Select **Undo** (Ctrl + Z).
- Select the **star vector**, shift select the **circle vector** and then the cross section, **vector 2**.
- Select **Highest**, followed by **Create Blend**.

The new **Relief** has been produced as the scaled **vector 2** between the **inner** and **outer vectors**. It then continues at constant height (5mm) across the area inside the **inner vector**.

- Select **Undo** (Ctrl + Z).
- Select the **star vector** and shift select the cross section, **vector 3**.
- Select **Middle of Border Vector**.
- Select **Highest**, followed by **Create Blend**.

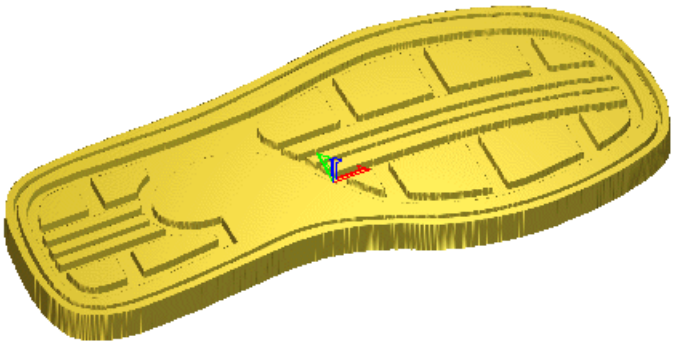
The shape of the **Relief** is controlled by cross sectional, **vector 3** running from the **outer star vector** inwards as well as from the **centre** outwards. The maximum height (5mm) occurs exactly half way between the outer **star vector** and the **centre**.

Fade Relief

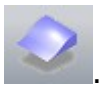
This command will reduce a relief down by a percentage (100% is down to zero) within a specified area.

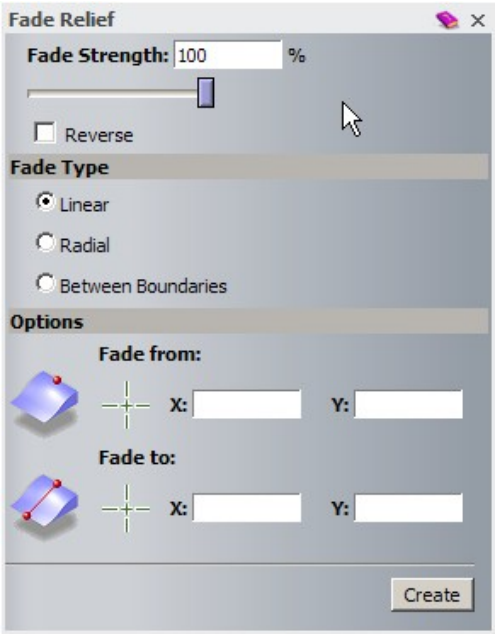
Shoe Sole Exercise

- Open the model **shoe-tread.art** from: **D:\users\trainingArtCam Data**.



This **shoe sole Relief** was generated from **vectors**, created by opening a picture file. The sole needs to be **faded** to generate a better design.

- Select the **2D View**.
- From the **Assistant**'s page, select **Fade Relief**  .



Fade Strength can be set anywhere from 1 to 100%, with 100% being faded down to 0 and 50 % down to half the current height in Z.

The **reverse** option allows you to fade upwards instead of downwards.

Linear Fade, with fade the whole relief between the start and end of a line.

Radial Fade will produce a radial fade from a central position.

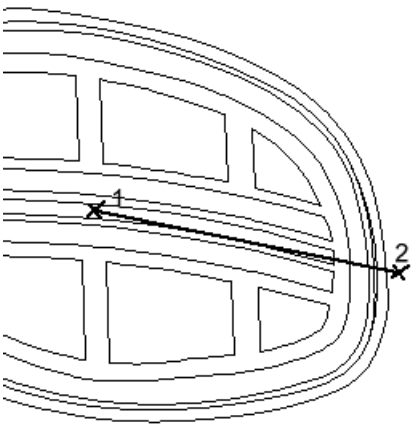
Between Boundaries will limit the fade area between two selected vectors.

- Ensure **Fade Strength** is set at **100%** and **Fade Type Linear** is selected.
- Using the **left mouse button**, **Drag and drop the cross hair** below **Fade from**: into the location as shown below as number 1.

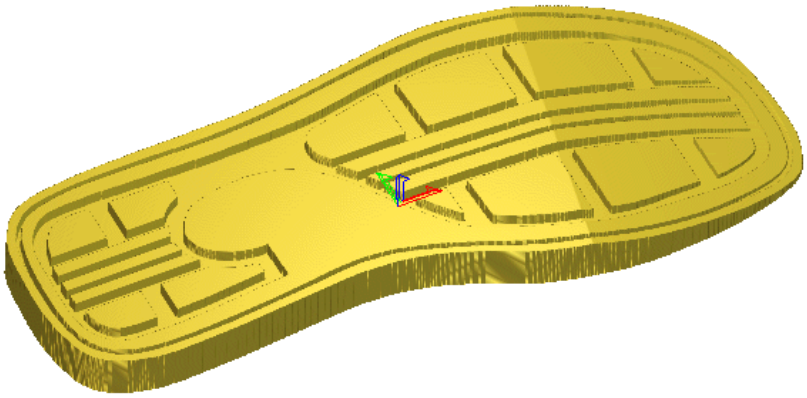
The X and Y coordinates are updated to reflect the position.

- **Repeat the above** and **drag the cross hair** below **Fade to:** to the number 2 position shown below.

Position 1 shows where the **Fade** is going to start and the **Position 2** where it will end (to Z=0)



- Select **Create**.
- Select **F3**.



The toe region has faded. The **X** and **Y** values are kept even after undo, to allow different options.
The **Fade** is parallel to the line, so if angled points were selected, the fade would also be angled.

7. Extrude, Spin, Turn and Two Rail Sweep

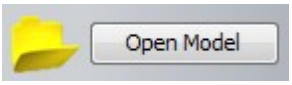
Introduction

Extrude, **Spin**, **Turn and Two Rail Sweep** are commands that create **Reliefs** from cross sections along **Vectors**. These functions can allow the creation of complex and free form shapes quickly. A Relevant example will be used to demonstrate each of these functions.

Extrude Relief

An **Extruded Relief** is produced using **two** or **more vectors**. The **Relief** is produced as a swept form of the **Start Profile vector** along the **Drive Curve vector**. If you use a different **End Profile vector**, the **Relief** will change shape from one end of the drive curve to the other. A fourth curve known as a Z modulation curve determines the shape of the swept relief in the **Z direction**.

Extrude Relief Exercise – Picture Frame

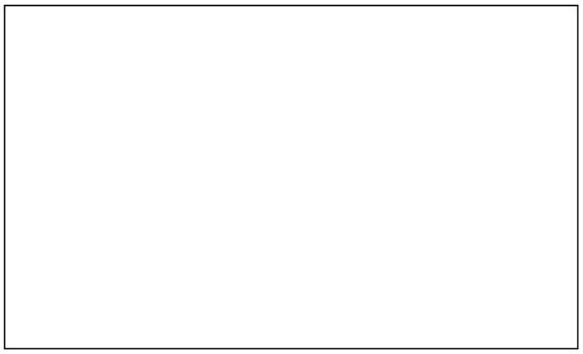
- Select **File - Open** or 

.
- Load in the model **Picture frame.art** from: **D:\users\trainingArtCAM Data**.

The model contains two vectors.

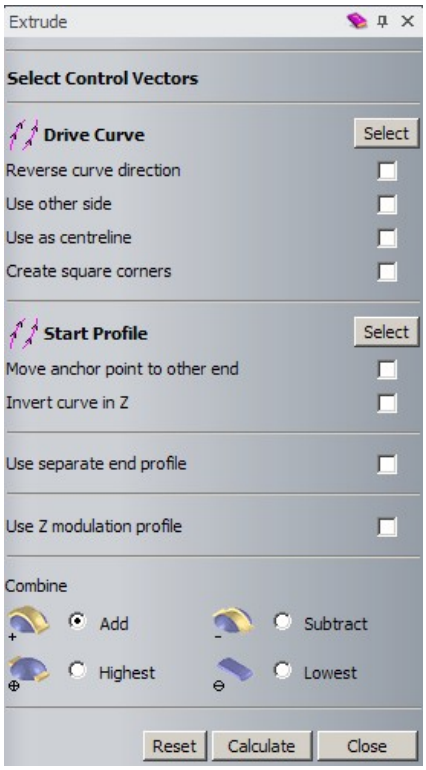
The **rectangle** represents a **drive curve.** This curve can be **open** or **closed** (as in this case).

The small vector shape is the **Start Profile (section).**



Note: The profile vector is the exact size that is required and can be located anywhere in the **2D View**. Also it must be a **single open vector** (not Grouped).

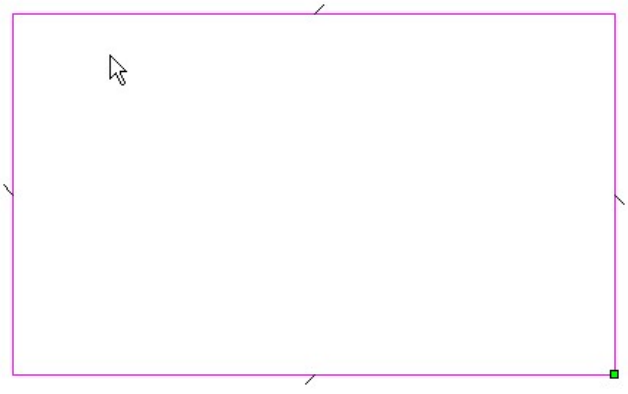
- Select **Extrude** from the **Relief Tools** tab.



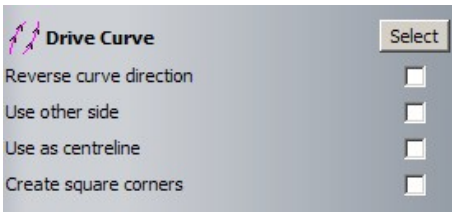
The **Extrude** page provides the options for the user to create the required **Extruded Relief** shape.

- Select the Rectangle vector with the **left mouse button**, followed by **Select** in the **Drive Curve section** of the form.

The **Drive Curve vector** is highlighted.

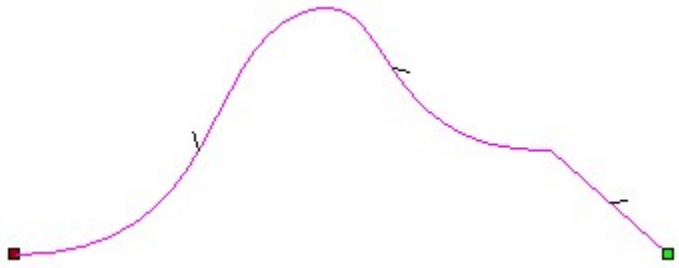


The small **green square** indicates the **Start** of the **Curve**, where the **Start Profile** will be located.
The small lines running off the sides **indicate** which side of the **vector** the sectional profiles will be extruded along. These options can be changed by ticking the relevant boxes as shown below.



- Select only the option to **Create square corners**.

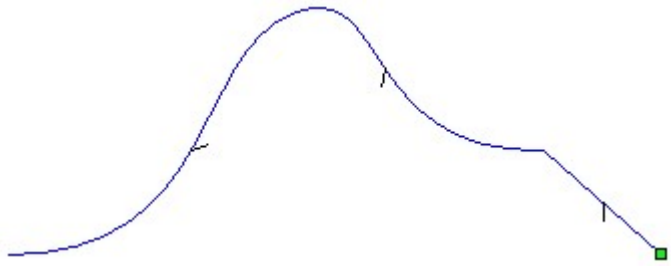
- Select the small open vector with the **left mouse button**, followed by **Select** in the Start profile section of the form.



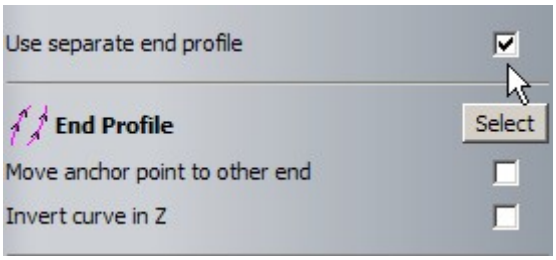
The **Start Profile vector** is highlighted.
As before, the **Green** square indicates the **Start** of the section.
The small lines running off the curve indicate whether the **Relief** would be **positive** (ticks inside) or **negative** (ticks outside). For this exercise, a positive **Relief** is required.

The anchor point is critical in this case as it will dictate which part of the profile is on the outside of the picture frame. A comparison is shown below.

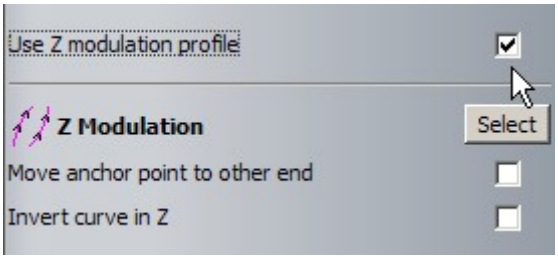
- Leave the anchor point in its current position, but select **Invert Curve in Z** to create a **positive relief.**



This option can be selecting if an **End Profile** of a different shape to the **Start Profile** is required.
By default the **End Profile** is the same as the **Start Profile**. If an **End Profile** is required, the **Use separate end profile** field must be **selected** to provide access to the required selection options.



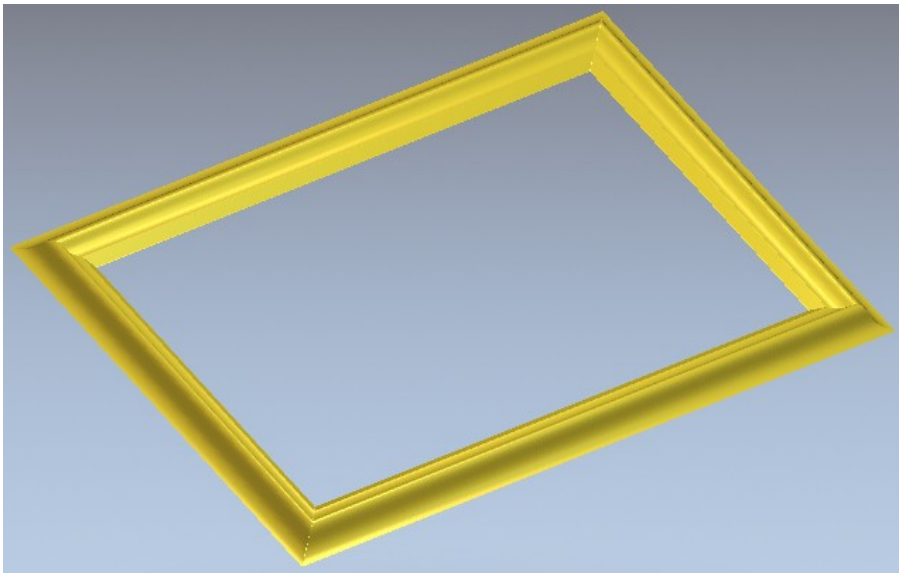
This area of the page enables you to include a **Z modulation Vector**. This controls the **Relief Height** along the **Drive Curve**. As above, this must be selected to reveal the selection options.



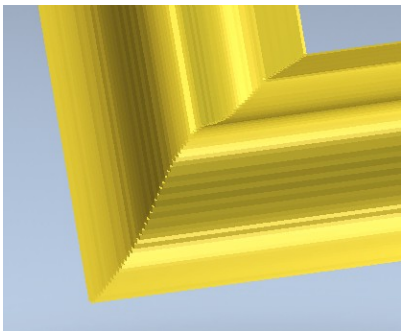
Similar to **Shape Editor**, this page controls the method to combine the shape with the existing **Relief**.

- Ensure **Add** is selected.

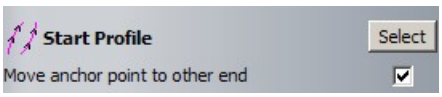
- Select **Calculate** to create the relief.
- **Close** the form and view the results in 3D.

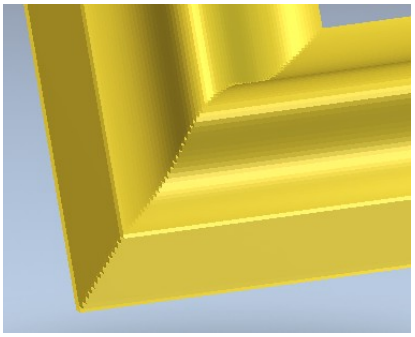


Square corners have been created because the option was selected in the Extrude form.



If the option **Move anchor point to other end** was selected, then the **profile vector would be reversed** during the extrusion. The result would then be as shown to the right.



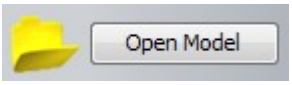


- Select **File** - **Save As**, enter the **File name** as **training-PictureFrame** and save it in: **D:\users\training\COURSEWORK\ArtCAM JewelSmith-Jobs**.

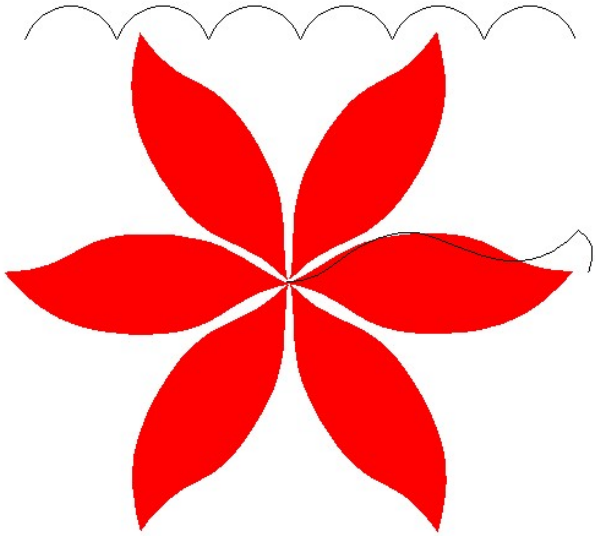
Spin Relief

A **Spin Relief** is produced, by spinning a single **Cross Sectional vector** around its own start point (green square). Spin Relief also allows the inclusion of a separate end profile and Z modulation vector.

Spin Exercise – Leaf shape

- Select **File - Open** or 

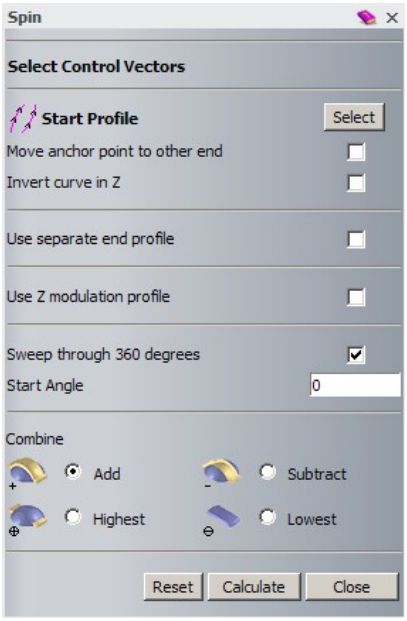
.
- Load in the model **Spinleaf.art** from: **D:\users\trainingArtCAM Data**.



The model includes two vectors and a bitmap of a leaf shape.

This **Polyline** will be spun around its own start point (shown as a green square) to generate a Relief. The **Polyline** or **Start Profile** determines the actual size of the model and has to be a single joined **vector**.

- Select **Spin** from the **Relief Tools** area.



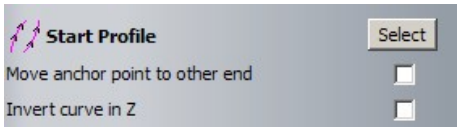
The profile by default will be swept a full circle (360 degrees). Unticking this option will allow the start and end angles to be specified.

- Select the **profile vector** with the **left mouse button**.
- On the **Spin** page, click **Select**.

A **positive Relief** is required therefore the indicator marks should point inwards as shown.

The start point green square is on the left hand side indicating the anchor point at which this profile will spin around.

If necessary, both options can be changed by selecting the relevant box.

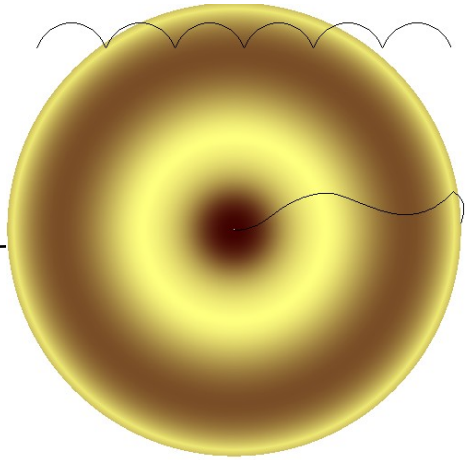


- Ensure **Add** is selected.
- Select **Calculate** to create the relief. **Close** the form.

- From the **2D view** tab, select **Preview Relief Layer**.

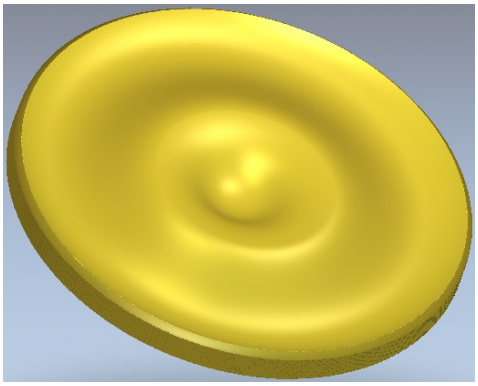
The Relief Layer is displayed in the 2D view.

The result shows how the profile was swept full circle around the anchor (start) point.



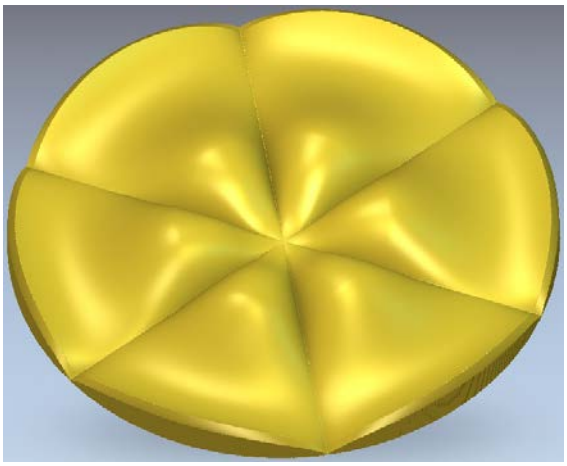
Switch to the 3D view to see the results.

This process will be repeated to include the **Z modulation vector**.



- From the **Relief Editing Toolbar**, select **Reset Relief**.
- Return to the **2D view** and **Switch off Preview Relief layer.**
- Select **Spin** from the **Relief Tools** area.
- **Reselect the profile vector** as the **Start profile**
- Tick the option **Use Z modulation profile,** to reveal the further options.
- Select the curved vector, followed by **Select** in the **Z modulation** section of the form.

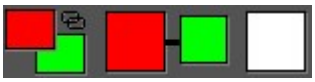
- Select **Calculate** to create the relief. **Close** the form.



Switch to the 3D view to see the results.

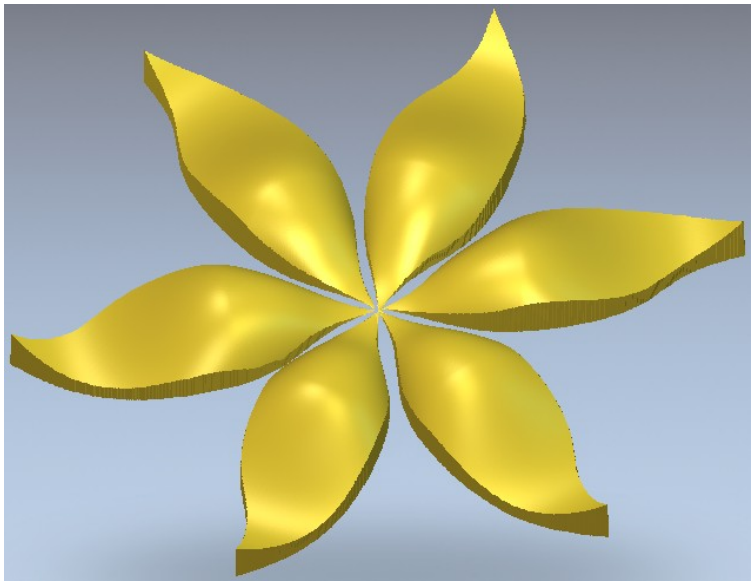
The six curve profile has scaled the Relief in the Z-axis (along its length).

The final leaf shape will now be completed.



- From the colour palette, ensure **Red** is selected as the **Primary colour**.
- From the top menu.
- Select **Reliefs - Keep under colour**.

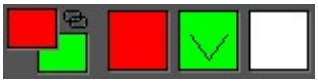
This will reset all areas of the Relief **NOT under the primary colour (red)**.
Note: Selecting **ZERO REST** in **Shape Editor** would give the same result.



- View the result in **3D**.

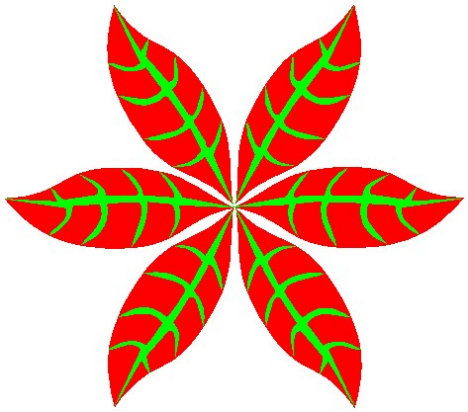
The leaf pattern has been created from the original swept relief.

- From the top menu, select **Bitmap-Colour-Reset All Links**.



The previously linked green colour has been reset. This has exposed the leaf ‘veins’.

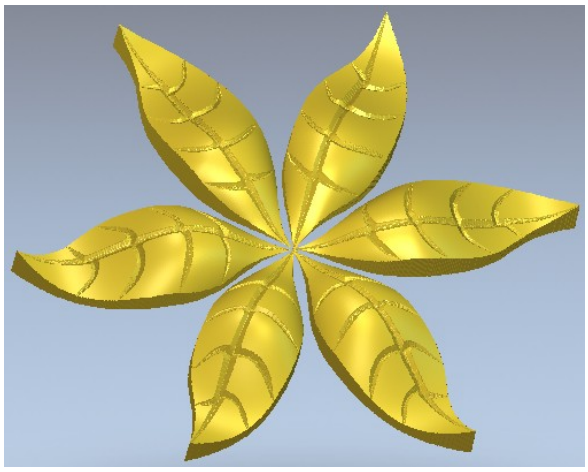
- Enter **Shape editor** using the **green colour** (double left mouse click directly in the view or palette)



- **Subtract** a triangular feature using a **45 degrees angle.**

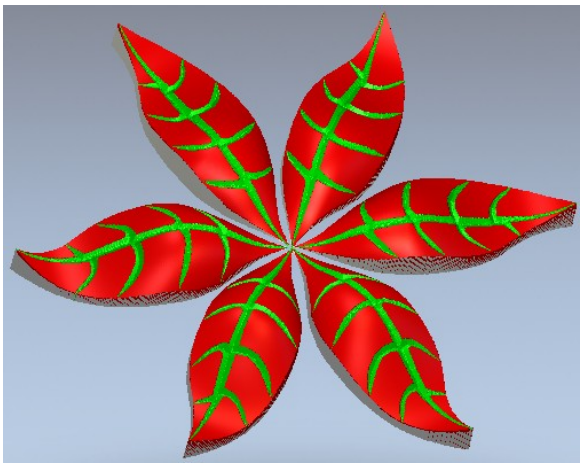
Note: subtracting a 45 degree angle is equivalent to adding -45 degrees.

The 'veins' have been added to the final relief.



- From the **3D view** tab, **select Colour Shade**.

The original bitmap has been applied to the underlying relief.

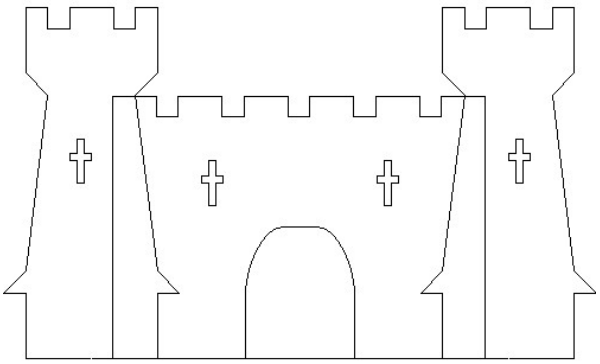


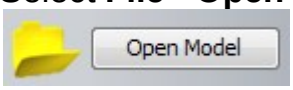
- Select **File** - **Save As**, enter the **File name** as **training-SpinRelief** and save it in: **D:\users\training\COURSEWORK\ArtCAM JewelSmith-Jobs**.

Turn Relief

The **Turn** command takes a **vector (cross section)** and **rotates** it over itself to generate a **Relief**.
The axis of rotation is defined along the line between the start and end points of the **vector**.

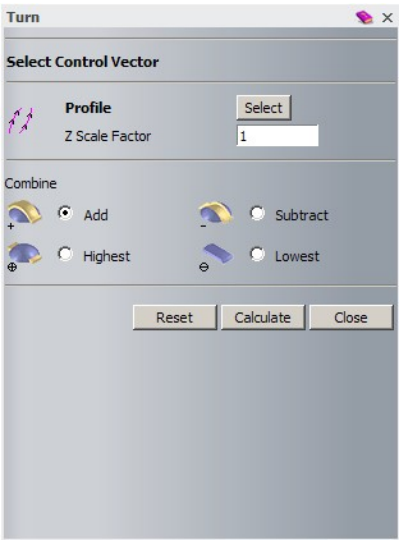
Turn Exercise - Castle



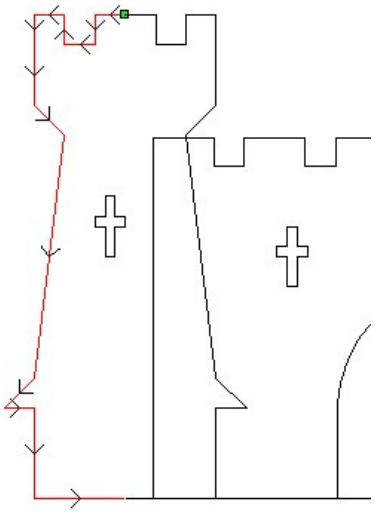
- Select **File - Open** or 

- Load in the model **Castle turn.art** from: **D:\users\trainingArtCAM Data**.

- Select **Turn** from the **Relief Tools** area.



The **Turn** page provides an option for **vector selection** (**Profile**), **Z Scale Factor** for the **Z Height** and **Combine Relief** creation method.

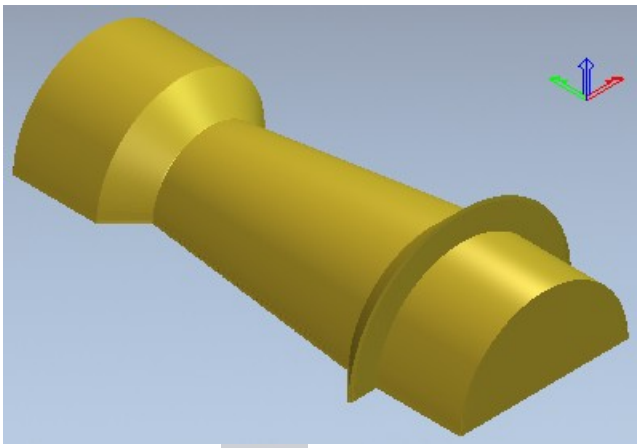


- Select the 'left tower' **vector** as shown with the **left mouse button**.
- On the **Turn** page, click **Select**.

- Select **Add,** followed by **Calculate**. Select **Close**.
- View the results in 3D.

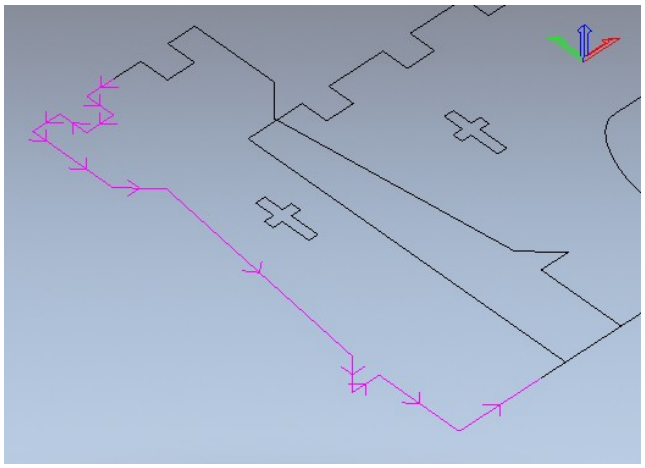
The **Relief** is turned out (180 degrees) on the page. The Z height of the Relief was dictated by the size of the vector profile itself.

This will be repeated but a scale factor will be applied.



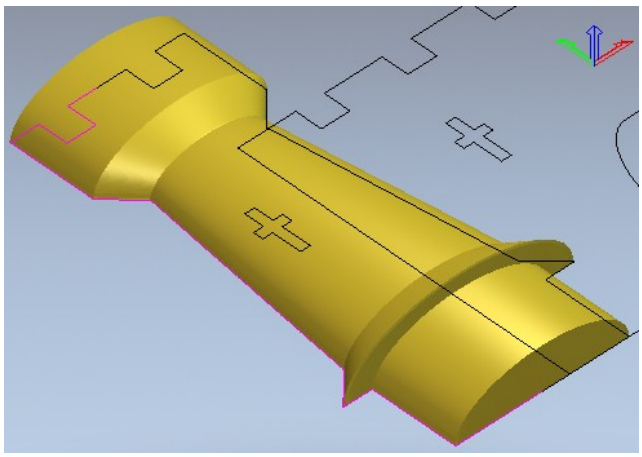
- From the **Relief Editing Toolbar**, select **Reset Relief**.

- Select **Toggle Vector Visibility**, from the **3D view Toolbar**.



The **2D** vectors are displayed in the **3D view**. The remainder of the castle will be created within the **3D view**.

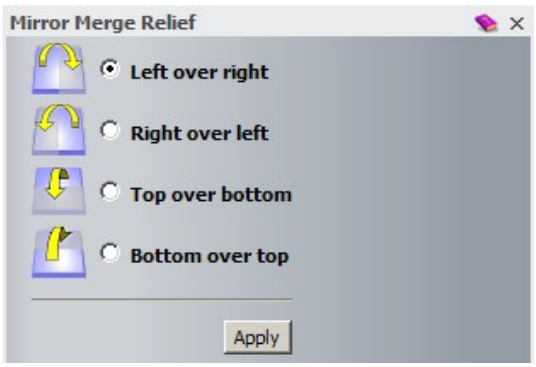
- Reselect the same ‘left tower’ vector and then **Turn** from the **Relief Tools** area.
- Change the **Z Scale factor to 0.5**.
- Select **Add,** followed by **Calculate**. Select **Close**.



Without changing the X and Y parameters, the Relief height (Z) is now **reduced by 50%.**

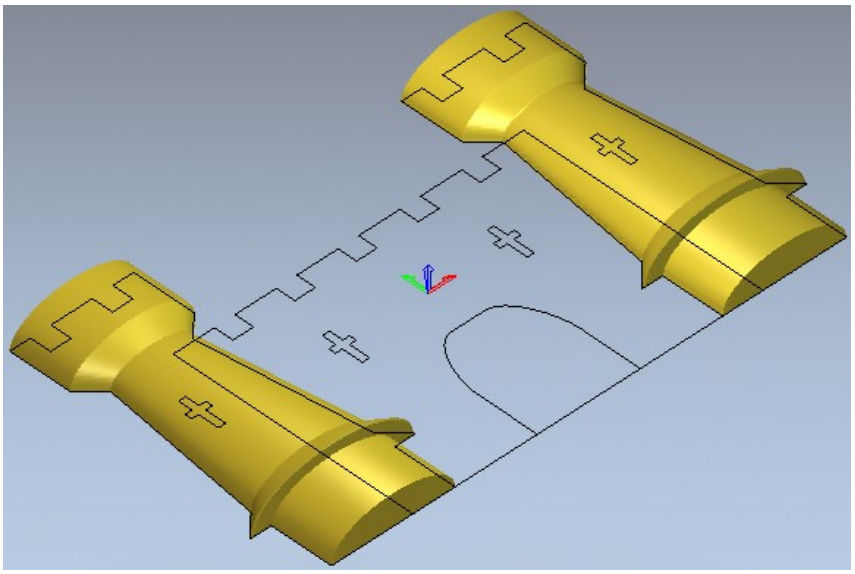
This can be repeated to create the **second identical tower.** However for this example, the **Mirror Merge Relief** function will be shown.

- From the **Relief Tools area**, select **Mirror Merge Relief**.



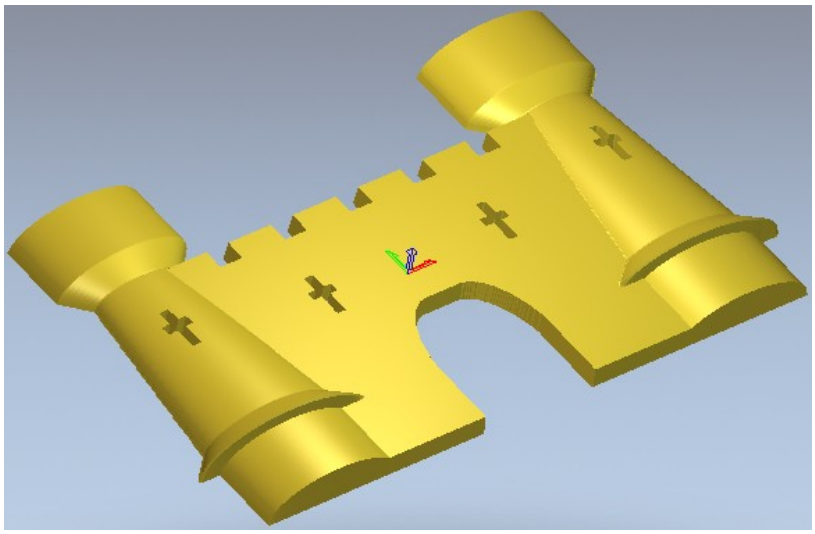
The relief will be mirrored across the origin based on the option selected.

- Select the option **Left over right** and then **Apply**.



The remainder of the castle will be merged.

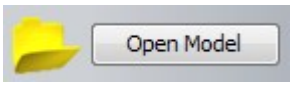
- Select only the **outer rectangular vector**.
- Within **Shape Editor**, **Merge High** a **flat plane** of **height 0.8mm**.
- **Shift Select** the **four 'cross' shapes** and the **entrance (door)**
- Within **Shape Editor**, Select **Zero**.
- Select **Toggle Vector Visibility**, from the **3D view Toolbar to** hide the vectors.



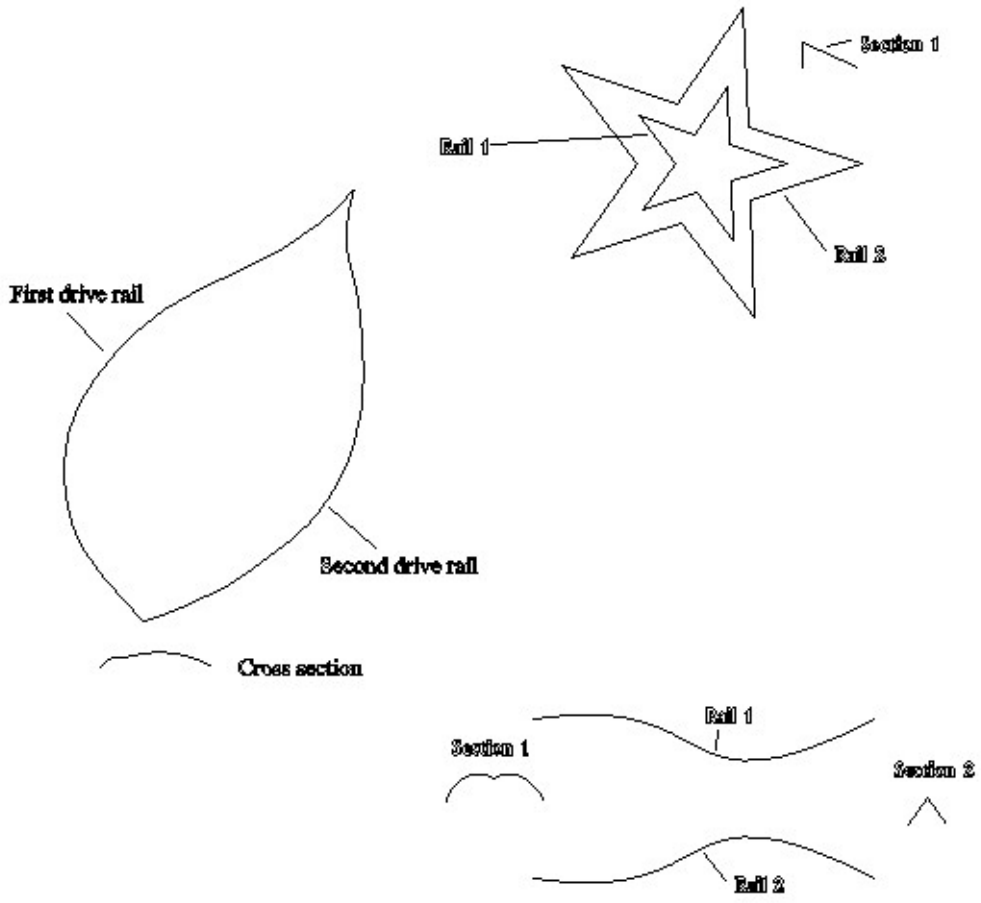
- Select **File** - **Save As**, enter the **File name** as **training-castleturn** and save it **D:\users\training\COURSEWORK\ArtCAMJewelSmith-Jobs**.

Two Rail Sweep

The **Two Rail Sweep** provides a powerful **Relief** creation tool with a variety of controlling options. The basic principle is that one or more **scale sectional vector forms** (**profiles**) are extruded between **two Drive Curve vectors** (**rails**).

- Select **File - Open** or 

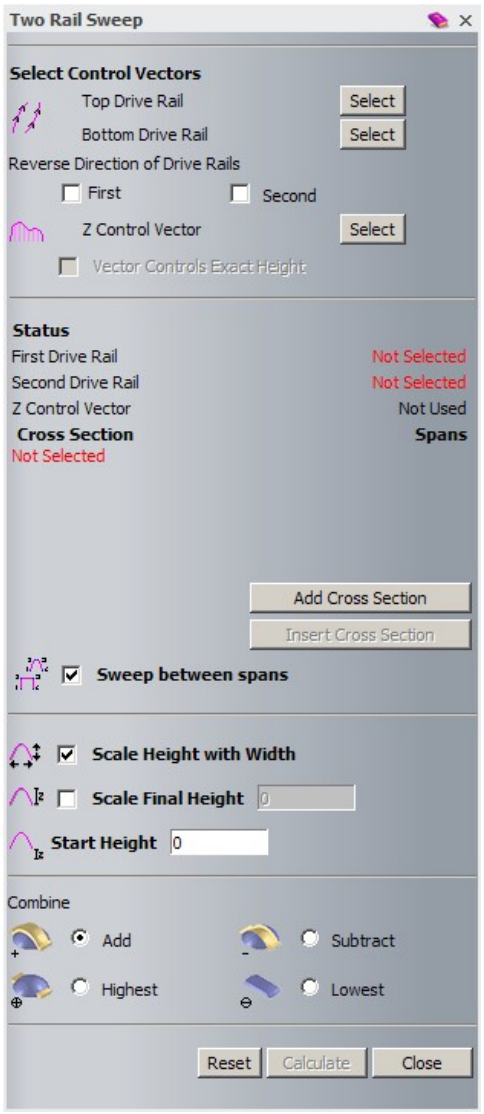
.
- Load in the model **two rail sweep.art** from: **D:\users\trainingArtCAM Data**.



These three examples will introduce the two rail sweep function capability.

Leaf shape

- Select **Two Rail Sweep**, from the **Relief Tools** area.



The form enables the required vectors to be selected.

The **two drive rails** must have the **same direction** (as indicated by the arrows once selected)

The **Z modulation vector** (as with extrude and spin) is selected here.

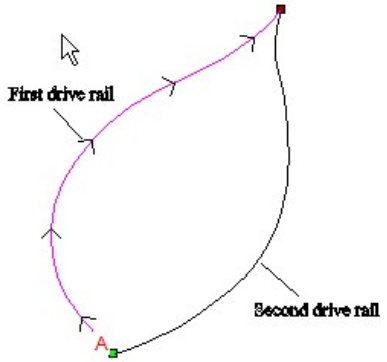
This section allows multiple cross sections to added and individual positions specified. (**Note:** Cross sections must be open, ungrouped vectors).

The final scaling of the relief can be managed in this section of the form.

The usual **Combine options** are selected here before selecting **Calculate**.

- Select the **left hand leaf vector** identified as the **First drive rail**.

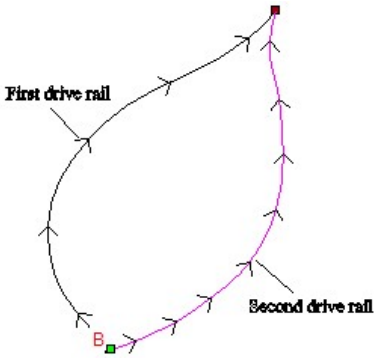
- Click **select** in the form next to **Top Drive Rail**.



Arrows have appeared on the vector indicating its **direction**. The **Green Square** and **red letter A** also signify the start point.
In the status area, the **First Drive Rail** status changes from **Not selected to valid**.

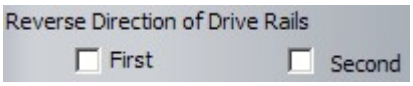
- Select the **right hand leaf vector** identified as the **Second drive rail**.

- Click **select** in the form next to **Bottom Drive Rail**.



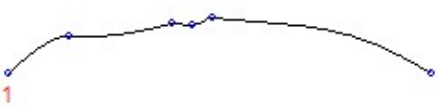
As before, arrows indicate its **direction.** The **Green Square** and **red letter B** signify the start point.
In the status area, the **Second Drive Rail** status changes from **Not selected to valid**.

If required, the arrow/vector direction can be changed by selecting the relevant check box.



- Select the **profile vector** identified as **Cross section.**

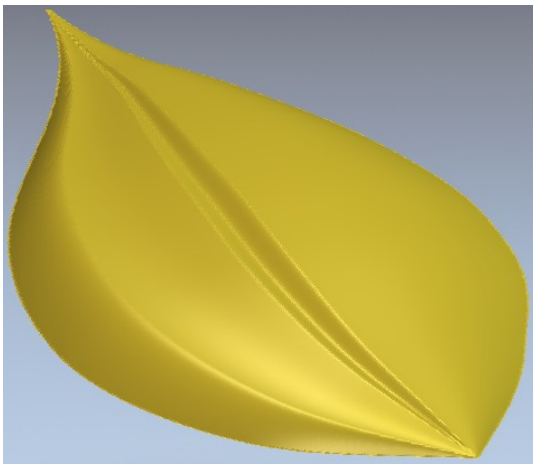
- Click the **Add Cross Section** button in the form.



In the status area, **Cross section 1** is now listed with its status as valid. The **number 1** indicates its start point.

- Ensure **Scale Height and Width** and the combine option **Add** are both selected.
- Select **Calculate** and view the resulting relief.

The cross section has swept between the two rails to create the leaf shaped relief.



- From the **3D view toolbar**, view the **relief along the Y axis**.

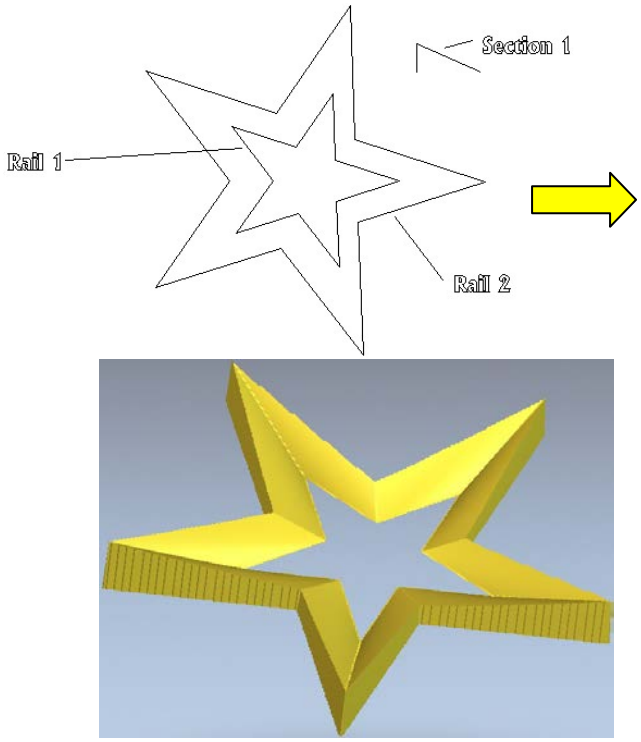
Selecting the option **Scale Height and Width** meant that the Z height of the cross section is scaled relative to the width (across drive rails).

Not selecting the **Scale Height and Width option** would have given a constant height.

Star shape

Drive curves/rails can also be **closed vectors**.

- **Repeat the above procedure** to create the **star shaped relief**. Use the vectors as labelled.

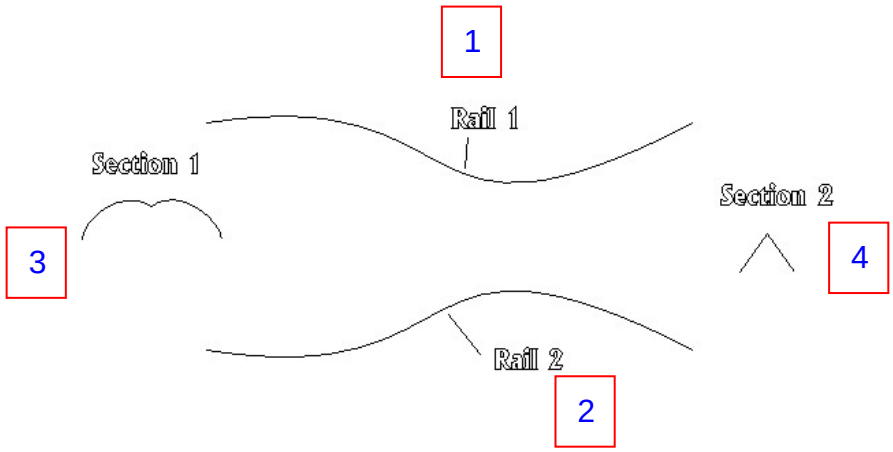


Multiple sections

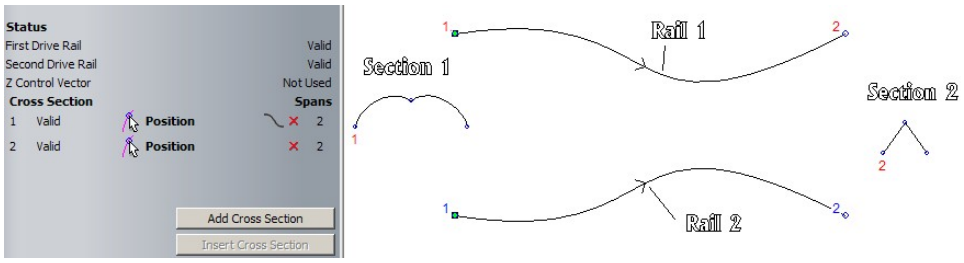
Any number of sections can be added and used in the calculation of the relief. The **position** of the cross sections can also be specified.

Vectors can also be selected prior to opening the two rail sweep form.

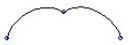
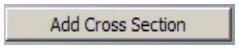
- **Shift-select** the two curves and sections in the order shown.

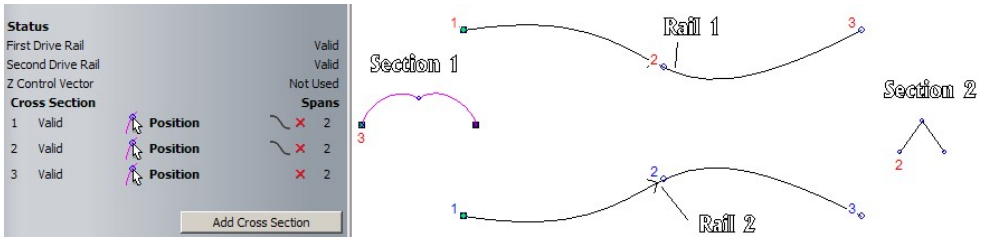


- Select **Two Rail Sweep**, from the **Relief Tools** area.



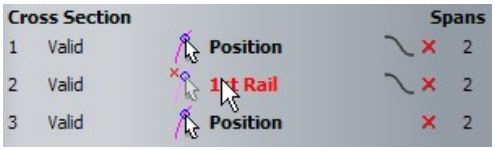
The vectors are identified with arrows and numbers to specify their start and end positions.

- Re-select and ensure only the **Section 1 vector**  is selected.
- Select 



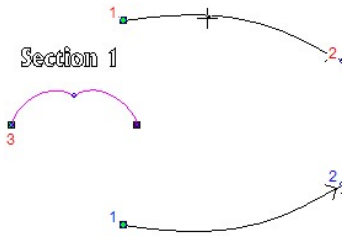
This **additional** section has been inserted midpoint between the previous two.

- In the **Cross Section** status area, select the word **Position** adjacent to **Cross section 2**.



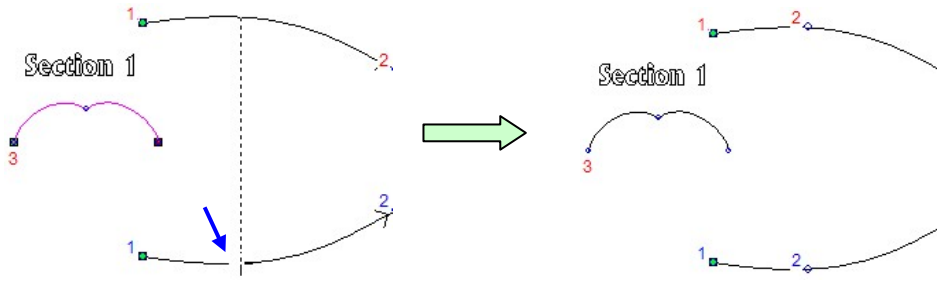
The word **Position** changes to **1st Rail**.

- Select the drive curve vector in the area shown to define the first point.

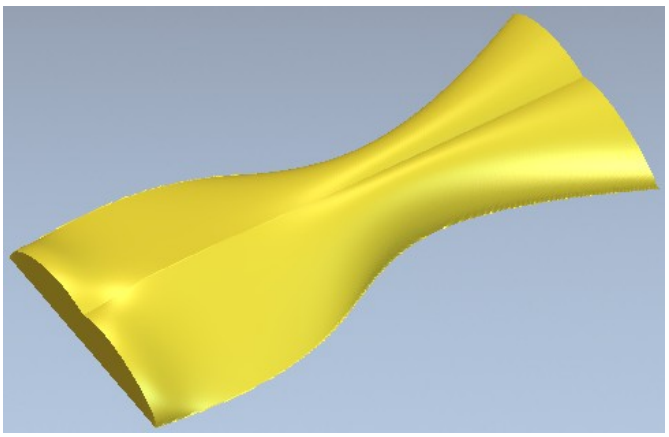


The word **Position** changes to **2nd Rail**.

- Select the second point as shown below to define the new position.



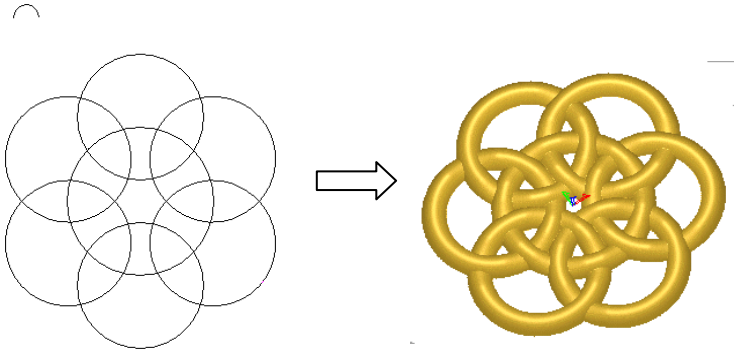
- Untick the option **Scale Height and Width**.
- Select **Calculate** and view the results.



8. Weaves

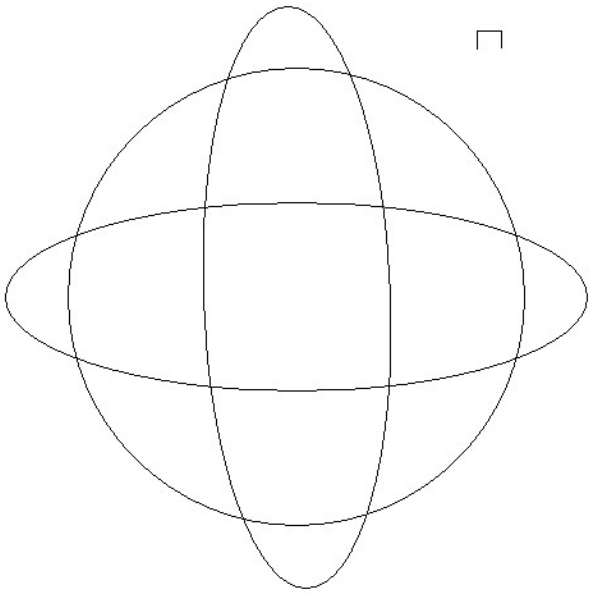
Weave Relief

A **Weave Relief** is generated from a series of overlapping **vectors** and a **Section vector**, using the **Weave Wizard**.



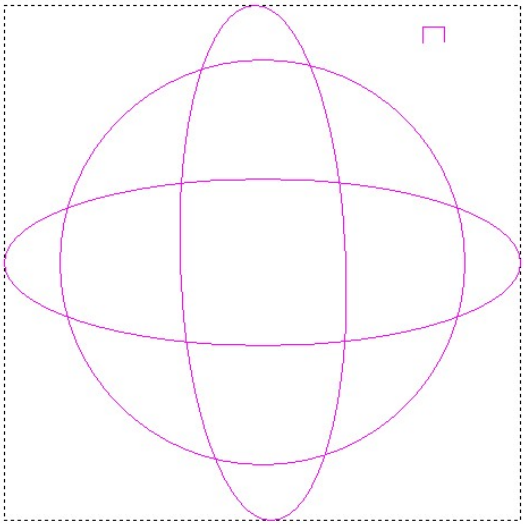
Weave Exercise 1

- Create a **New Model** with **Width** and **Height** of **25mm** and **origin** in the centre.
- Create **three vectors** for the **Drive Curves** and a **small open square vecto**r for the **Cross Section**, as shown in the image below.



The **overlapping vectors** will be used as the **centrelines** for the **Drive Curve**.

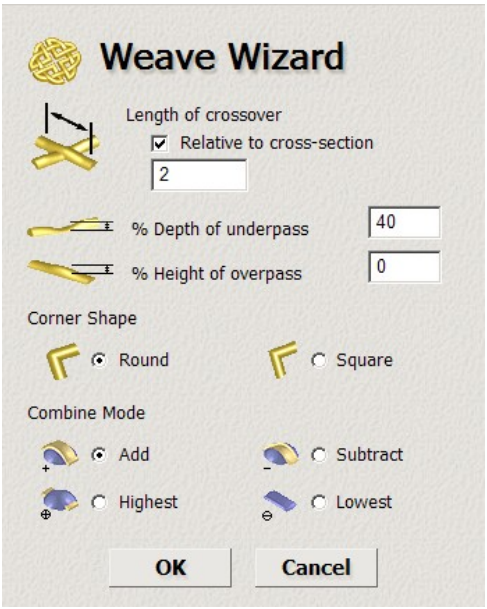
The **smaller vector** will be the **Cross Section** of the **Weave** pattern and must be an **Open** vector. The small vector section is actual size of the desired relief.



- Shift select the **Drive Curve** vectors and the **Cross Section** vector last.

The vectors turn **pink** as they are selected and a box appears around the extents of the vectors to show that they are selected.

- Select **Weave Wizard**.



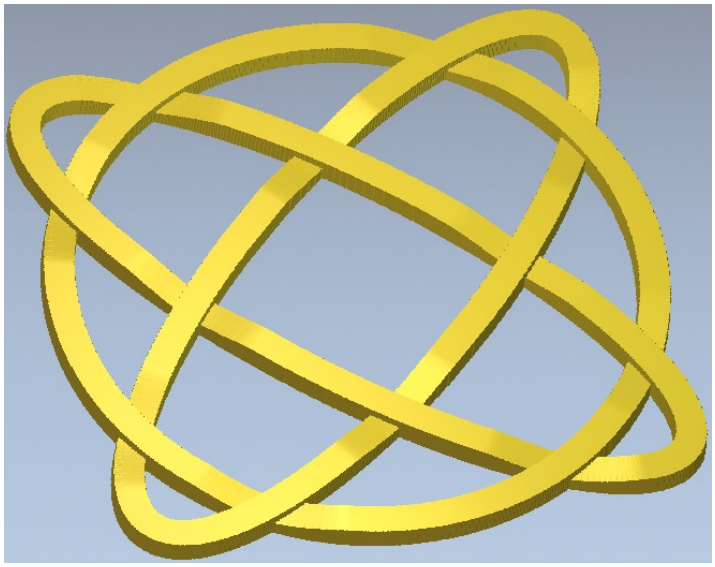
ArtCAM creates the weave pattern at the intersecting regions of the vectors.

The direction of the vectors determines underpass and overpass which vector goes under or over the others.

Length of Crossover determines the length of the weave that will be lowered or raised at the crossover point. This is usually **Relative to Cross Section**.

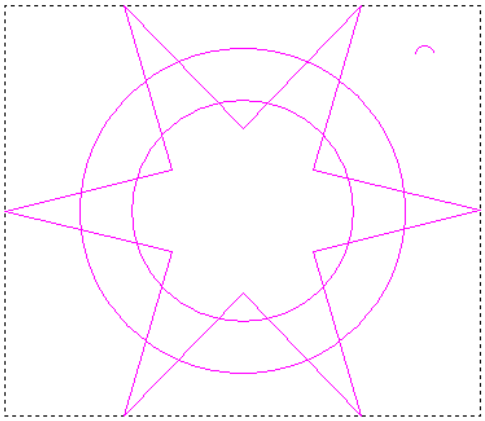
% Depth of underpass and **% Height of overpass** allow you to determine the percentage that the height of the weave **Cross Section** is lowered or raised at the crossovers.
The **Corner Shape** can be **Round** or **Square**, and the relief is combined in the same manner.

- Leave the defaults options and select **OK** to calculate the relief.
- Select the **3D View** tab (or **F3**) to view the result.

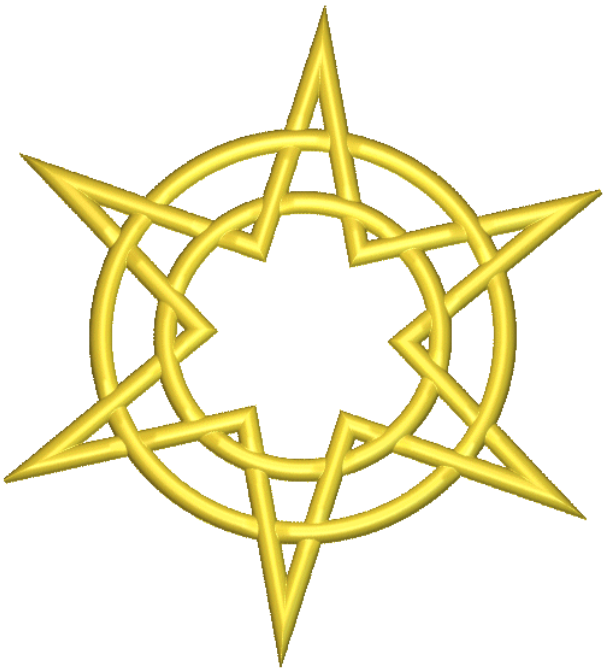


Weave Exercise 2

- Create the following vectors, including the **small half Ellipse** cross section vector.



If the cross section is to big the weave will cross over itself.



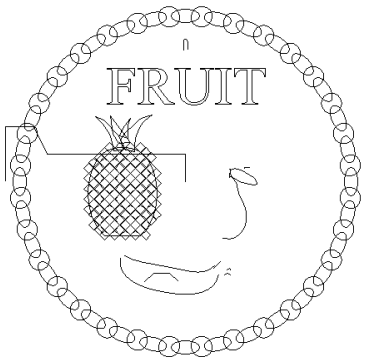
- Shift select the **Drive Curve** vectors and the **Cross Section** vector last.

- Select Weave Wizard .
- Select **Relative to cross section** and enter a value of **1.5mm**, select **Square**, followed by **OK**.

With **Square corners** selected, the **Weave** has sharp edges, rather than rounded.

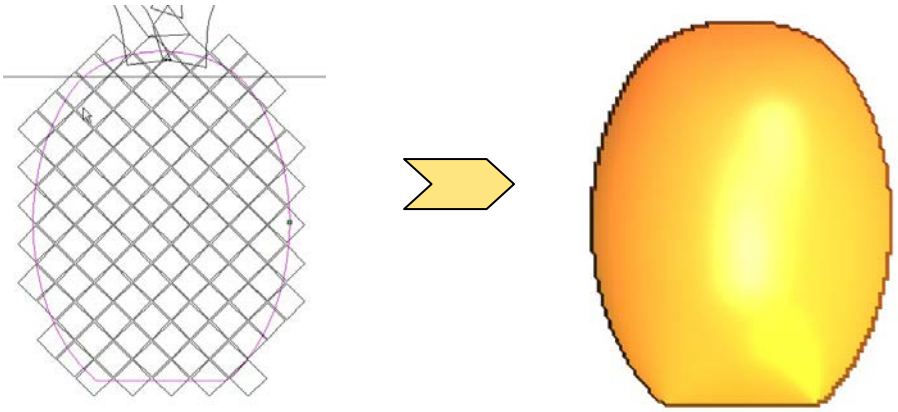
Fruit Plate Exercise

- Open the model **fruits-on-plate.art**, from the **ArtCAM Data** folder.

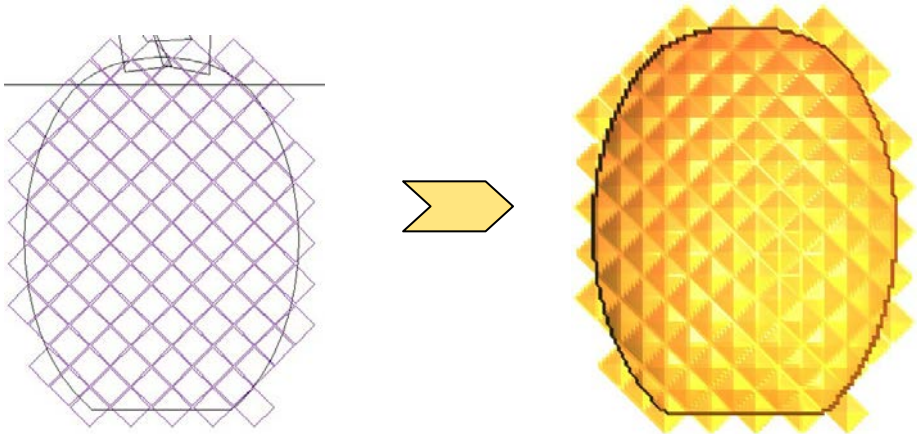


These vectors will be turned into a plate relief, using swept profiles.

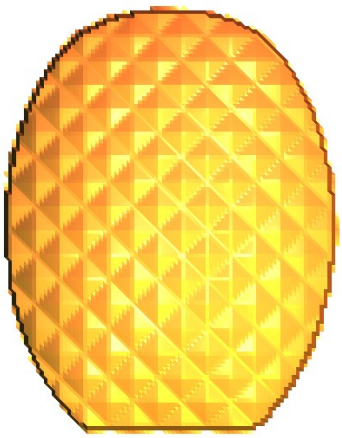
- Select just the pineapple **Dome vector** and generate an **Added Dome Relief** with an **Angle** of **45 degrees**, **Start Height** of **0.4mm** and with **No Limit** selected. Select **Close**.



- Use the overlapping **diamond vector group** and generate an **Added Pyramid Relief** with an **Angle** of **25 degrees**, **Start Height** of **0** and with **No Limit** selected. Select **Close**.

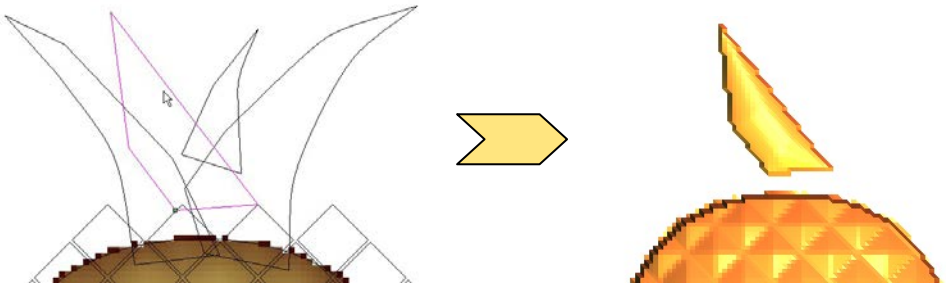


The generated **Relief** goes over the edge of the pineapple. This 'excess' relief can be removed by applying **Zero Rest** in the **Shape Editor**.

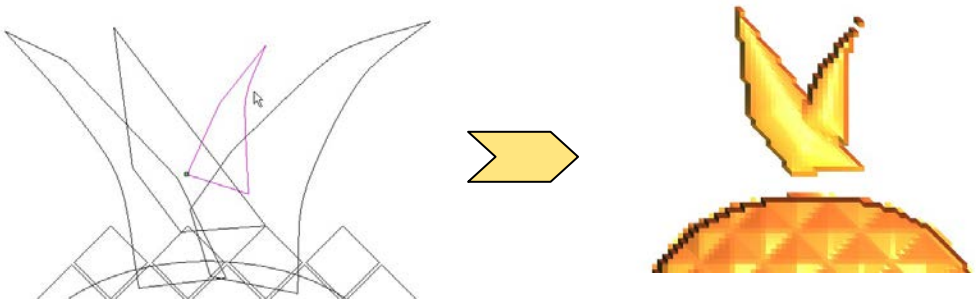


- Double click the **round pineapple vector**. In **Shape Editor**, select **Zero Rest**.
- Close the form.

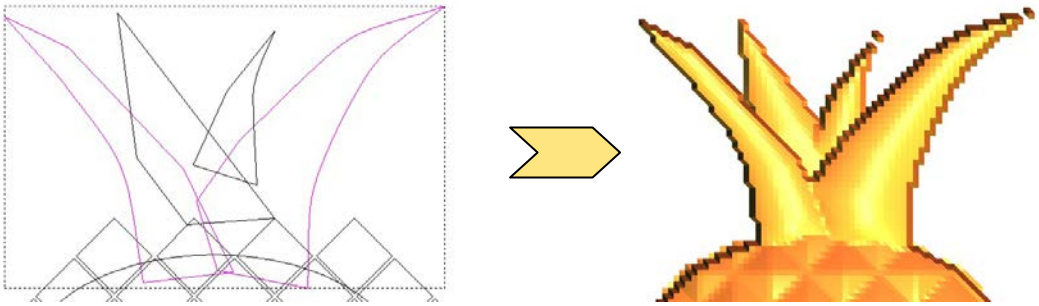
- Use the left middle leaf vector and generate an **Added Dome Relief** with an **Angle** of **45 degrees**, **Start Height** of **0.1mm** with **No Limit selected**.
- Select **Close**.



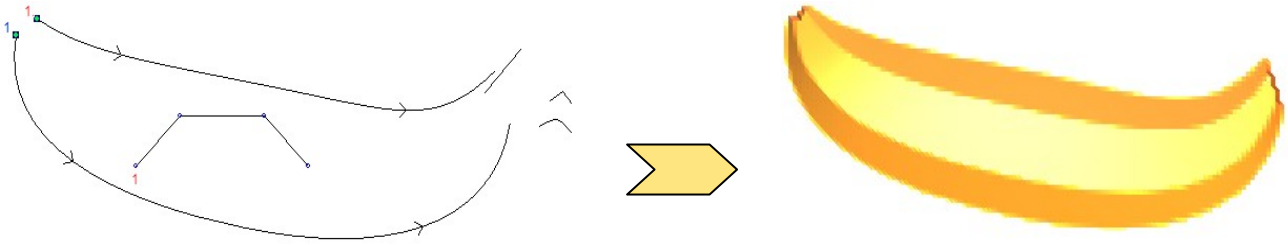
- Use the right middle leaf vector and generate a Merge High Dome Relief with an **Angle** of **45 degrees**, **Start Height** of **0.2mm** with **No Limit** selected.
- Select **Close**.



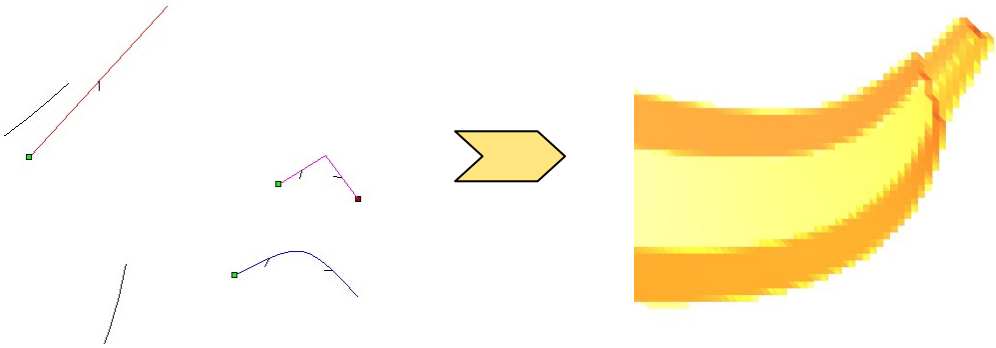
- Use the **outer leaf vectors** and generate a **Merge High Dome Relief** with an **Angle** of **45 degrees**, **Start Height** of **0.4mm** with **Limit** to **Height** at **1mm**.
- Select **Close**.



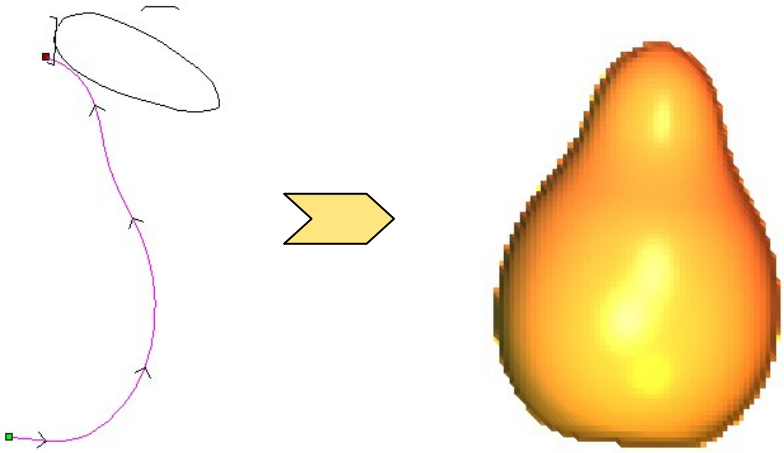
- Select the **three vectors** for the banana and generate an **Added Two Rail Sweep Relief** .



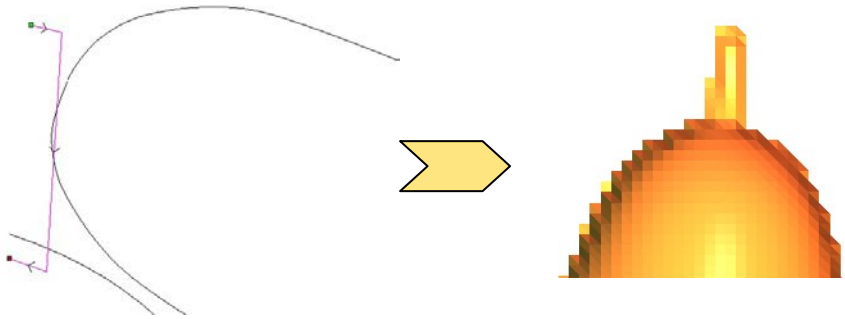
- Generate an **Extruded Relief** using the line as a **Drive Curve**, the arch as the first section and the angle as the end section. Select **Merge Highest**.



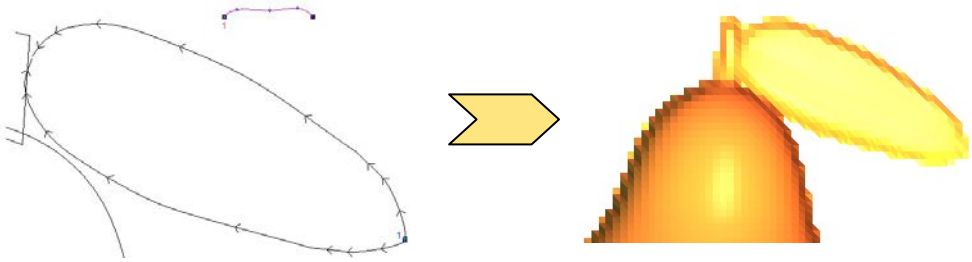
- Select the **pear shape vector** and generate an **Added Turn Relief**.



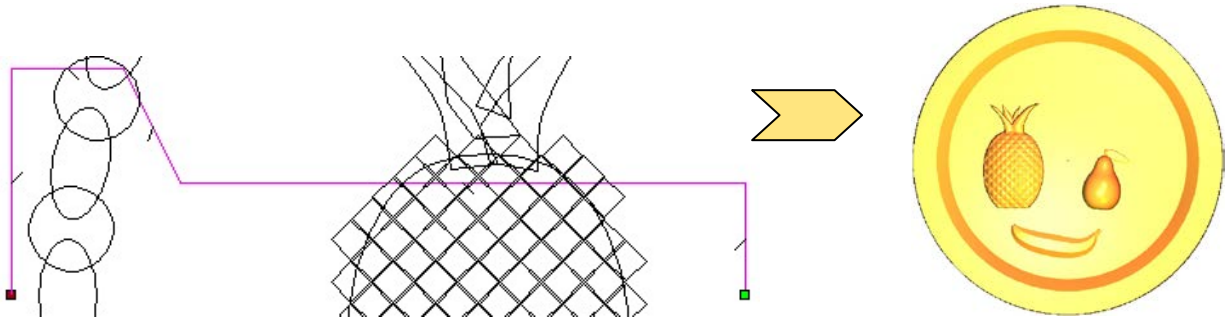
- Select the **stalk vector** of the pear, and generate a **Merge Highest Turn Relief**.



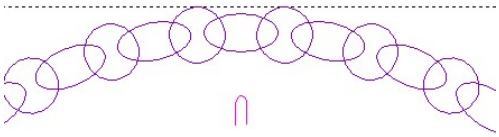
- Use the **leaf vectors** and section to generate a Merge Highest **Two Rail Sweep Relief**.



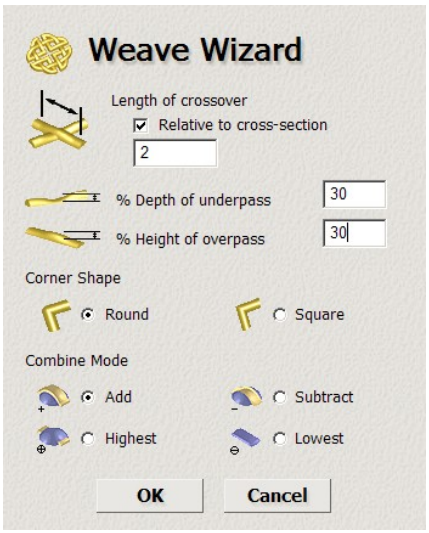
- From the main **Polyline** vector, **Add** a **Spin Relief**, with the option **Invert curve** in **Z** selected.

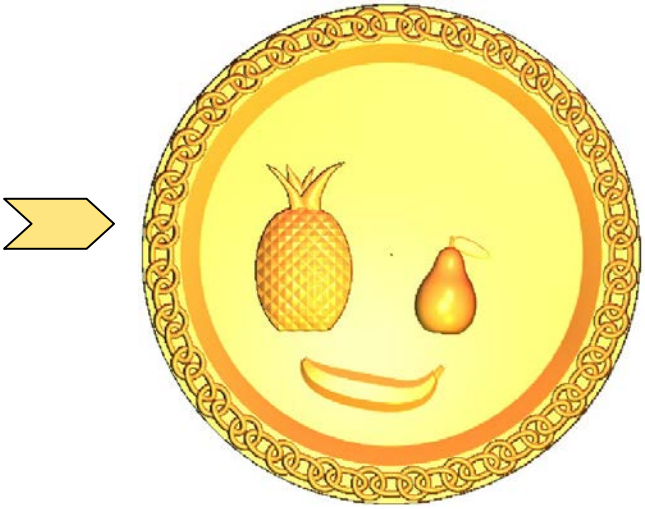


- Select the **grouped chain** design of **vectors** and then the nearby **small vector**, as shown below.



- **Add** a **Weave Relief** with the following values and select **OK**.





- Select the **Text fruit** and generate an **Added Pyramid** relief with **No limit** and a **Start Height** of **0** and an **Angle** of **60 degrees**.

- View the final **Relief**.

FRUIT

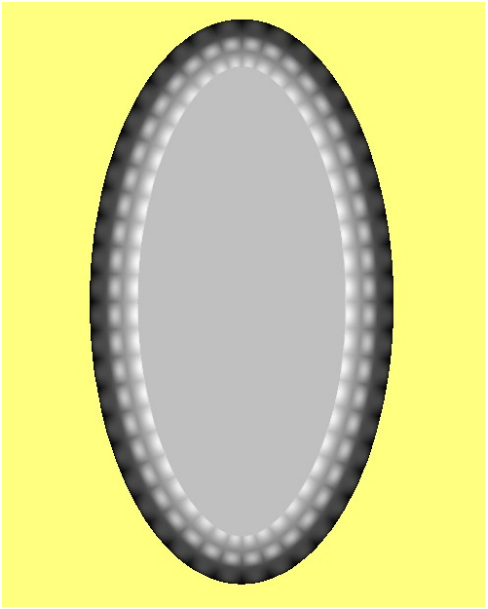
9. 3D Clipart and Texturing

3D Clipart

The **3D Clipart** dialog box opens when the user imports an existing externally stored **Relief** using the **Paste Relief from A File** option. The **3D Clipart** form enables the **Relief** to be **scaled**, **re-positioned**, **re-orientated**, **copied**, etc. Before being combined into the current model.

Lady Exercise

- Select **Open Model**.
- Open **Pend_frm.rlf** from: **D:\users\trainingArtCAM Data**.

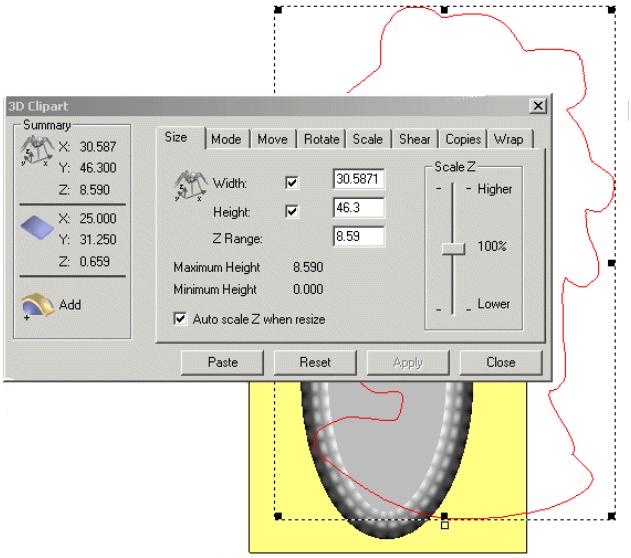


On opening the **Relief**, **ArtCAM** automatically generates both a **Bitmap** (colour) and **Greyscale** representation in the **2D view**.

The **model size** and **resolution** is the same as the imported **Relief** before it was originally exported from **ArtCAM** as a **.rlf** file.

This summary can be seen at the top of the **Assistant tab**.

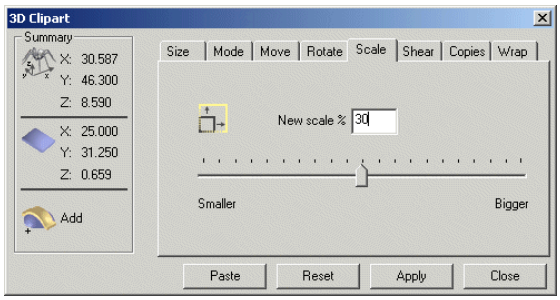
- Select **Paste Relief from a File**, from the **Relief Tools area**.
- Browse and select the file **Lady.rlf** from the **D:\users\trainingArtCAM Data** directory and select **Open**.



The **3D Clipart** form and a vector outline of the imported relief appear in the **2D View**.

A **Preview** of the **Relief** is displayed as a **vector outline**, and is currently too large. It will be transformed, sized and positioned, using the **3D clipart** form before being **Pasted** onto the existing model.

- Select the **Scale** tab.
- Enter the **New Scale** as **30%**.
- Select **Apply**.

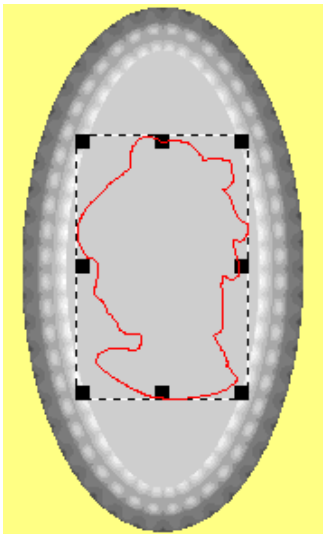


The **Relief** could also be scaled manually by dragging the corner handles of the relief vector, with shift held down to maintain the proportion.

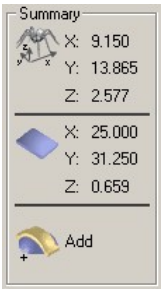
Now the **vector** (and associated relief) can be moved to the centre of the pendant.

- Move the cursor on the vector outline so that **Move Cursor** appears.
- Select the **Left** mouse button and move the mouse to ‘drag’ the **Relief**.
- Release the button when the **vector** is suitably positioned.

(**Note:** Keyboard shortcut to **centre in page** is **F9**).

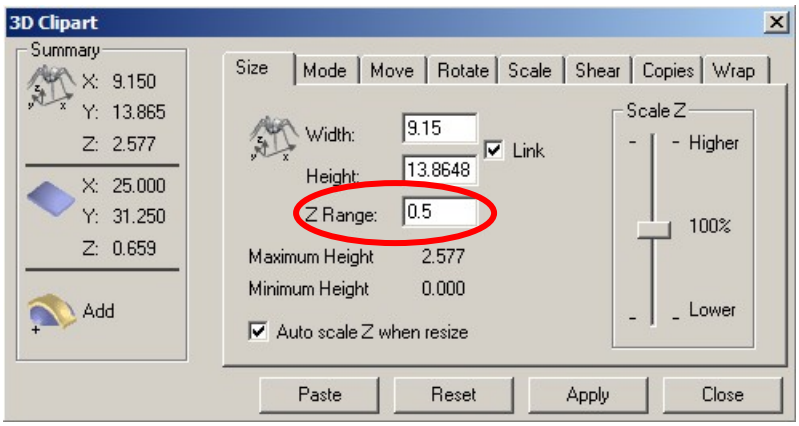


Now that the **Clipart** is suitably positioned, the inherent **Z Range** value can be altered to provide independent control to the final **Z height** of the new **Relief**.

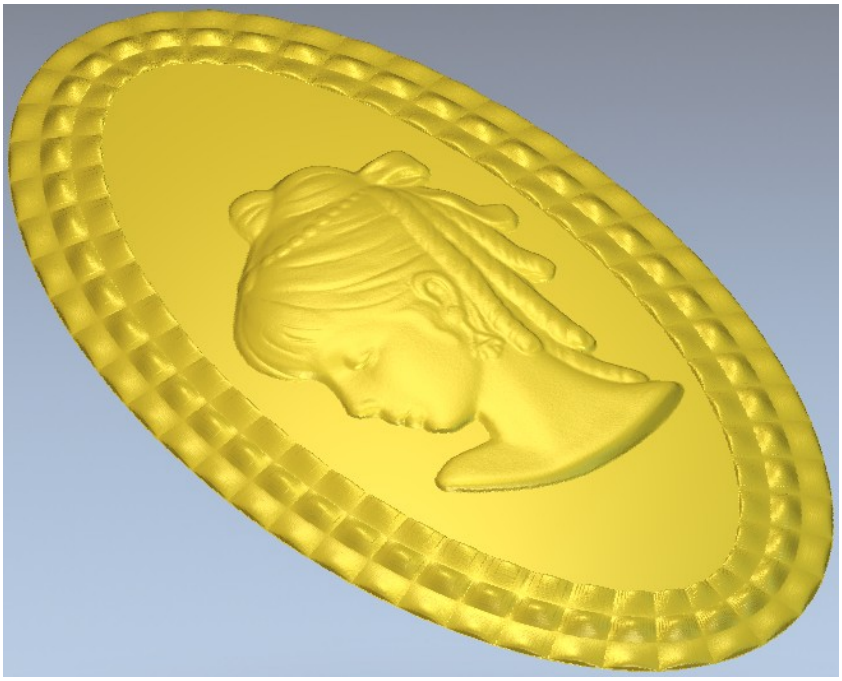


The **Clipart** summary shows the **vector Relief height** as nearly **2.6mm** with the **current Relief** at nearly **0.7mm**.

- Click the **Size** page on the **3D Clipart** dialog box.
- Input a value of **0.5** in the **Z Range** box to control the new **Relief height** and select **Apply**.



- Click the **Mode** tab on the **3D Clipart** dialog box.
- Ensure that the **Add** mode is selected, click the **Paste** button, and then **close** the **3D Clipart form**.

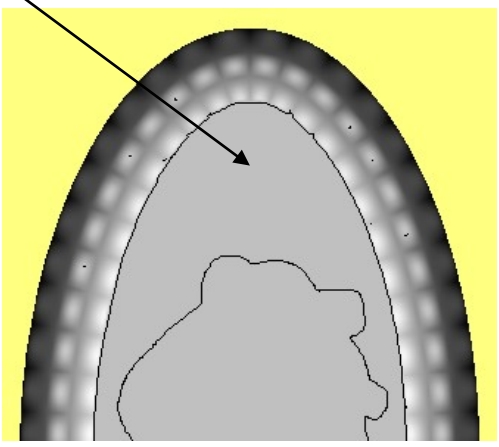


The new **Relief** has been **added** to the original pendant adding an additional height value of **0.5mm** to the model.

Texture Relief

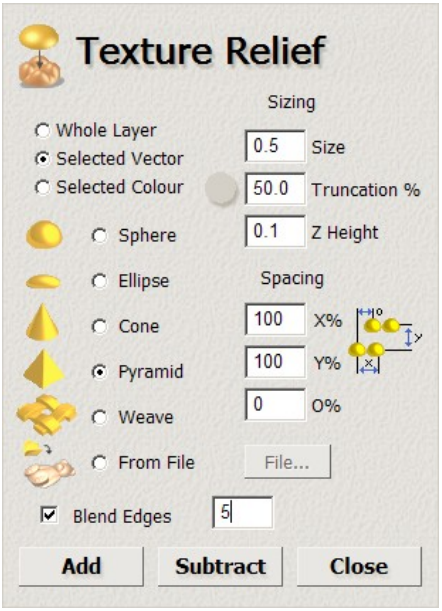
A Texture will be applied between the head and the outer frame. To define this area, a **vector** can be created around the central mid-grey coloured area. A **vector** around the profile of the head was created during the last **clipart** operation. The **Texturing** will be created between the **two vectors**.

- In the **Bitmap** view, **double click** within the **grey colour shown.**
- **Close** the Shape Editor form. The selected **grey colour** is now assigned as the **Primary colour**.



The grey colour also applies to other tiny areas and as a result several additional **vectors** are created, but these can be ignored.

- Select **Bitmap To Vector** .
- Select **Create Vectors**.
- Shift Select the **new oval outer vector** and the **inner head vector**.
- Select the **Texture Relief** .



The **Texture Relief** dialog appears:

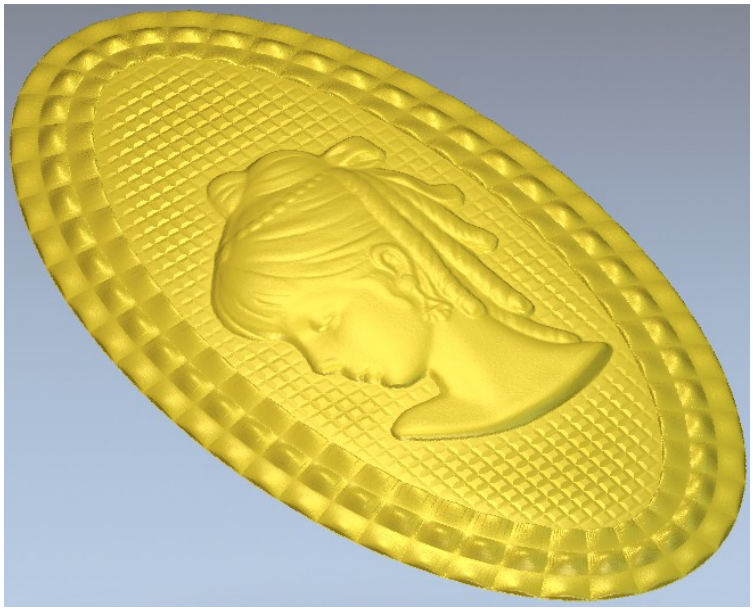
This dialog box allows the selection of several **pre-defined** textures including **Sphere, Ellipse, Cone, Pyramid** and **Weave**.

Other options provide the user with **Sizing** and **Scaling** capabilities to adjust the **Texture** exactly to the desired form.

The **From File** option enables a user defined **Relief or** even **Bitmap** to be imported for use as a **Texture**.

If selected, **Blend Edges** allows the input of a fading distance from the **vector** into the **Relief** area from **zero** to the full **Texture - Z Height**.

- Enter the details into the form as shown above. Select the **Pyramid shape**, enter the **Size** as **0.5mm**, the **Truncation** as **50%** the **Z Height** as **0.1mm** and select the option **Blend Edges**, entering a value of **5mm** and select **Add**.



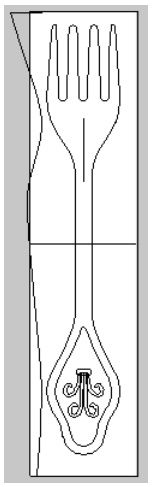
- Select **File** - **Save As**, enter the **File name** as **lady head pendant** and save it in: **D:\users\training\COURSEWORK\ArtCAM JewelSmith-Jobs**.

Paste Relief Along Vector

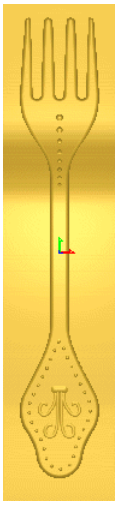
Paste Relief Along Vector on the **Relief Tools** allows several copies of the **3D Clipart** to be pasted along a selected vector.

Fork Exercise

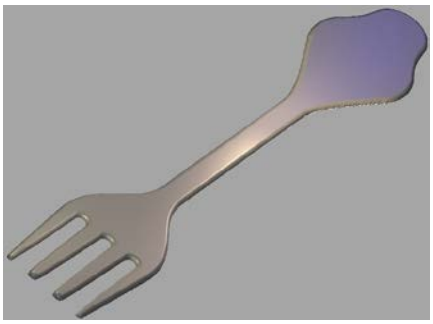
- Open the model **fork.art** from: **D:\users\training\ArtCAM Data**.



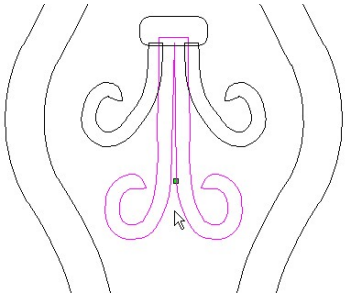
This model contains the **vectors** to generate a fork shape. It also contains some additional **vectors** along which a Jewel **Relief** will be pasted.



- Select the main **fork vector** and generate an **Added Dome** relief with an **Angle** of **90 degrees** and with a **Limit to Height** of **1.5mm**.

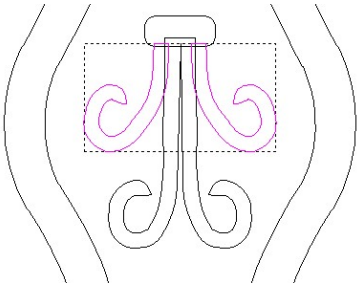


- Select the **bottom curved vector** of the decal.



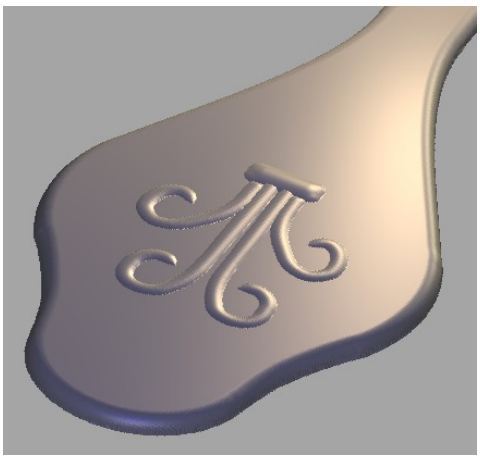
This decal will be added onto the main flat fork relief.

- Generate an **Added Dome** profile with an **Angle** of **30 degrees**.

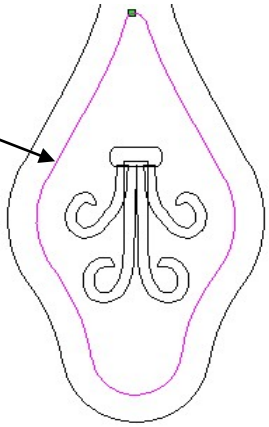


- Select the **two side curled vectors**.
- Define a **Dome** profile with a **Start Height** of **1.5mm**, an **Angle** of **30 degrees** and select **Merge High**.
- Select the **oval vector** and define a **Dome** profile with a **Start Height** of **1.5mm**, **Angle** of **30 degrees** and **Merge High**.

- View the relief.

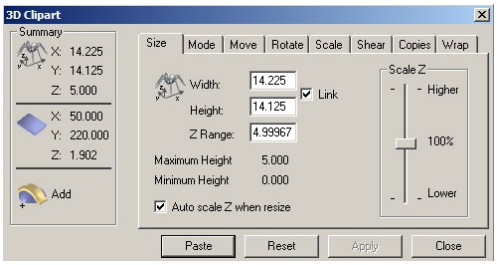


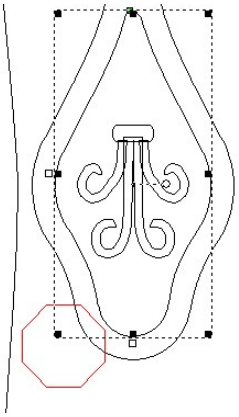
- **Select** the **inner closed vector** around the decal as shown.



An imported Relief will be pasted along the centre of this selected vector. As with **Paste Relief from a File**, This relief can also be modified prior to pasting.

- From the Relief tools area, select **Paste Relief along Vector** .
- Select the relief **Jewel.rlf** from the **ArtCAM Data** folder.

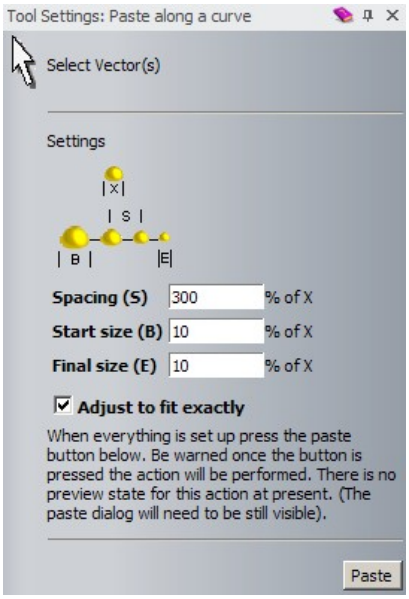




The **vector** outline appears in the **2D View** and the **Paste along a curve** page appears in the **Tool Settings Tab** along with the **3D Clipart** dialog box in the graphics area. The **3D Clipart** box is not used in this case as the **Mode** is already set to **Add**. It must remain open until the **Paste along a curve** process is completed.

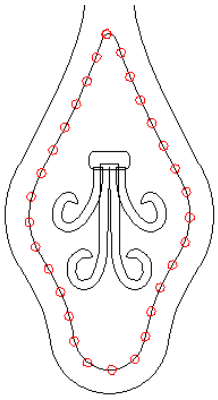
The **Spacing** setting in the **Assistant** page allows you to define the space between adjacent copies of the clipart. 100% means they will be next to each other, less than 100 means they will overlap, and greater than 100 means there will be a gap.

The **Start size** and **Finish size** define the sizes of the **Relief** at the start and end of the curve. By making the sizes different, **ArtCAM** will scale the clipart automatically from one size to the other.



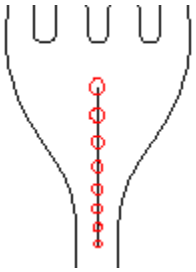
- In the **Paste along a curve** page, set **Spacing** as **300%**, **Start** and **End size** as **10%** and select **Adjust to fit exactly**.

- Select **Paste**.
- Do not close either the **Paste along a curve** or the **3D Clipart** dialog boxes.



The **vectors** indicate where the **new Reliefs** have been **added** to the **original Relief**.

- Select the **vertical vector** in the middle of the fork.
- In the Paste along a curve form, change the **Spacing** to **200%**, a **Start size** of **10** % and an **End size** of **20**%.
- Select **Paste**.

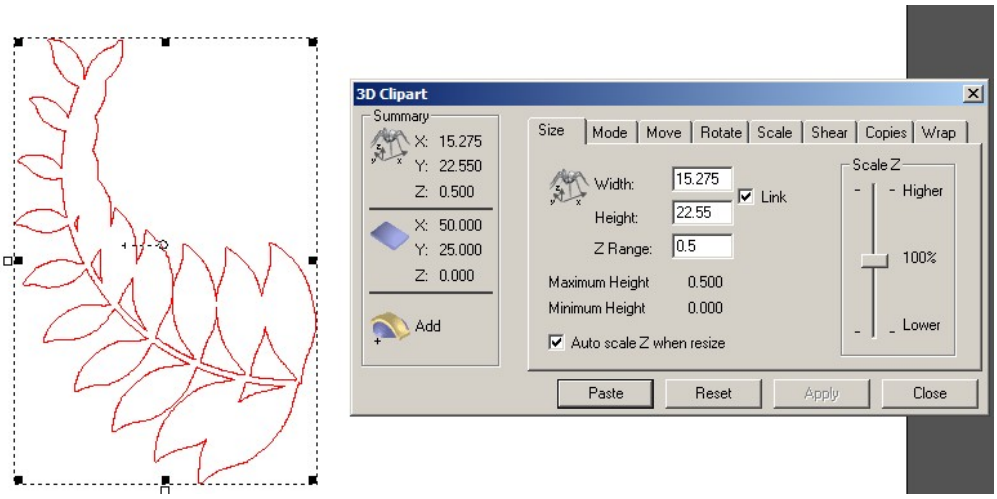


The gem details have all been added.

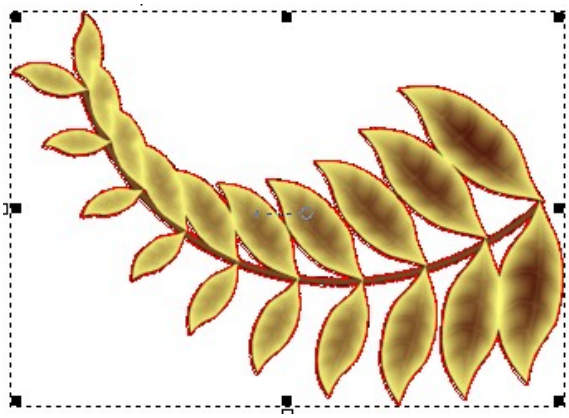
- Close the **Paste along a curve** and **3D Clipart** dialog boxes.
- View the results.

Motif Exercise

- Create a **New Model** with a **Height** of **25mm, Width** of **50mm** and **origin in the centre**.
- Select **Paste Relief from a File** and open the Relief **Leaves.rlf** from **D:\users\training\ArtCAM Data**.



- Select the **Rotate** tab on the **3D Clipart** dialog.
- Enter in the **Rotate by angle** field an **Angle** of **-40 degrees** and select **Apply**.
- Select the **Mode** tab, followed by **Add** and then **Paste**.



The vector rotates to reflect the change in Angle.

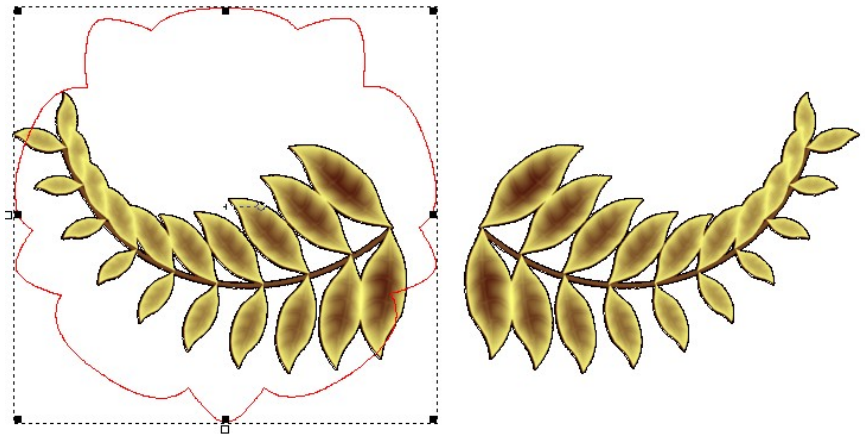
When the **Paste** box is selected, the new **Relief** is Added to the model page. The 3D clipart form remains open by default in anticipation of further pasting operations.

- In the **Rotate** tab, select the **Horizontal** button.

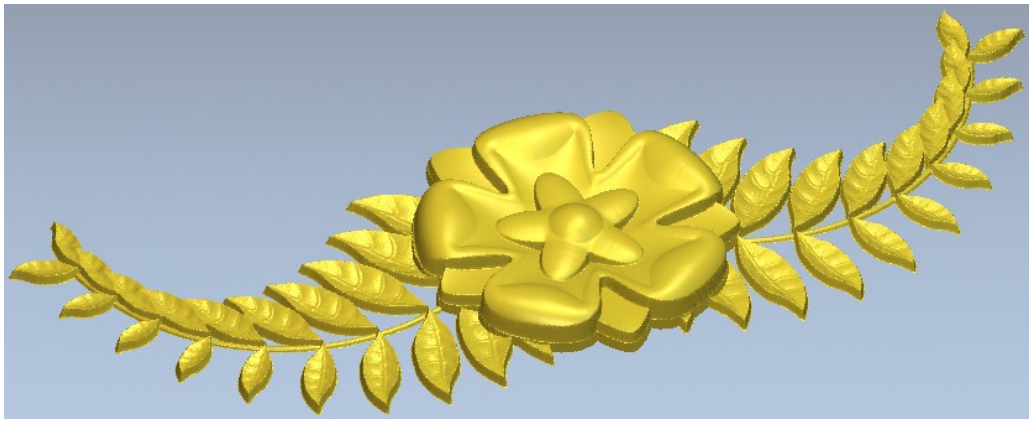
- Switch to the **Move** tab and set the **Move X origin by** field to **25**. Select **Apply** followed by **Paste**.
- **Close** the form and view the results.

Pasting a relief can also be accessed from the **main drop down**. The Motif will now be completed by adding a central flower relief.

- Select **Reliefs** - **Import** from the top menu bar and import **Flower.rlf** from the **ArtCAM Data** folder.



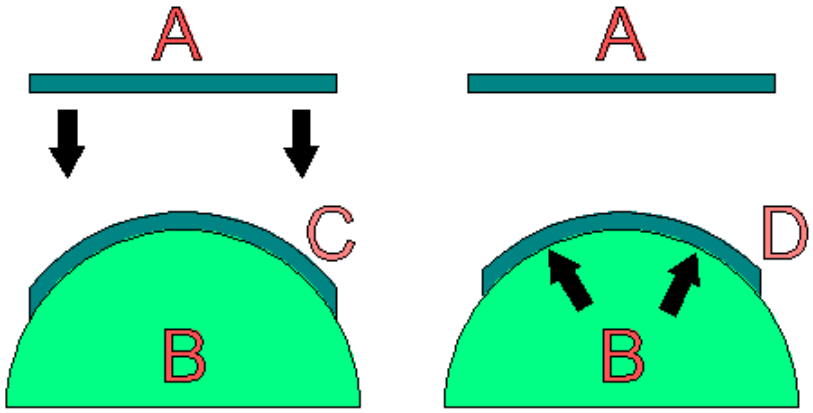
- Select the **Scale** tab on the **3D Clipart** dialog and set the **new scale %** field to **60%**. Select **Apply**.
- In the **2D View,** select and **drag** the **vector outline** of the flower **between** the **leaves**, as shown in the image below. (or press **F9** to centre in page)
- On the **Mode** tab, select a **Start Height** of **0.5mm** and the **Mode** as **Merge Highest**.
- Click **Paste** and then **Close**.



- Select **File** - **Close Model** (save if desired).

Relief Wrapping

When a **Relief** is added onto a surface it is normally projected down the **Z-axis**. A **Relief** can also be wrapped onto a surface within the **3D Clipart** or **Vectors** can be wrapped onto the surface. The process of **Wrapping** will 'bend' the **Relief** to wrap around the model without changing its overall size. (Minimise distortion)



In the above diagram the **vector A** is wrapped onto the **relief B**.

On the **left hand side**, the **vector** is **not wrapped** but is simply projected **down Z** and therefore the finished **vector C** is **distorted** as it goes over the curve.

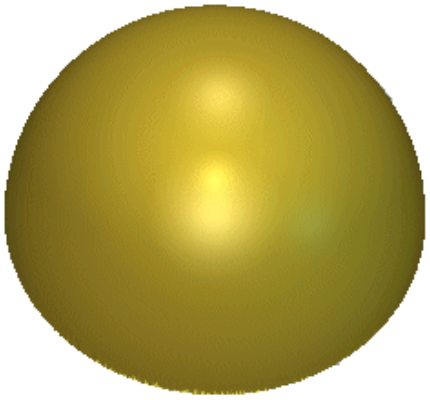
On the **Right hand side** the **vector** is **wrapped** to produce **vector D,** which retains the same dimensions along the 3D surface as the original 2D vector.

In **ArtCAM** in addition to projecting down **Z** it is possible to wrap **radially**, such as around a **sphere**, or **cylindrically**, like a tube in the **X** or **Y** direction.

This will be demonstrated with a simple example.

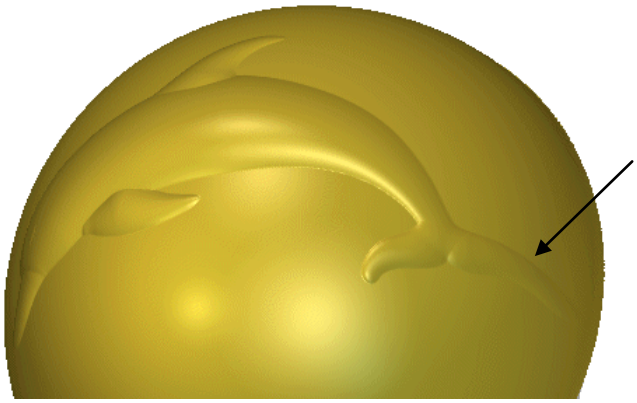
Wrapping Exercise

- Create a **New Model** of size **X 100** and **Y 100** with the **origin** in the **Centre**
- Create a **Circle** of **Diameter 80mm** with the **Centre** at **X0 Y0**.
- Remove the **left half of the circle** using **Node Editing**.
- Create a **Turn Relief** with a **Z Scale Factor** of **1**.



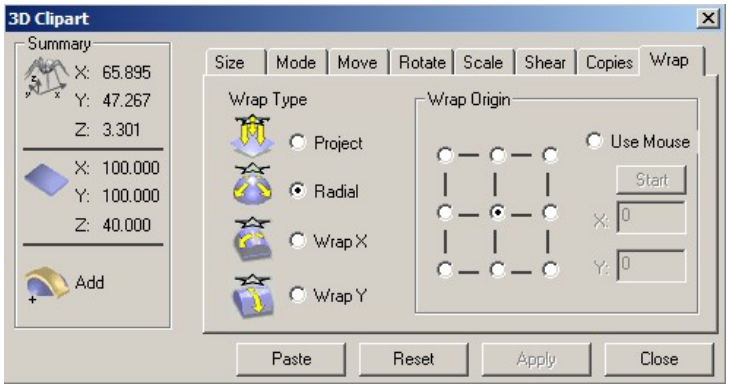
A second **relief will be pasted onto this hemisphere**.

- Select **Paste Relief from a File** and select the **Relief dolphin.rlf** from **D:\users\training\ArtCAM Data**.
- Select the **Scale** tab on the **3D Clipart** dialog and set a **New Scale %** of **125%**. Select **Apply**
- Ensure combine mode is set to **add**, followed by **Paste** (do not close the 3D Clipart form).
- Select the **3D View** to view the **Relief**.



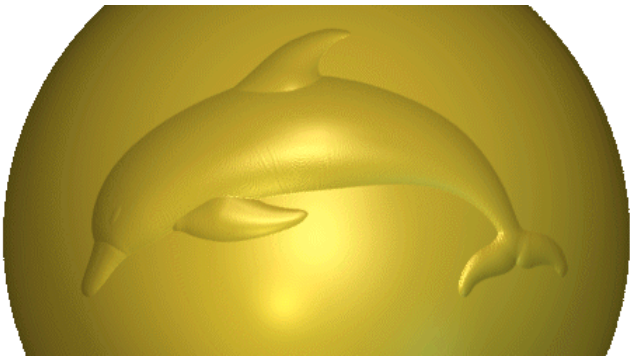
The default option, **project down Z** when applied to a very rounded shape, such as this **Sphere** has caused the resulting relief to be elongated as it is projected onto a steep area. It is especially noticeable on the tail area.

- Select **Undo** (Ctrl+Z).
- On the **3D Clipart** dialog, select the **Wrap** tab.



There are four types of Wrapping - **Project** (default), **Radial** (for **Sphere** shapes), **Wrap X** and **Wrap Y**. The **Wrap Origin** can also be set.

- Select **Radial**, followed by **Paste** and then **Close**.



The dolphin is scaled in such a way as to make it look as though it has been wrapped around the spherical surface, as opposed to simply being projected down Z.

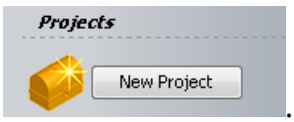
- Close the **ArtCAM** model without saving.

10. Component Library Assembly

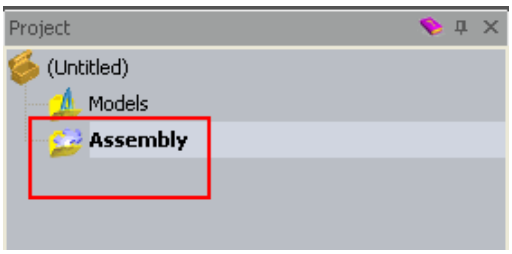
Introduction

In **ArtCAM JewelSmith** a range of standard **Shanks** and **Settings** models are quickly accessible via the **Libraries**.

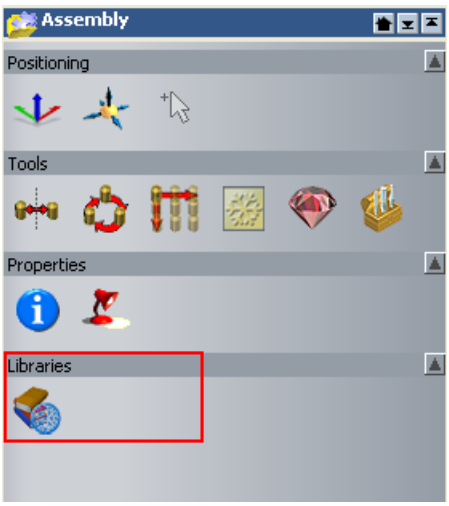
The Setting creation

- Select **Create New Project** 

.

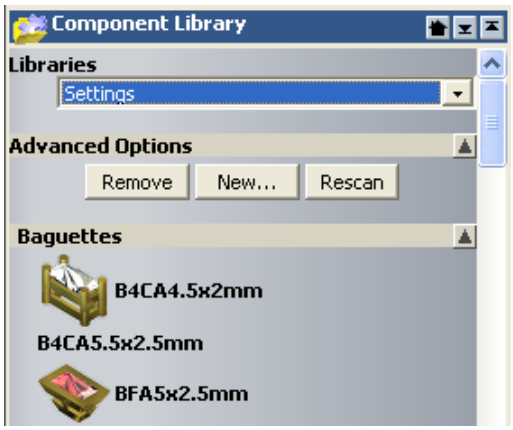


- Select **Assembly** from the root **Project** folder.



- Select **Libraries** from the **Assembly** area.

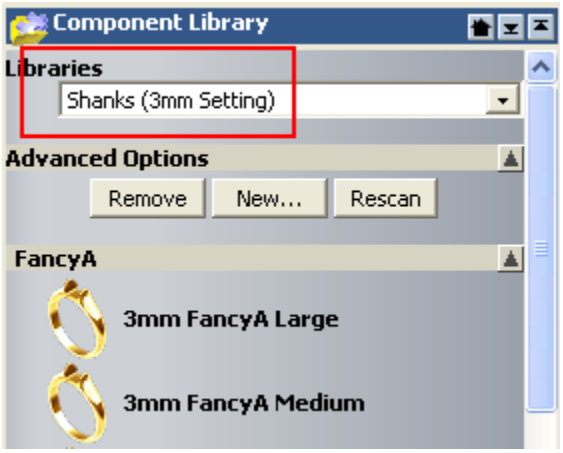
The component library will be visible with a selection of preset gem settings, shanks etc. These are triangulated models in .3da or .stl format and can be positioned and scaled in X, Y and Z.
Available are primitives, settings shanks and bosses in this section and it is possible to add your personal product library here.

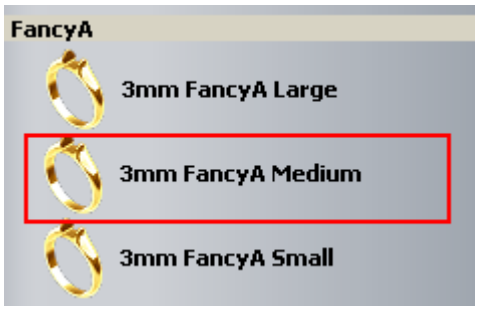


It is possible to select the available libraries by either:

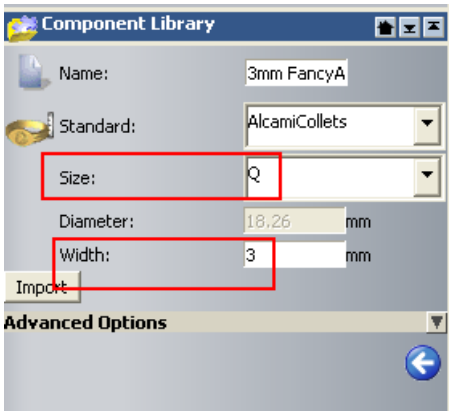
Selecting the **New** and then selecting the drive where the items are stored usually located in: **C:\Documents and Settings\All Users\Documents\ArtCAM Files\Component Libraries** or using the arrow key to select the component library folder of your choice.

- Select **Shanks (3mm Setting)**.





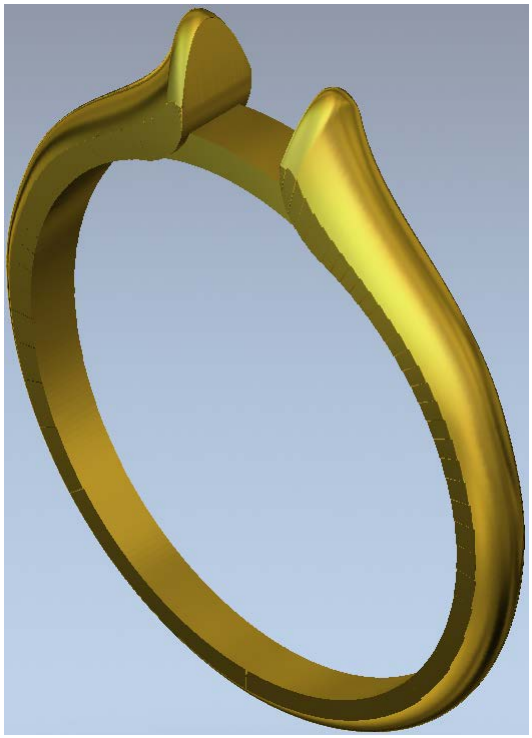
- Select **3mm FancyA Medium** shank.

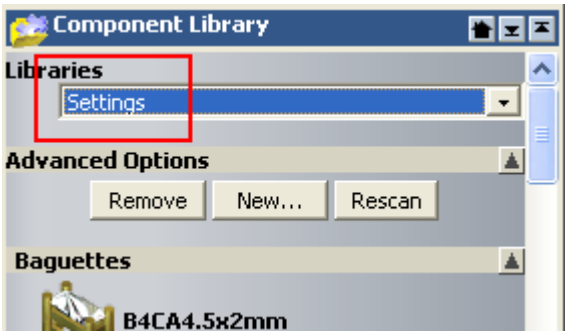


Currently there are 3 range sizes for the rings. Selecting the shank from one of these ranges will ensure a better fit for the required setting.

Small = H to L
Medium = M to Q
Large = R +

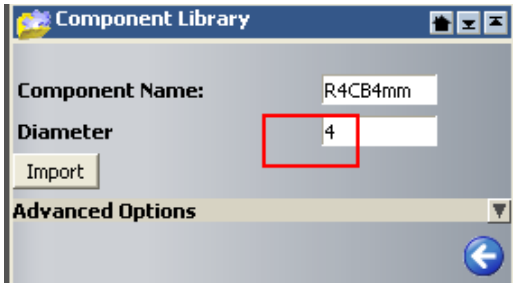
- Select **Size Q** and enter **3mm** for the **Width**.
- Select **Import**.





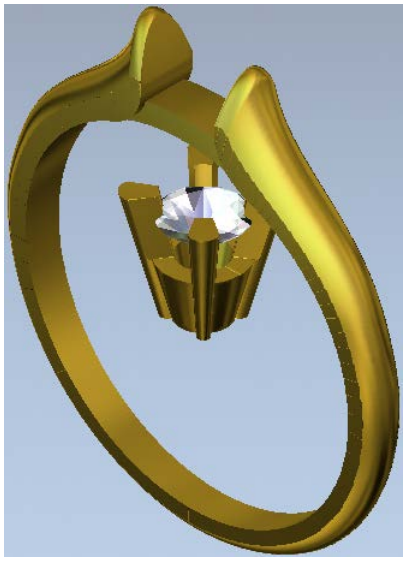
- Select **Settings** from the pull down list.

- Select **Round** setting **RBCB4**.

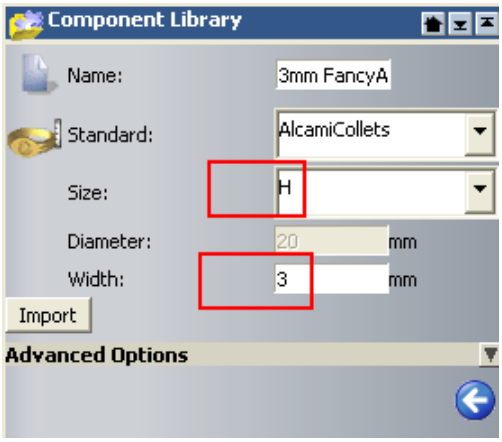


In this section it is possible to set any particular diameter gem stone required.

- Select **Import** with the default **Diameter** of **4mm**.



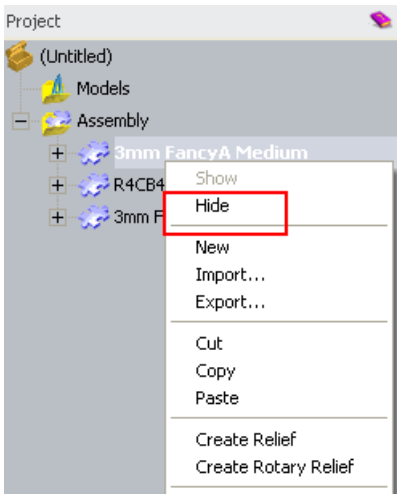
- Select **Shanks (3mm Setting)** from the **Libraries** options.
- Select a **3mm FancyA Small** shank.



- Select **Size H** and **Width** of **3mm**.

The smaller ring should now be inside the larger ring and at the top of the screen in the history tree should be a record of all the items currently selected.

- Move the mouse over the first ring on the list.

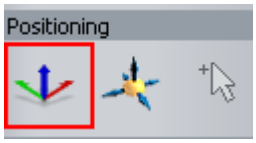


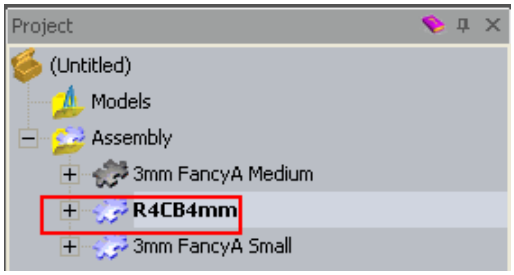
The item then should remain hidden until required again.

- Select **Hide** from the side menu.

The resulting image should be like this.

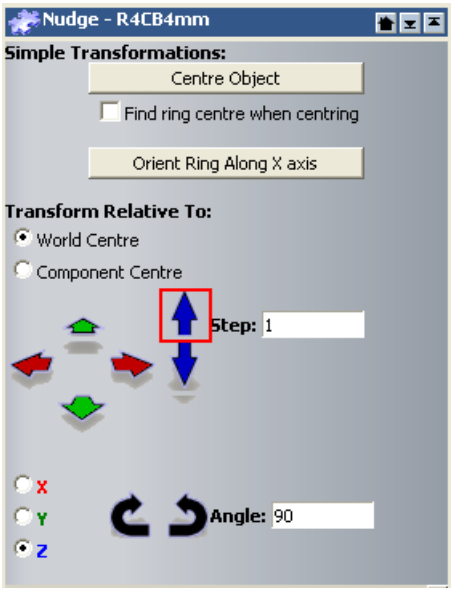
It is now necessary to nudge the claw into position using the positioning options.





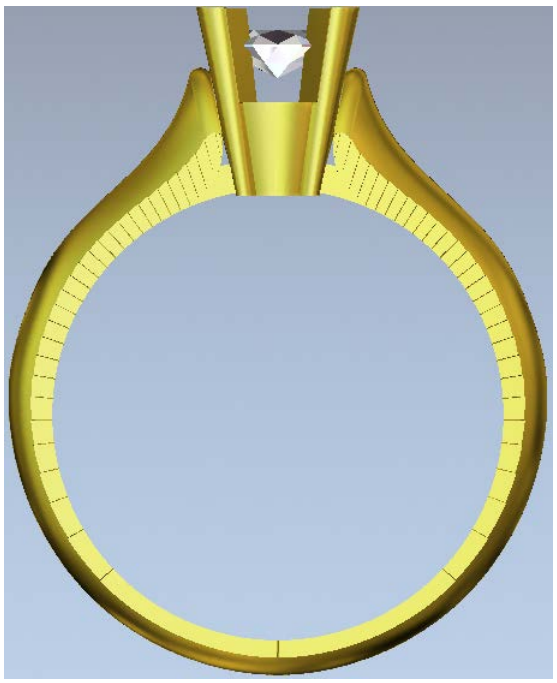
- Select the **Setting** model from the history tree.

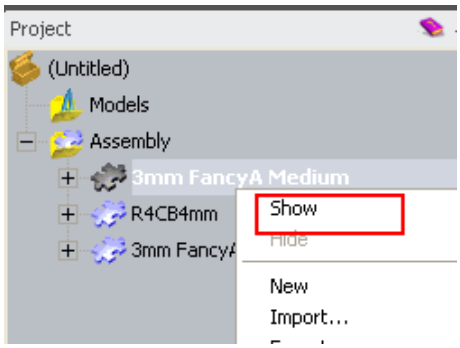
- Select **Nudge** .



- Type **1** into the **Step** value box.
- Select **World Centre**.
- Select the **Up blue arrow** until the setting is leveled with the under bezel of the ring.

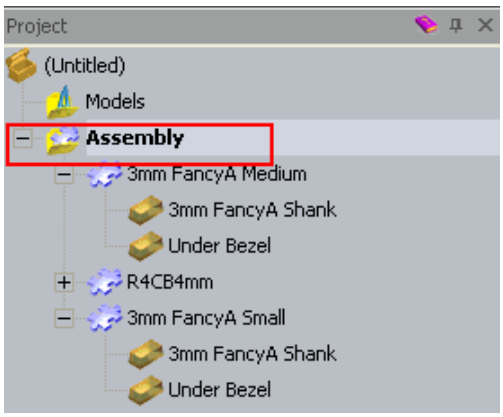
Using the transformation buttons nudge the claw up into position.



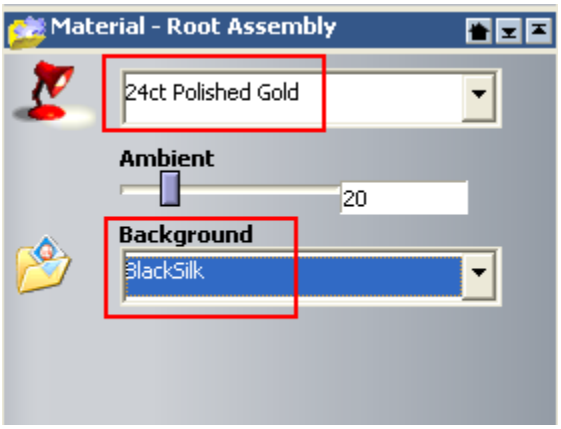


- Select **Show** next to the **3mm FancyA Medium** shank.

- Select **Assembly** from the **Projects tree**.

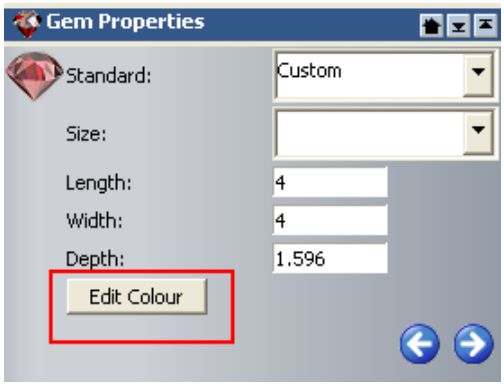


- Double mouse click on the **Edit Object Shading** icon.



- Set up the **Material** and the **Background** as shown on the image above.
- Select the icon to close the **Object Shading** page.

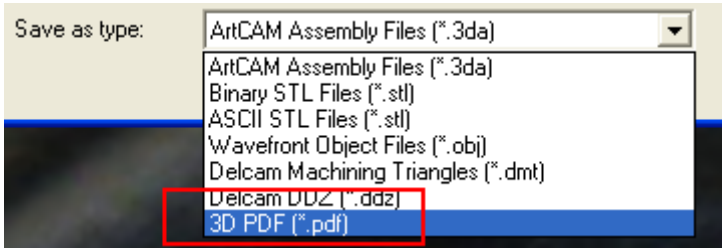
- Select **RoundFlushSettingGem** from the **Assembly** tree.
- Select the icon .



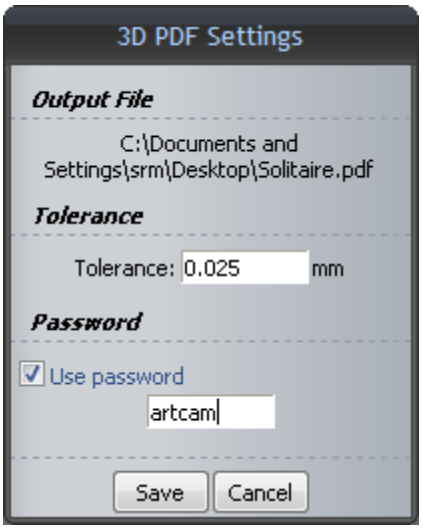
- Select **Edit Colour**.
- Select **Amethyst colour**

.

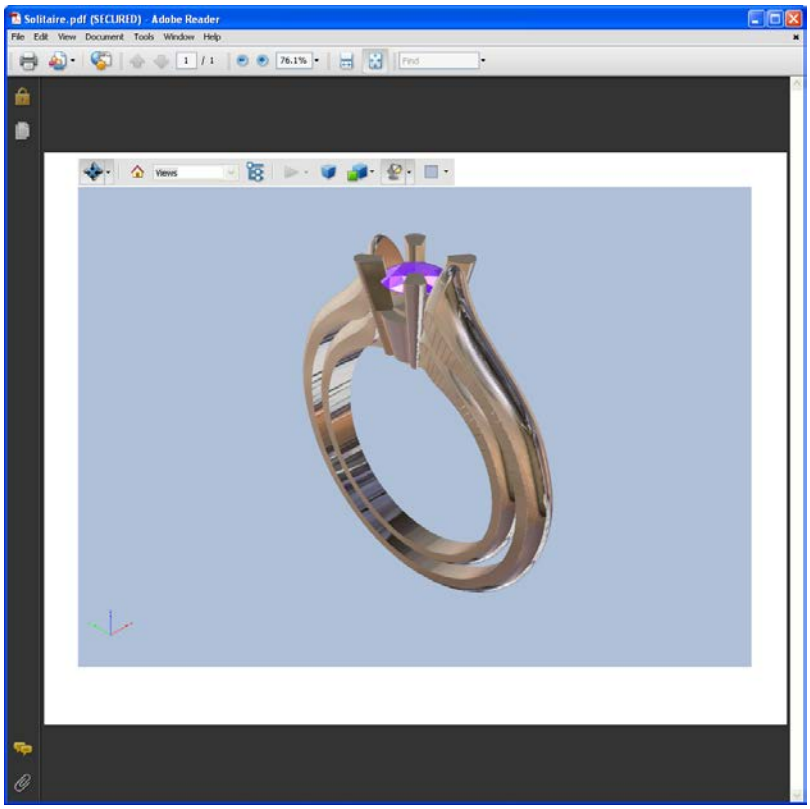
- Right mouse click on **Assembly** to display the right menu.



- Select **Export**, browse to: **D:\users\training\COURSEWORK\JewelSmith-Jobs**, enter the name: **Solitaire** and **Save as type** – **3D PDF** (***.pdf**).



- Select the field **Use password**, enter the password as **artcam** and select **Save**.



By exporting the ring design into the **3D PDF** format, it's easier to send it to the customer via e-mail and quicker to get his feedback.

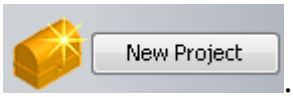
- Open the ***.pdf** document.
- Use the views and the different types of shading to gain a better visualization of the model.
- Select **File** – **Save As**, browse to: **D:\users\training\COURSEWORK\JewelSmith-Jobs** and enter the name **Solitaire**.

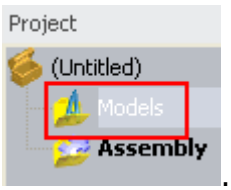
11. Basic Ring design

Introduction

In this chapter you will learn the basics of creating a ring.

Star Ring Exercise

- Select **Create New Project** 

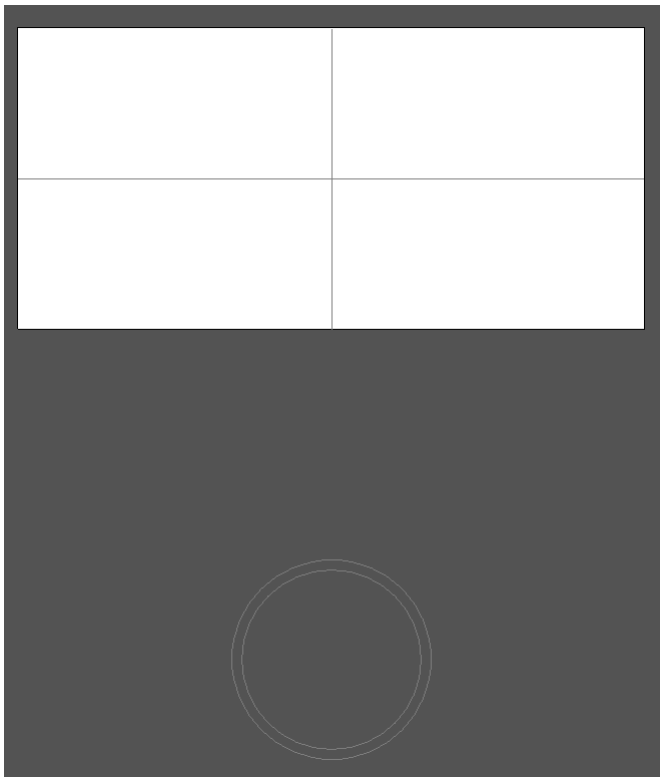
.
- Select **Models** from the root **Project** folder 

.
- Select **Create Rotary Axis Blank** from the **New Blanks** area.

The **Rotary Shank** page allows you to specify the **Size** of the ring using either a **Standard** or **Custom** size.

Note: All ring sizes may have a slightly different **Diameter** and the **ArtCAM** ring diameter is based on an average size.

- Leave the name as **RotaryAxisShank**.
- Select **AlcamiCollets**, **Size P**, shank **Width** of **20mm**, **Border** of **5mm**, **Thickness** of **1mm** and **Resolution** of **40**.
- Select **Accept**.

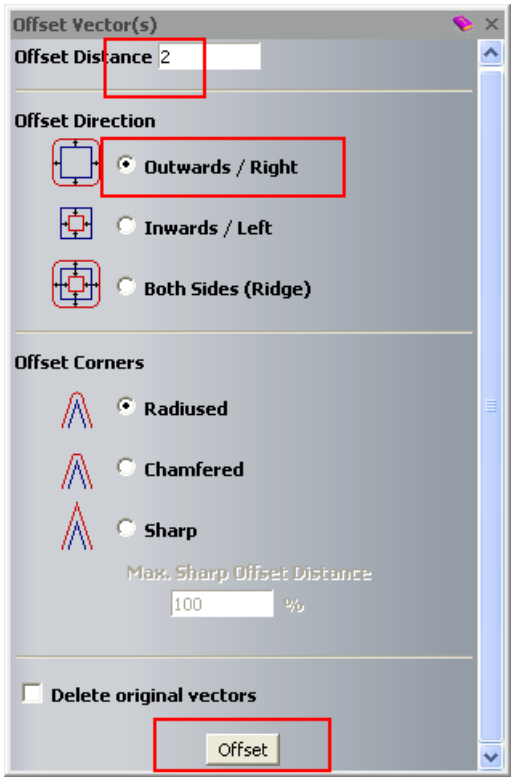


A new **ArtCAM** model is opened called **Rotary Axis Shank** with locked vectors automatically generated in the **2D View**. The length of the **ArtCAM** model is the outside surface of the ring un-rolled. The ring profile is shown below the **Relief** area.

The **X0**, **Y0** position of the ring is always in the centre of the **ArtCAM** model.

You can **offset copies** of the **centre line vectors** to create the correct ring **Shaft Width**.

- Select the **centre horizontal locked vector line**.



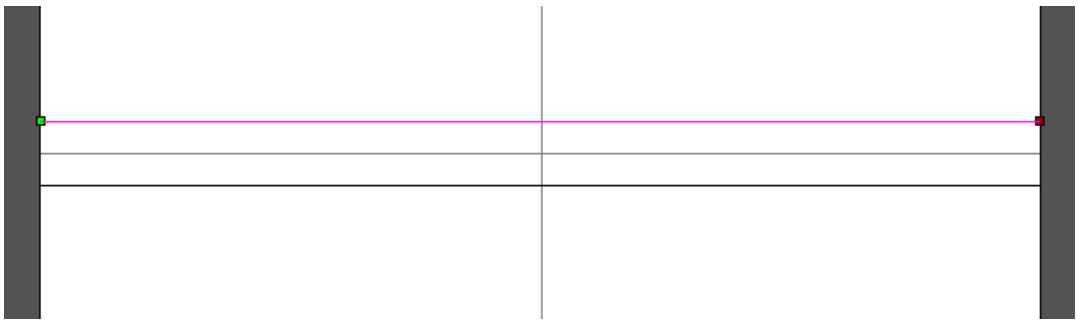
The **Offset Distance** required is **2 mm** either side.
To tell which side the offset will be on an open vector, it depends which way the vector is travelling. By selecting a vector, the start point is shown, indicating the direction.
The **horizontal vector** has a direction going to the right, so an **offset** of **outwards/right** will go below the line.

- Select **Offset Vector(s)** .

- Enter an **Offset Distance** of **2mm** and select **Outwards / Right**.
- Select **Offset**.

You've created a **Line** for the whole **length** of the **Relief**, **2mm** below the **centre line**.

- Select the **horizontal locked vector line**.
- Leave the **Offset Distance** as **2mm** and select **Inwards** / **Left**.
- Select **Offset** and **Close** the form.

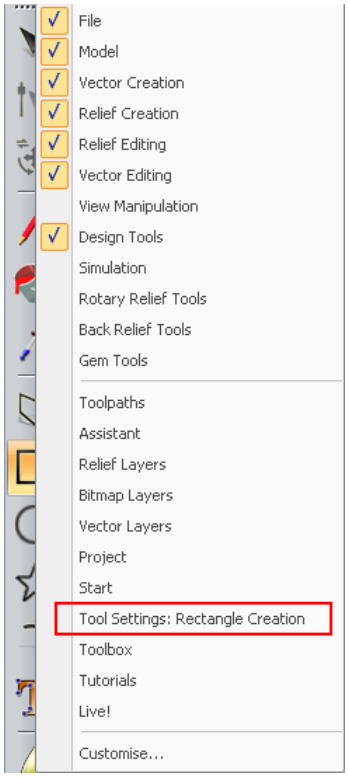


These **Offset** vectors will be considered as **Drive Rails**.

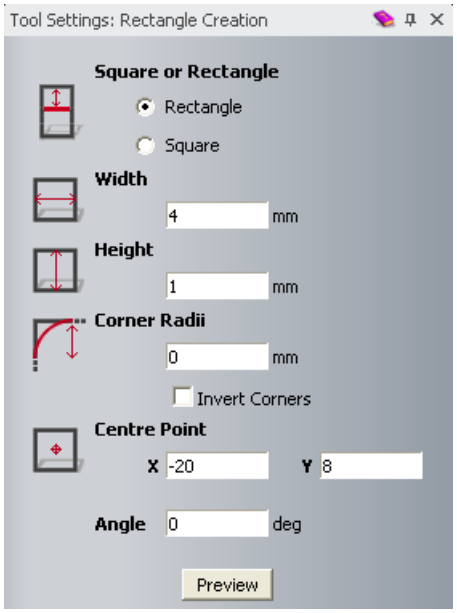
By offsetting the vectors this way, it ensures that they are traveling parallel to one another as they are like **Drive Rails** in a **Two Rail Sweep**. If the **vector lines** went in opposing directions, a twist would occur in the ring **Shank**.

You will now create the ring section by altering a **Rectangular** vector.

- Select **Create Rectangle** .



- Right mouse click on the **left hand corner** of the graphics area.
- Select **Rectangle Creation** .



The **Rectangle** is the basis for the ring section, so the **Width** is the same as the distance between the **Drive Rails** (**4mm**) and the **Height** (**1mm**) the same as the **Thickness** of the ring.

.

- Enter a **Width** of **4mm**, a **Height** of **1mm** with a **Centre Point** of **X–20** and **Y8**.

- Right mouse click on the graphics area to accept the settings for the rectangle and to close the **Rectangle Creation** form.

- Press **N** on the **keyboard** and **Zoom** around the **Rectangle**.

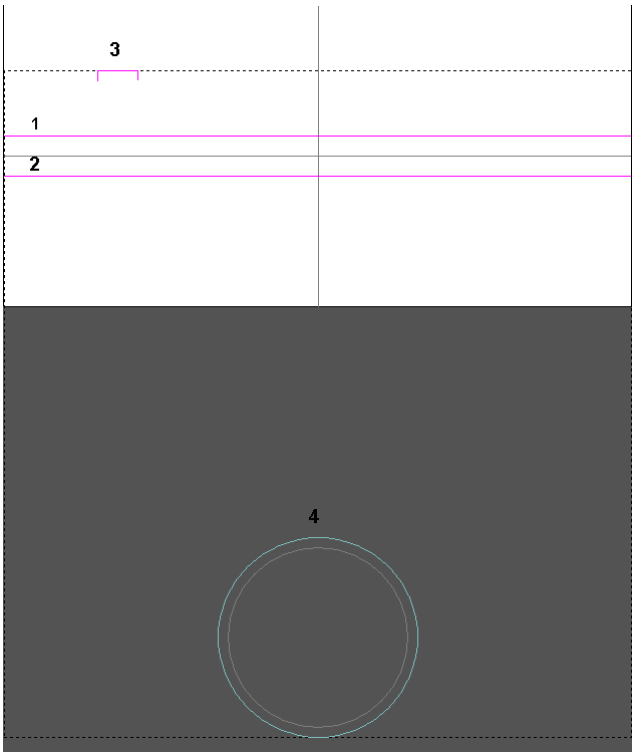
You will **remove** the **bottom span** of the **Rectangle**.

- Move the **mouse** on the **bottom span** and press **R** on the keyboard **Remove Span**.

Note: a ring section must be a **single vector**.

- Select .

You can generate the basic ring shape by using the **Sweep Profile** command.



- Hold down **Shift** and select the **Drive Rail vectors** (**1**, **2**), the **Section vector** (**3**) and finally the **Ring profile vector** (**4**).

- Right mouse click on the **left hand corner** of the graphics area and select **Rotary Relief Tools**.

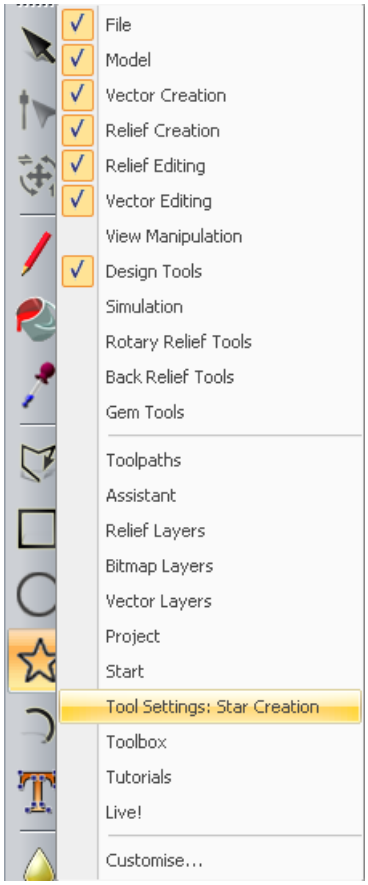
- From the **Rotary Relief Tools** toolbar, select **Sweep Profile** .

- Close the **Rotary Relief Tools** toolbar.
- Press **F3**.

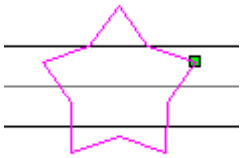
The basic ring is shown.
You can add additional **Reliefs** if required.

- Press **F2**.
- From the left hand toolbar, keep pressing the **Create Polygons** option to display the **Create Stars** option.

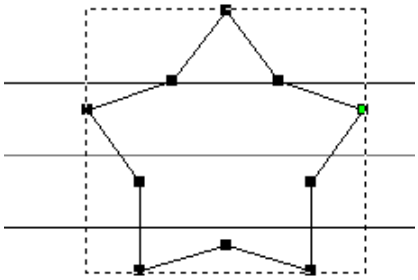
- Select **Create Stars** .



- Right mouse click on the **left hand corner** of the graphics area.
- Select **Star Creation**.

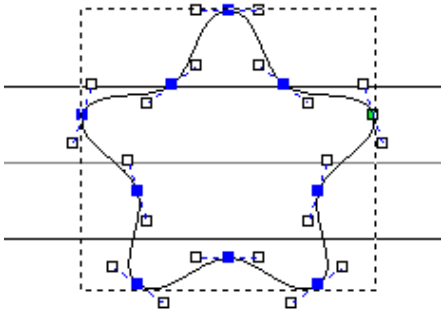


- Select **No. Points** as **5**, **Angle** of **0**, **Star Centre** as **X-8 Y0**, **First Radius** as **4** and **Second Radius** as **2.5**.
- Right mouse click to close the form and accept the star vector shape.



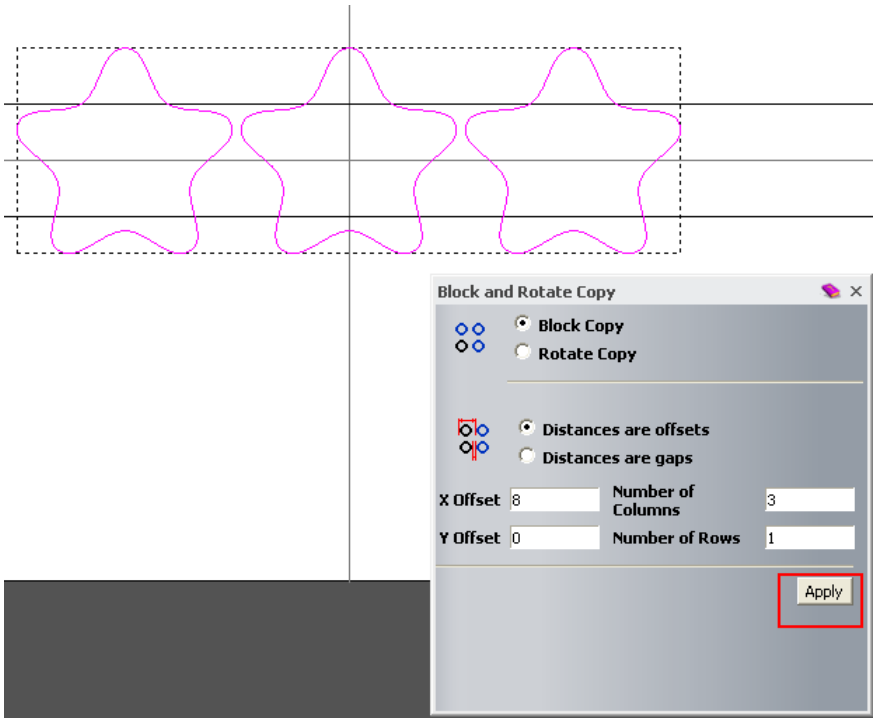
You can **smooth** each **node point** of the **Star** to get a **smooth shape**.

- Select the **Star** vector, press **N** on the keyboard to start the **Node Editing** mode.



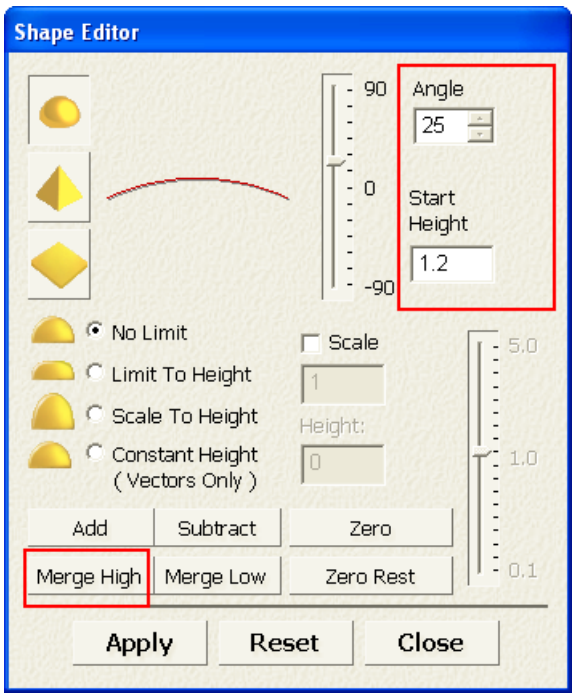
The **Star vector** now contains **Smooth nodes**. You can copy this vector shape, before creating the **Relief**.

- Hover over each node, in turn and press **S** (**Smooth node**) on the keyboard.
- Select .



- With the **Star vector** selected, select **Block / Copy Rotate** .
- Select **Block Copy** and **Distances are offsets**.
- Select **X Offset** as **8mm**, **Number of Columns** as **3**, **Y Offset** as **0** and **Number of Rows** as **1**.
- Select **Apply**.
- Close the form.

- With the **three shaped vectors selected**, press **F12** to display the **Shape Editor** form.

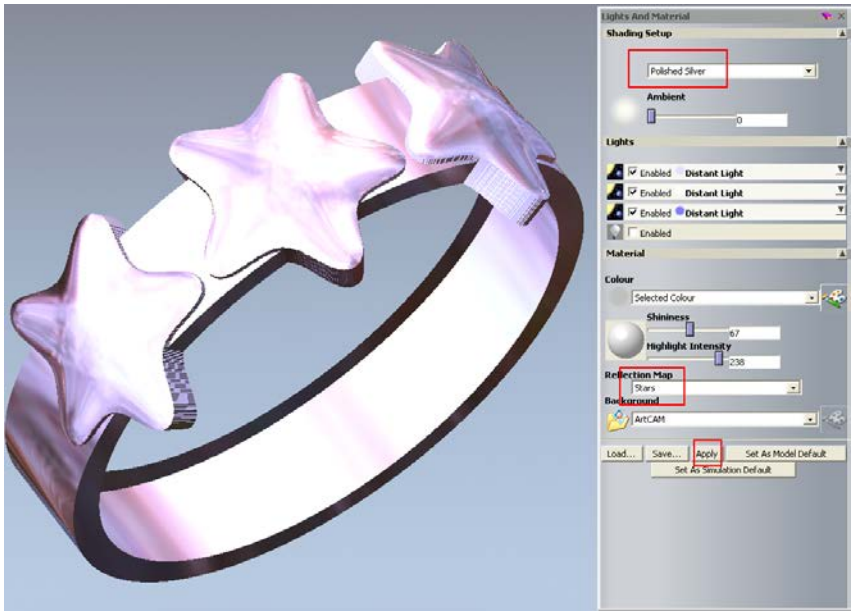


- Select a **Dome shape** with an **Angle** of **25 degrees**, a **Start Height** of **1.2**, **No Limit** set and select **Merge High**.
- Select **Close** and then press **F3**.

The **Star** shapes are placed around the ring, showing that the centre of the unwrapped ring is at the top part of the ring.

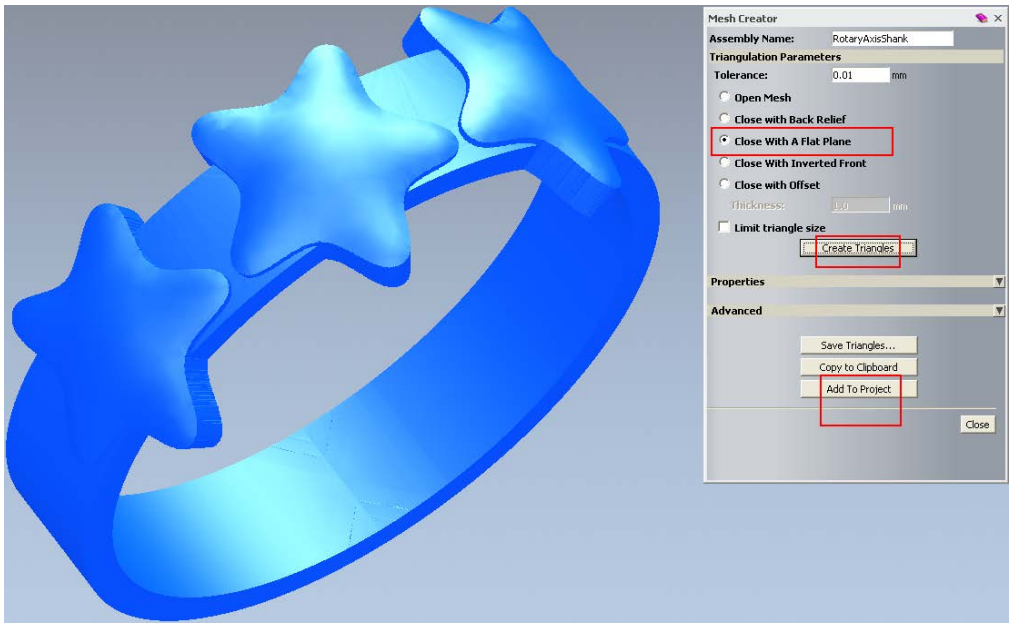
You can visualize the ring in different materials using the **Lights and Materials** option.

- Select **Lights and Materials** .



The ring design is now finished and you can now **add** it to the **Project**.

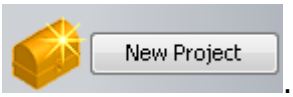
- Select **Polished Silver**.
- Select **Apply**.

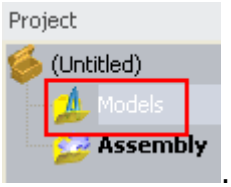


- Select **Create Triangle Mesh** .
- Select the option **Close With A Flat Plane** and then select **Create Triangles**.

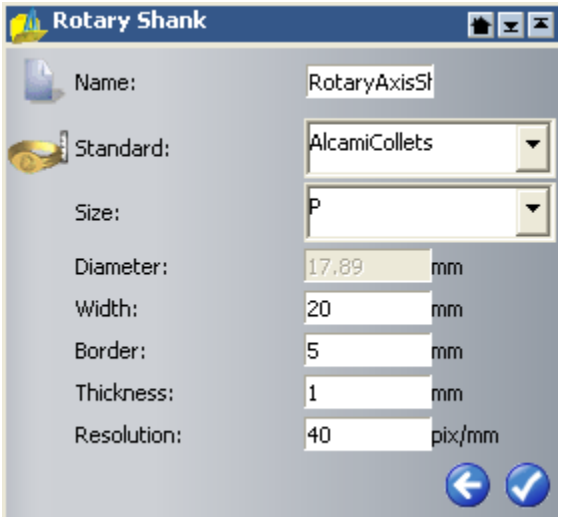
- Select **Add To Project** and then **Close** the **Mesh Creator** form.
- Select **File** – **Close Project**.
- Select **Yes** to update the project with the changes.
- Browse: **D:\users\training\COURSEWORK\JewelSmith-Jobs**.
- Enter as **File name** - **Star-ring** and select **Save**.

Three Metal Ring Exercise

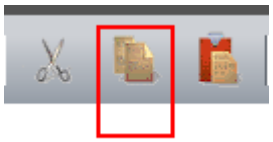
- Select **Create New Project** 

.
- Select **Models** from the root **Project** folder 

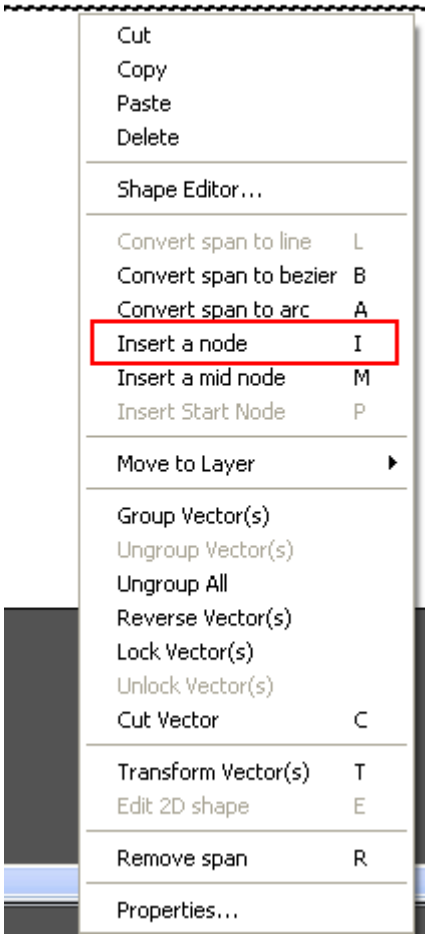
.
- Select **Create Rotary Axis Blank** .
- Leave the name as **RotaryAxisShank**.



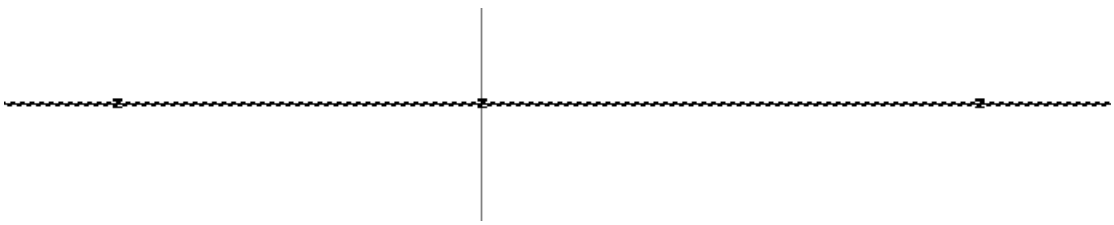
- Select **AlcamiCollets**, **Size P**, **Shank Width** of **20mm**, **Border** of **5mm**, **Thickness** of **1mm** and **Resolution** of **40**.
- Select **Accept** .
- Select the **centre horizontal locked vector line**.



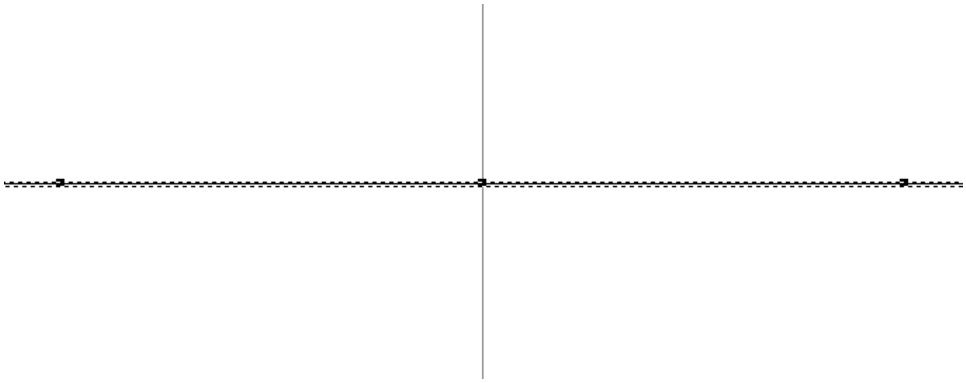
- Select **Copy** and then **Paste** .
- Select **Node Editing** .



- Insert **3 new points** by hovering over the line and right mouse click on it to display the point menu.

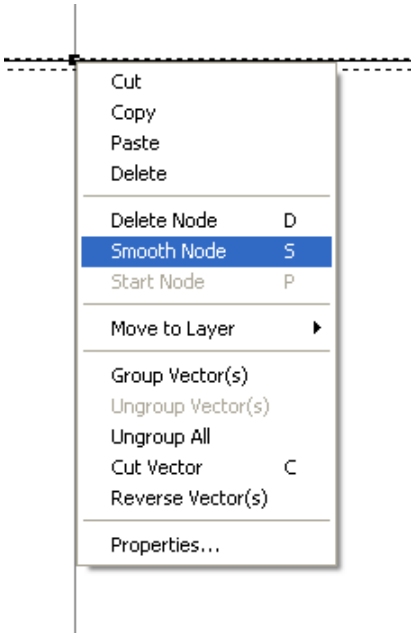


You will change the position of these points to suit.

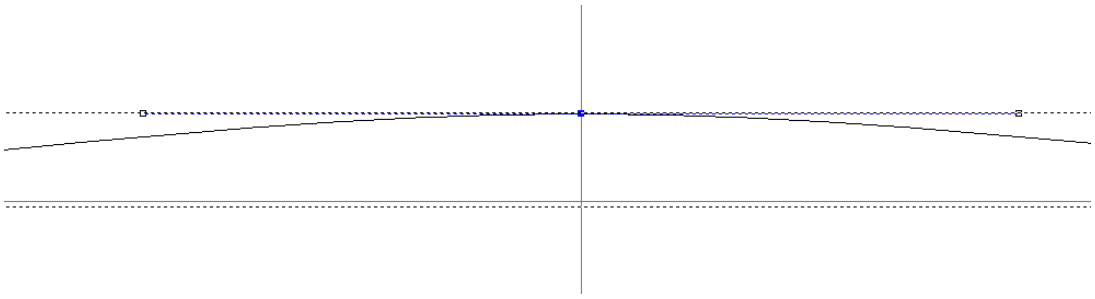


- On **point 1**, select **Properties** from the **right** mouse button menu and change the **X coordinates** to be **–15**, **Y**=**0**.
- On **point 2**, select **Properties** from the **right** mouse button menu and change the **X coordinates** to be **0**, **Y**=**0**.
- On **point 3**, select **Properties** from the **right** mouse button menu and change the **X coordinates** to be **15**, **Y**=**0**.

You've spaced the **points** (nodes) at known locations so that it remains symmetrical and when the shank is generated both ends meet neatly



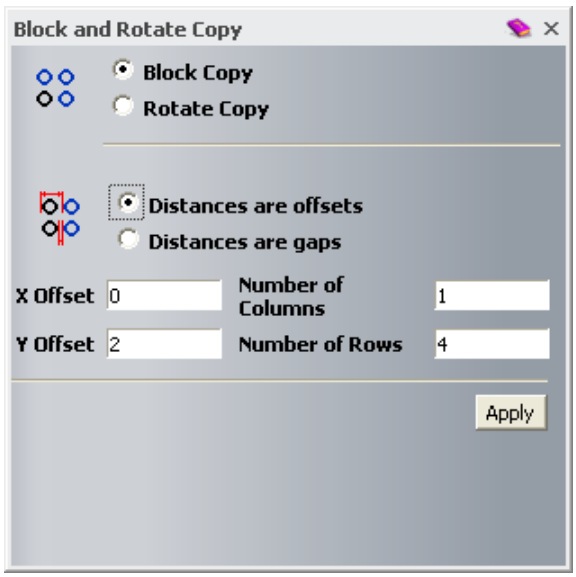
- Hover over the **central node** and **right** mouse click on it.
- Select **Smooth Node** (**S**).



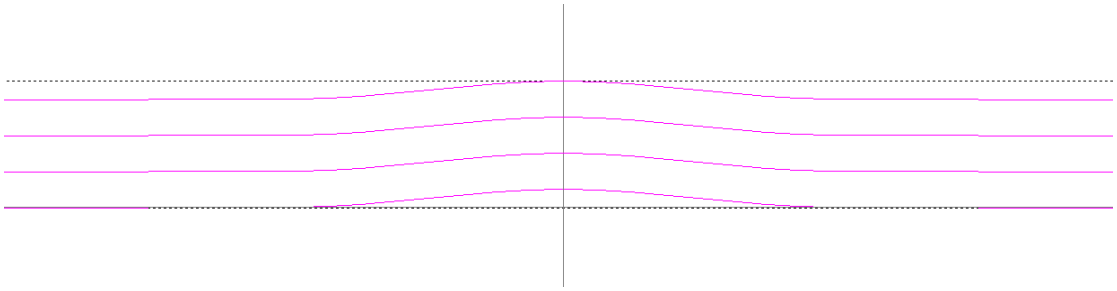
- Select **Properties** from the **right mouse button** menu and change the **Y coordinates** to be **1**.
- Select .

You will copy this **new vector** to make the **Drive Curves** for this ring.

- Select **Block / Copy Rotate** .

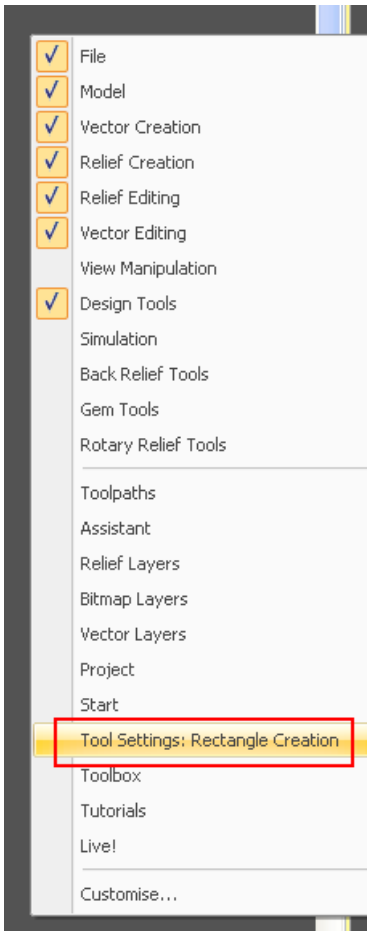


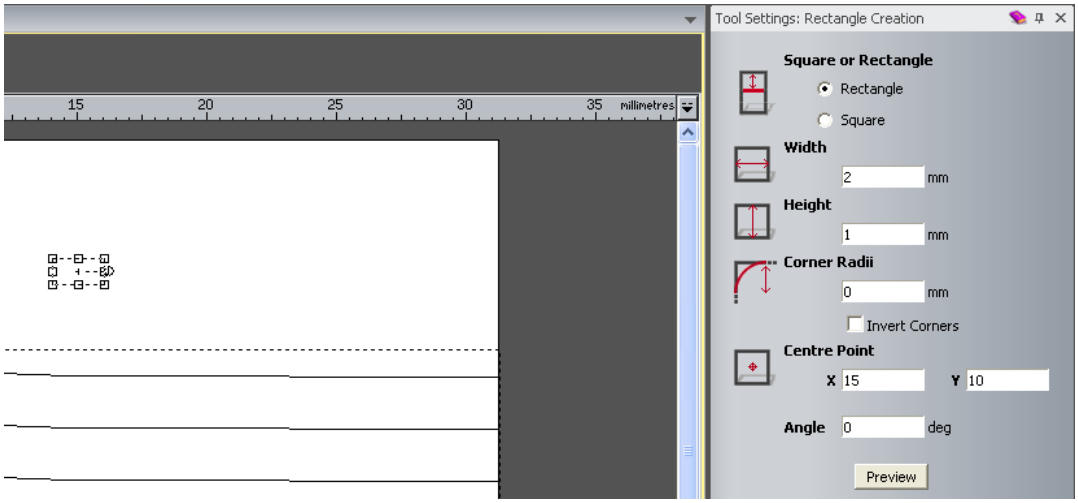
- Select **Block Copy** and **Distances are offsets**.
- Select **X Offset** as **0**, **Number of Columns** as **1**, **Y Offset** as **2** with **Number of Rows** as **4**.
- Select **Apply** and then **Close**.



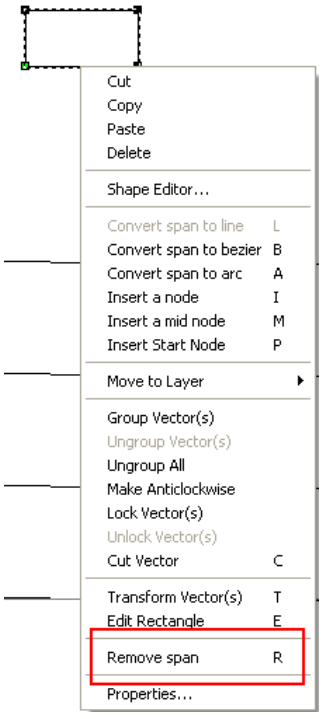
The **Drive Curves** do not need to be around the centre of the model to generate the ring **Relief**. You will now generate the section for the ring.

- Select **Create Rectangle** .





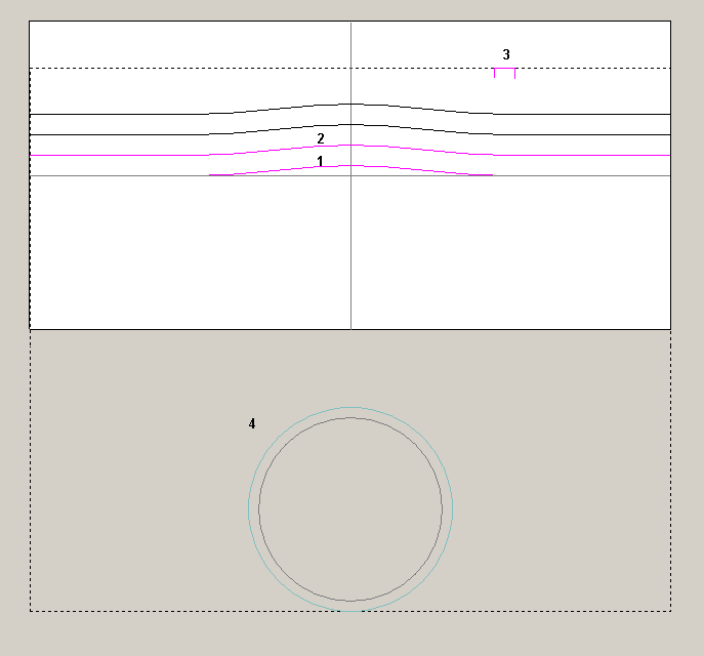
- Enter a **Width** of **2mm**, a **Height** of **1mm** with a **Centre Point** of **X 15** and **Y 10**.
- Right mouse click on the graphics area to accept the changes and close the form.
- Select the **Rectangle vector**, press **N** on the keyboard.
- Press **N** on the keyboard.



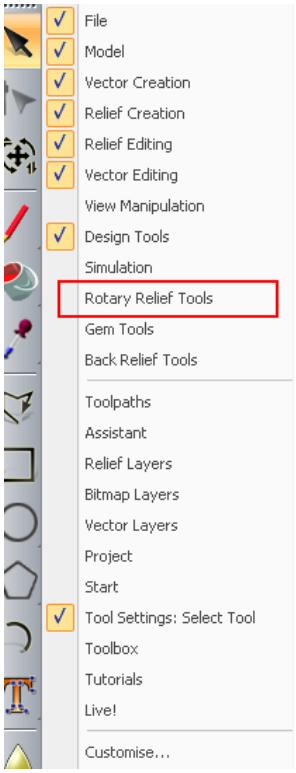
The ring section is complete. You can now make the ring in **three sections**.

- Right mouse click on the vector, select **Remove span** from the right menu.
- Select .

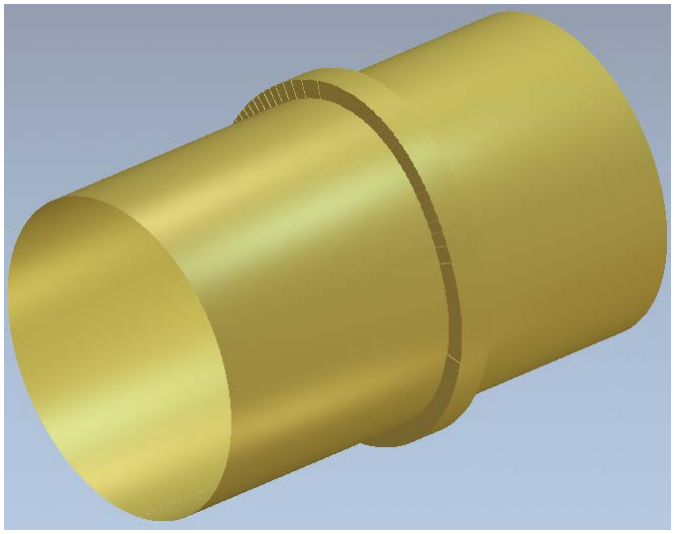
- Select the **bottom two Drive Rails** (**1** and **2**), the **Section** (**3**) and finally the **Ring silhouette** (**4**).



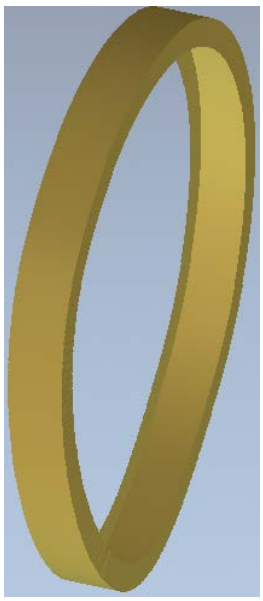
- Right mouse click on the left hand corner of the graphics area and select **Rotary Relief Tools**.



- From the **Rotary Relief Tools** area, select **Sweep Profile** .
- Close the **Rotary Relief Tools** toolbar.
- Press **F3**.



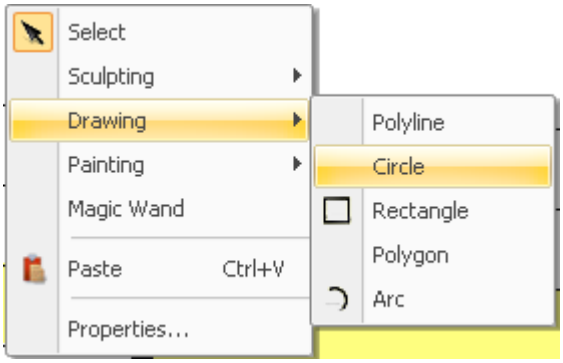
- Select **Draw Zero Plane**.



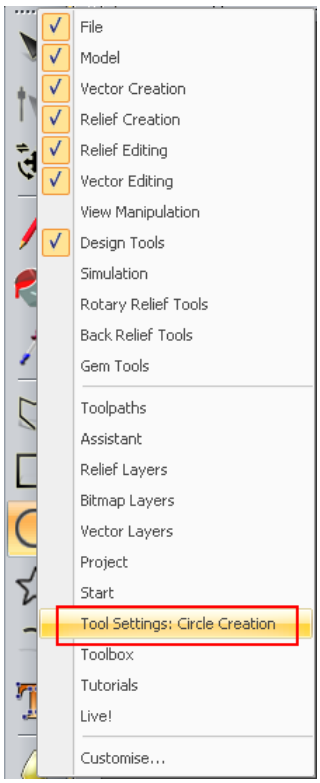
You'll add a small detail to this shank.

- Press **F2**.

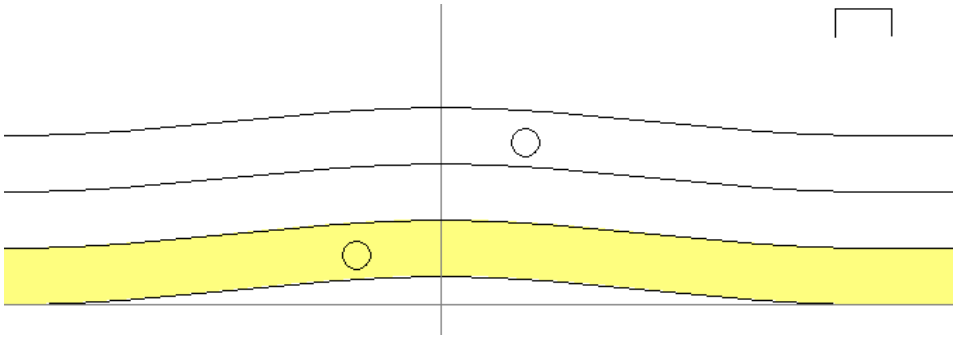
- Select **Preview Relief Layer** from the **2D View** toolbar.



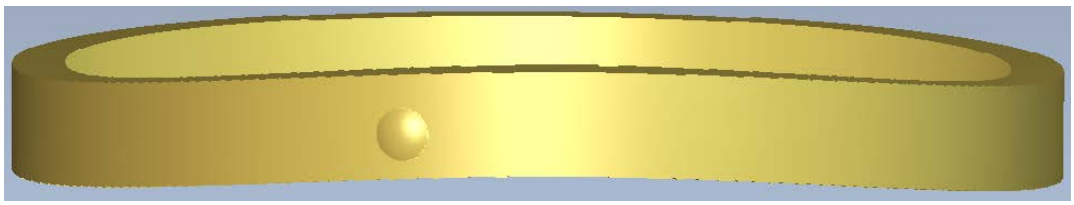
- Right mouse click on the graphics area, select **Drawing – Circle** from the form.
- Right mouse click on the **left hand corner** of the graphics area.



- Select **Circle Creation** to display the **Circle Creation** form.
- Enter a **Circle Centre** of **X–3 Y1.75**, a **Radius** of **0.5mm** and select **Preview**.
- Left mouse click to accept the new circle and to keep the form open.
- Enter a **Circle Centre** of **X3 Y5.75**, a **Radius** of **0.5mm** and right mouse click to accept the circle settings and to close the form.

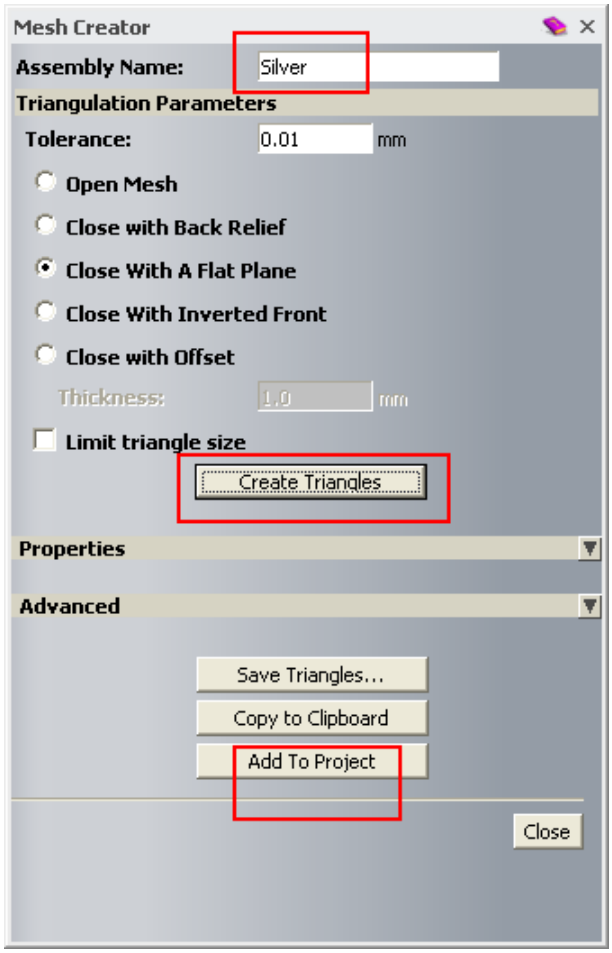


- Select the first created circle and press **F12**.
- Select a **Dome** shape with an **Angle** of **25 degrees**, a **Start Height** of **0**, **No Limit**.
- Select **Add**, followed by **Close**.
- Press **F3**.

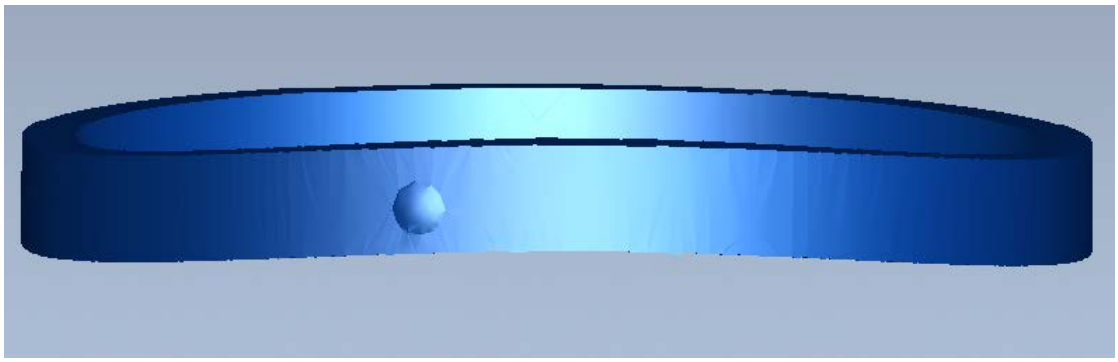


You will now create a **Triangule Mesh**.

- Select **Create Triangle Mesh** .

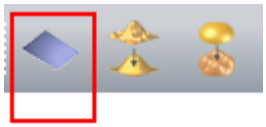


- Enter the **Assembly Name: Silver**.
- Select the option **Close With A Flat Plane** and then select **Create Triangles**.
- Select the option **Add To Projec**t and then **Close** the **Mesh Creator** form.

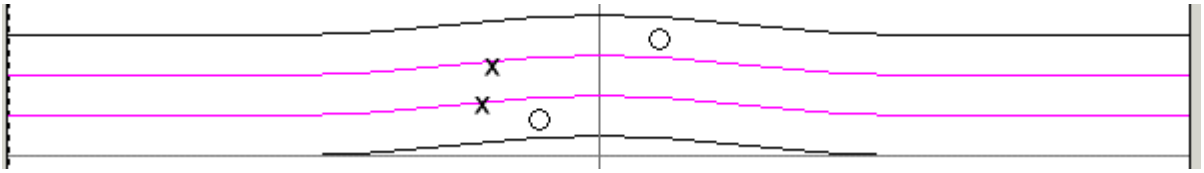


- Select **Toggle Assembly Visibility** from the **3D View** toolbar.

- Select **Reset Relief**.

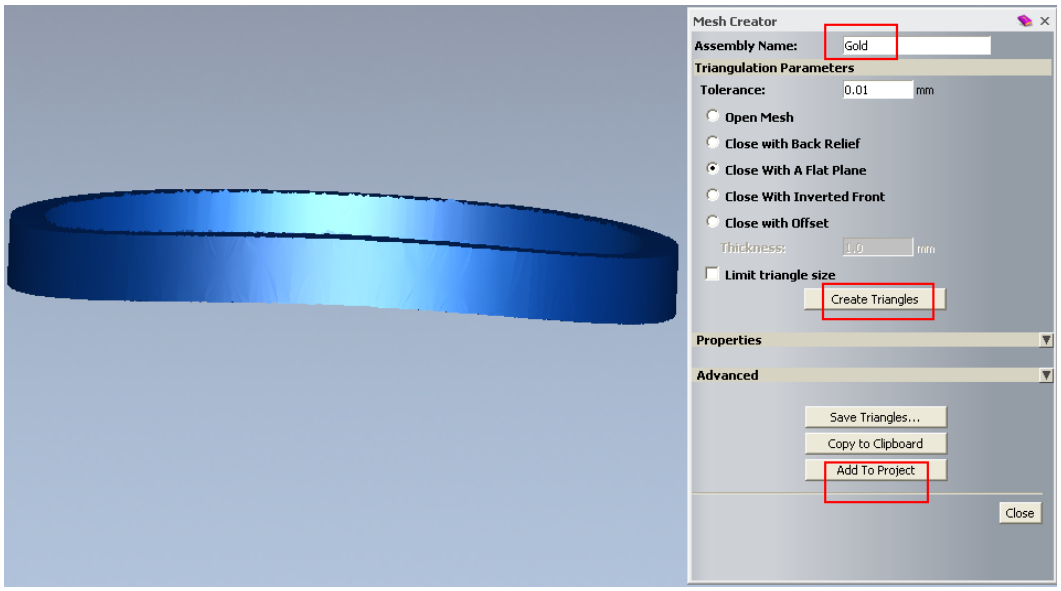


- Press **F2**.



- Select the **middle two Drive Rails** (**x** and **x**), the **section** and finally the **Ring silhouette**.

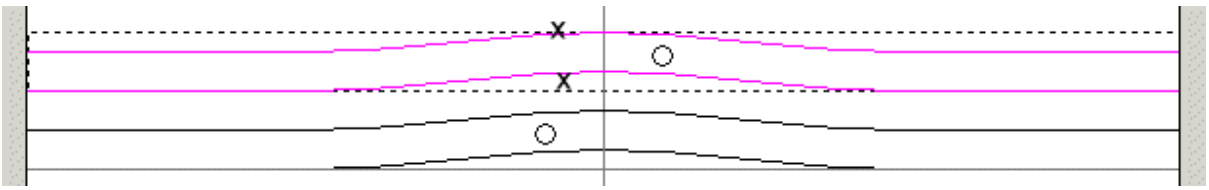
- Right mouse click on the left hand corner of the graphics area and select **Rotary Relief Tools**.
- From the **Rotary Relief Tools** toolbar, select **Sweep Profile** .
- Close the **Rotary Relief Tools** toolbar.
- Press **F3**.



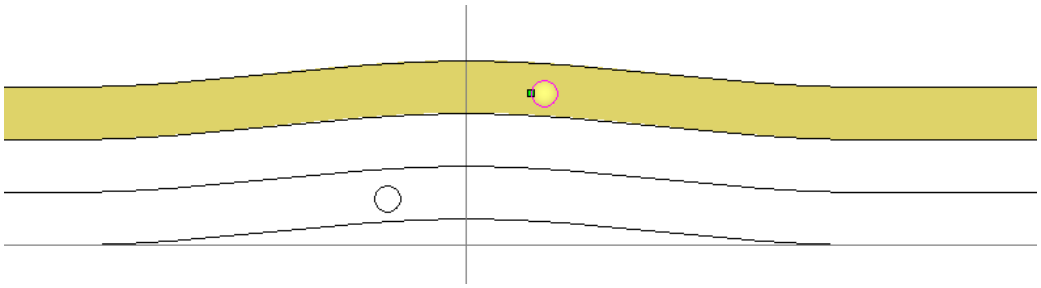
- Select **Create Triangle Mesh** .
- Enter the **Assembly Name: Gold**.
- Select the option **Close With A Flat Plane** and then select **Create Triangles**.
- Select the option **Add To Projec**t and then **Close** the **Mesh Creator** form.

The **inner band** is going to be **left plain**.
You will now **add** it to the **Project**.

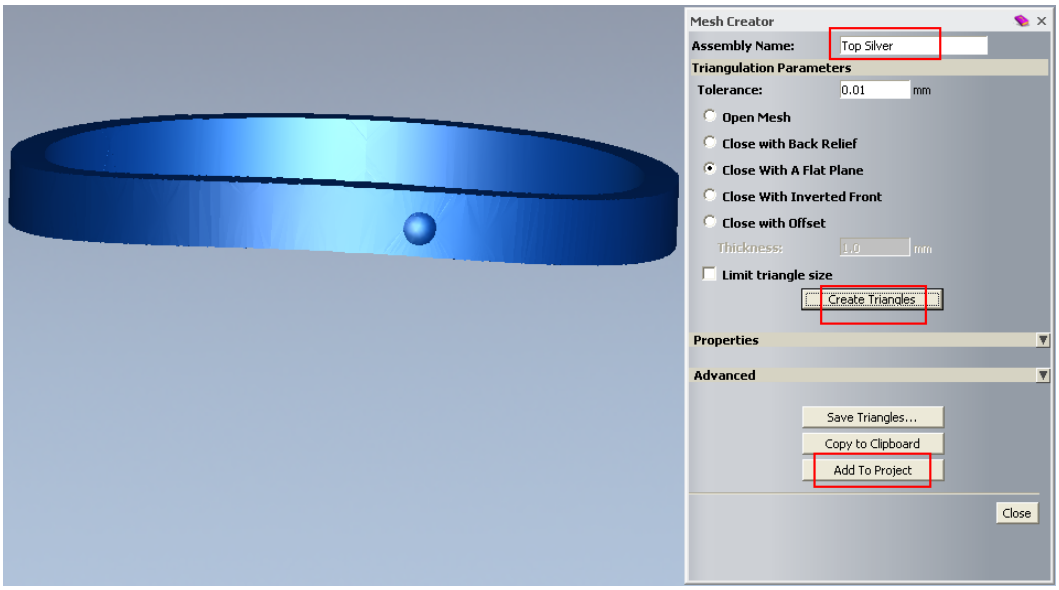
- Select **Reset Relief** .
- Press **F2**.
- Select the **top two Drive Rails** (x and x), the **section** and finally the **Ring silhouette**.



- Select **Sweep Profile** .



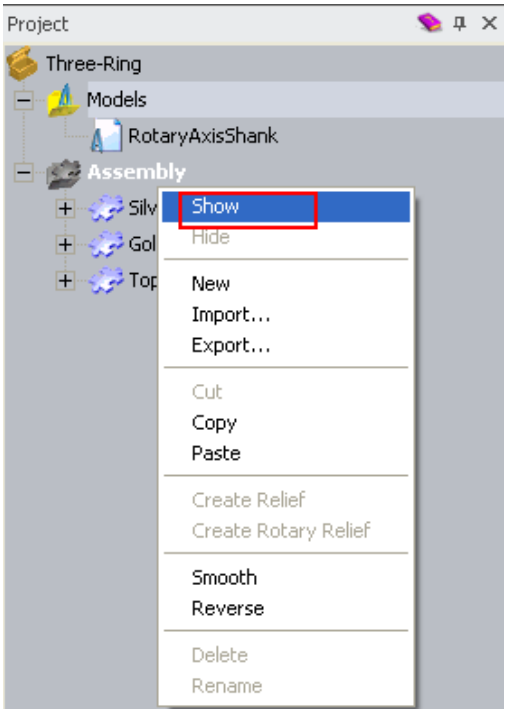
- Select the **top circle** and press **F12** to display the **Shape Editor**.
- Select a **Dome shape** with an **Angle** of **25 degrees**, a **Start Height** of **0**, **No Limit** set and select **Add**.
- Select **Close** and then press **F3**.



- Select **Create Triangle Mesh** .
- Enter the **Assembly Name: Top Silver**
- Select **Close With a Flat Plane** and then select **Create Triangles**.
- Select **Add To Project** and then **Close** the **Mesh Creator** form.

Three separate meshes have been created and **Added** to the **Project**.
You will assign **Material** (colours) for presentation.

- Select **File** - **Close Model**.
- Select **Yes** to the query.



There are now **three components** in the **Project** view.

- Expand the **Assembly** tree and select **Show**.
- Select **Gold** from the **Assembly tree**.
- Select **Edit Object Shading** .
- Select **24ct Polished Gold**.

You can clearly see the **gold inner** ring.
You can nudge around, scale and shade each individual component, accordingly without affecting the original **Relief** it was made from.
You will now **Save** the complete **Project**.

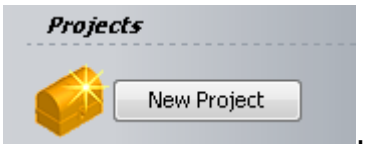
- Select **File** – **Save**.
- Browse: **D:\users\training\COURSEWORK\JewelSmith-Jobs**.
- Enter the **File name** – **Triple ring** and select **Save**.

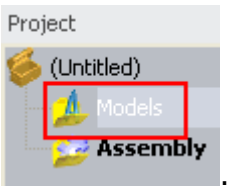
12. Customising a Shank

Introduction

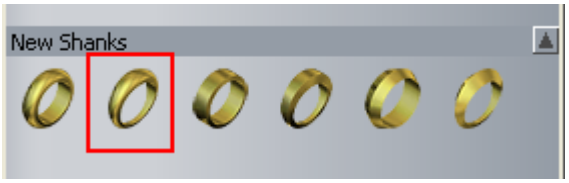
In **ArtCAM JewelSmith** a range of standard **Shank** models are quickly accessible via the **Shank library**. This has a preview feature, which allows you to check and modify the **Shank** before rebuilding it.
In the following exercise a twist is introduced around the band.

Designer Ring Exercise

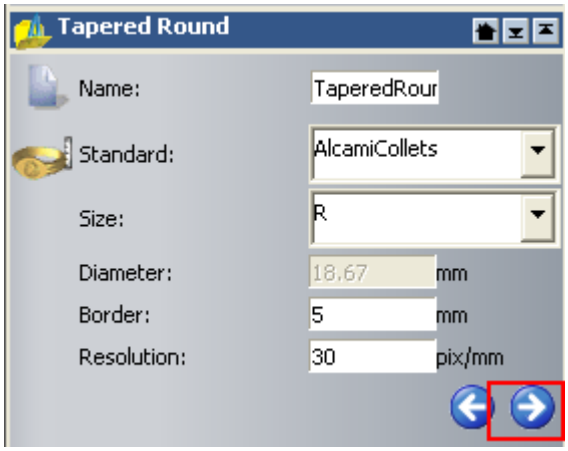
- Select **Create New Project** 

.
- Select **Models** from the root **Project** folder 

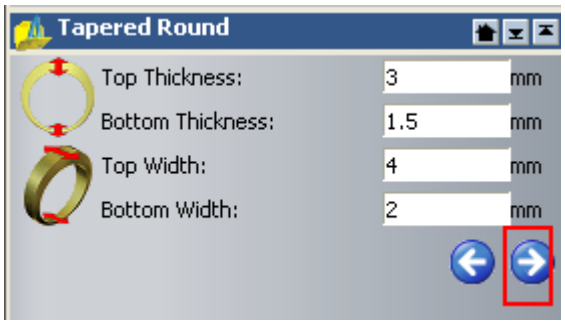
.



- Select **Create Tapered Round Shank**.



The **Project Name** and the basic specifications for this type of **Ring** are entered in this form.
The **arrows** provide the option to go **backwards** or **forwards** to the **previous** or **following** page of the **wizard**.

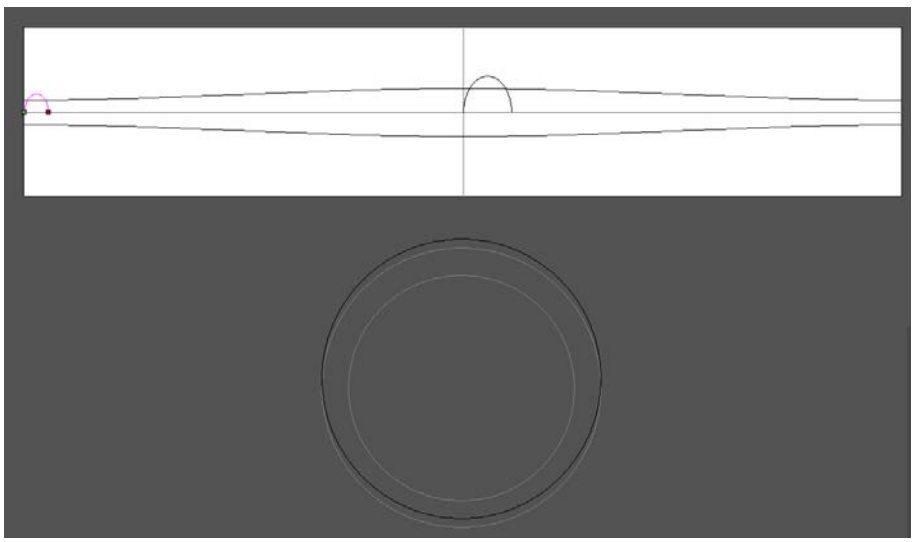


You can input different values at this stage if required.

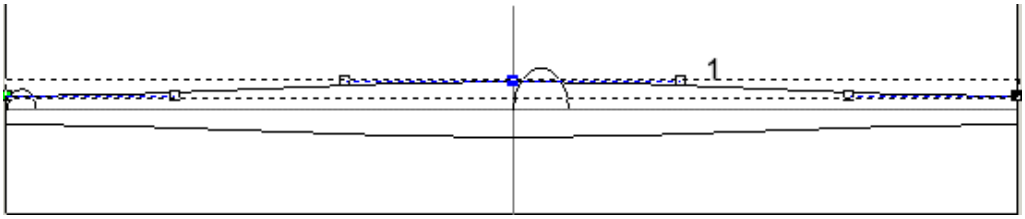
- Enter the **values** as **shown** and select **Next** .

Note: The last form of the wizard will remain active, but with the addition of an extra **Rebuild** button along with an **Accept** button to replace **Next**.

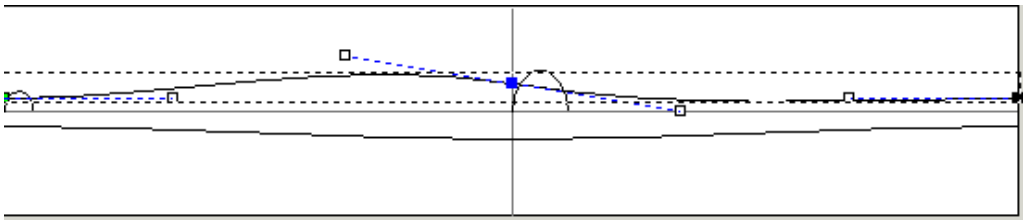
You've generated a basic **Ring** design at the first stage of the **Project**. You will now have to introduce a twist along the shape. This is achieved by modifying the existing **Drive Rail vectors** followed by clicking the **Rebuild** button in the **wizard** to **update the design**.



- Press **F2**.
- Select the **top drive rail vector** and press **N** on your keyboad.

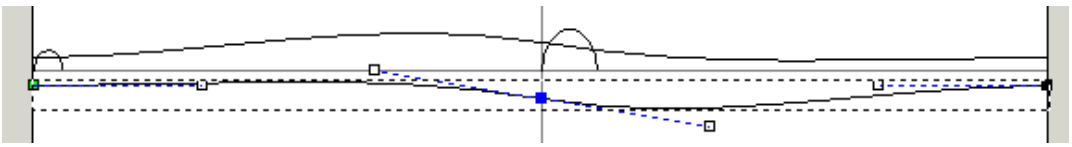


- Move the **cursor** exactly over the **white**, **control point** numbered **1** in the above diagram and **right mouse click** to access the local menu.
- Select **Properties** and change the displayed **Y co-ordinate** to **0** before clicking **OK**.



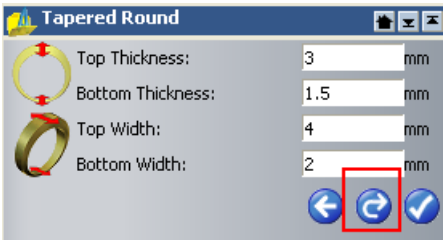
The **control point** has moved **downwards by 2mm** while maintaining tangency through the central **smooth node** (**blue**). As a result the controlled twist has been introduced along the **vector**.

- Select the **bottom Drive Rail** vector.
- Select the corresponding **control point** to the **right** of the **central node**.
- Using the right mouse button select **Properties**.
- Change the **Y coordinate** to **-4mm**.

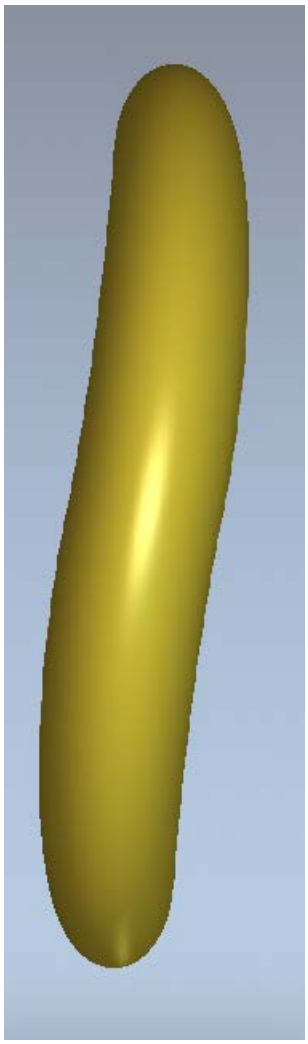


The **control point** has **moved down** by **2mm** in **Y**, to match the shape to the top **Drive Rail**.

- Select .



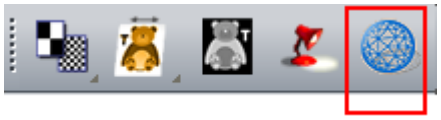
- In the **Tapered Round Wizard**, select **Rebuild** .
- Press **F3** and select **View Along Z**.



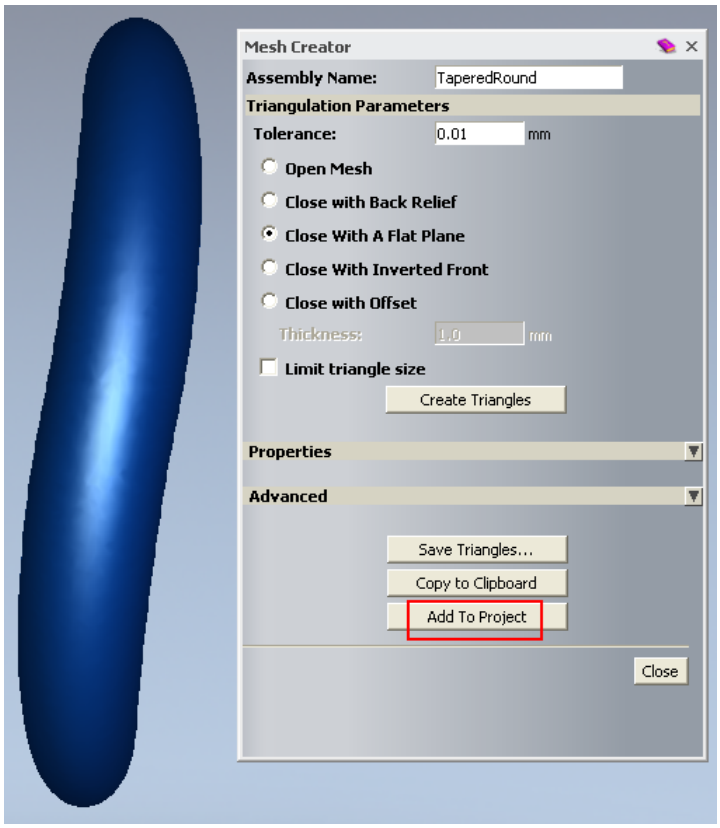
You've changed the **Shank** design to a non-standard shape. If required you can modify repeatedly the existing **vectors** and apply **Rebuild** to further update the **Shank** design. Once the design process is complete you'll have to select **Accept** to exit the **wizard**.

Note: While using the **wizard** it is **NOT** possible to add **new vectors** and use **Rebuild** to update the design.

- Select **Accept** .



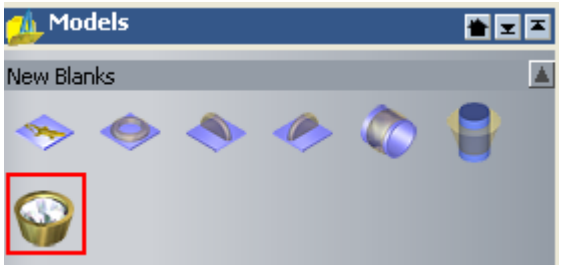
- Select **Create Triangle Mesh** from the top toolbar.



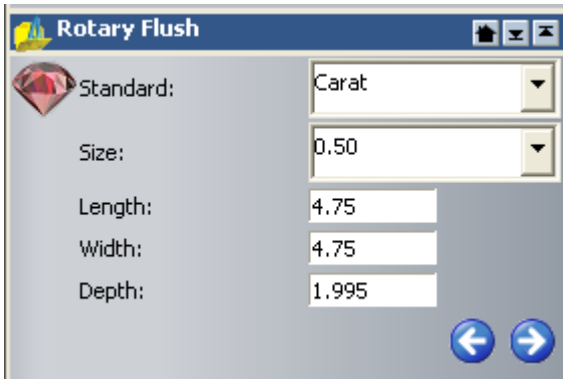
- Select the option **Close With A Flat Plane** and then select **Create Triangles**.
- Select the option **Add To Project** and then **Close** the **Mesh Creator** form.
- Select **File** – **Close Model**.

The **Project** now displays the **Shank**.

You will now create the **setting** using the rotary **Flush** option. This option, works on picking a **Stone** first and then automatically generating the setting around it. As the **setting** is an **ArtCAM** model it can be modified to suit the design.

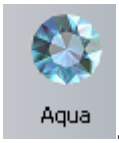


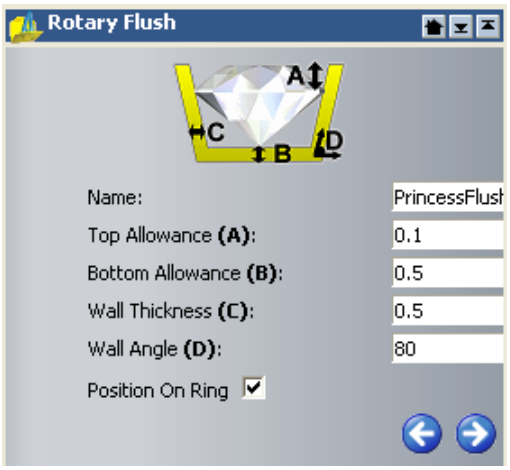
- From the **New Blanks** area, select **Create Rotary Flush Blank** .
- Select **Princess**
.



The **Gem** sizes can be selected either using:

Carat – **Size**, **Length**, **Width**, and **Depth** created automatically.
Custom - Length, **Width**, and **Depth** values are input manually by user.

- Enter the **values** as shown in the image below and select **Next** .
- Select **Aqua** 
.



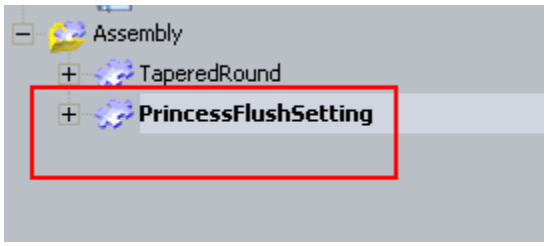
The diagram for the **Gem** setting is displayed.

- Enter the values as shown on the image above and select **Next** .

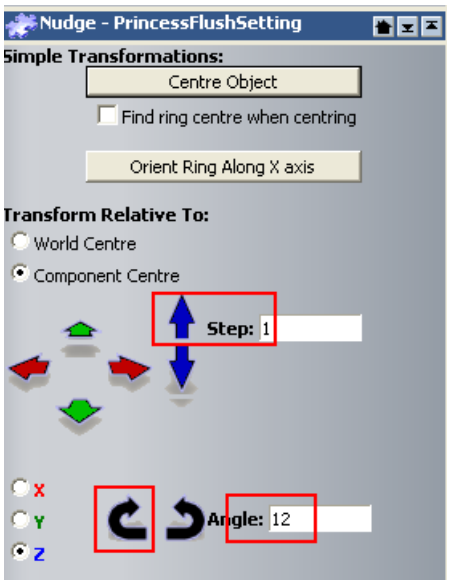
Not only is the **setting** clashing with the **Shank** it is also not suitably aligned with it. Before removing a clearance area from the **Shank**, the **setting** must first be rotated to achieve a more acceptable orientation. This is achieved using the **Nudge** option located in the **Projects** area.

You can change the design at this stage and then **rebuilt** it, if required. Once the design is finished, select **Accept**.

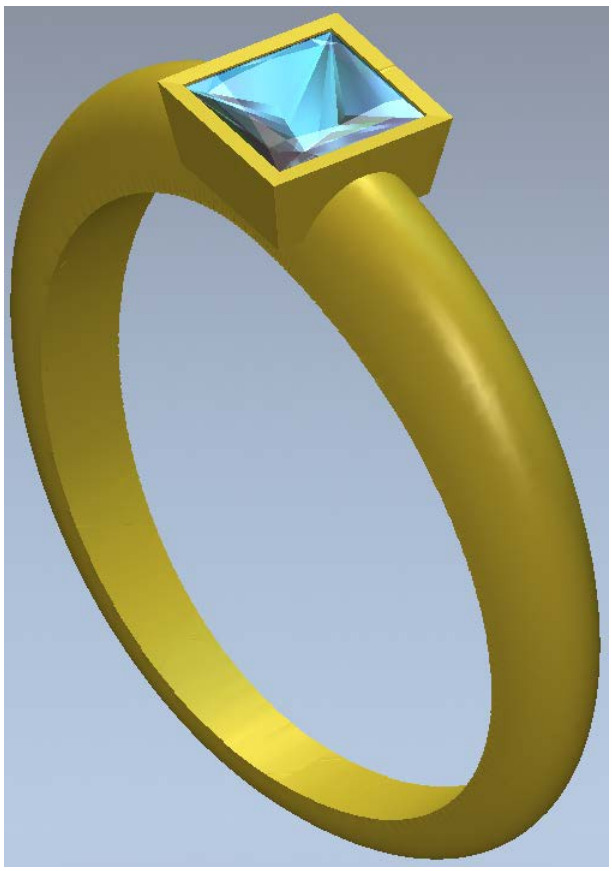
- Select **Next** .
- Select **Accept** .
- Select **File** – **Close Model**.
- Select **Yes**.



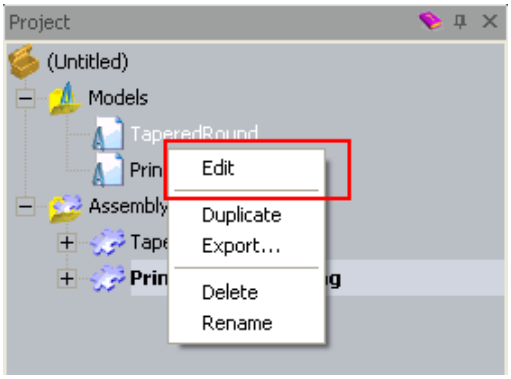
- Select the component **PrincessFlushSetting** in the **Assembly** tree.
- Double left mouse click **Nudge** from the **Positioning** area.



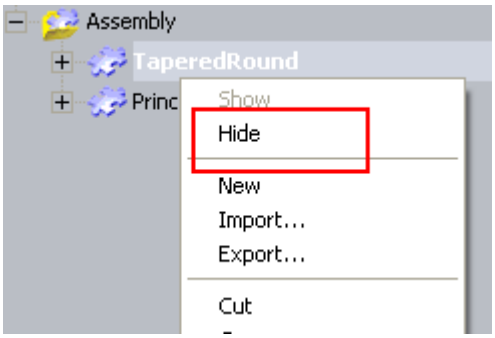
- Select **Component Centre**, **Z axis** and enter an **Angle** of **12 degrees**.
- Select **Nudge Clockwise** .
- Enter a **Step** of **1mm** and select the **up arrow** .
- Select the **Home** icon to close the **Nudge** form.



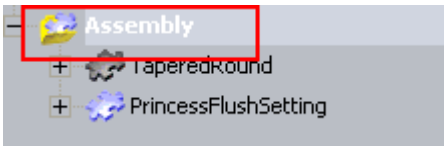
You've rotated the **setting** to a more suitable alignment with the **Shank**. You will remove a suitable section of the **Shank** to accommodate the **setting**.



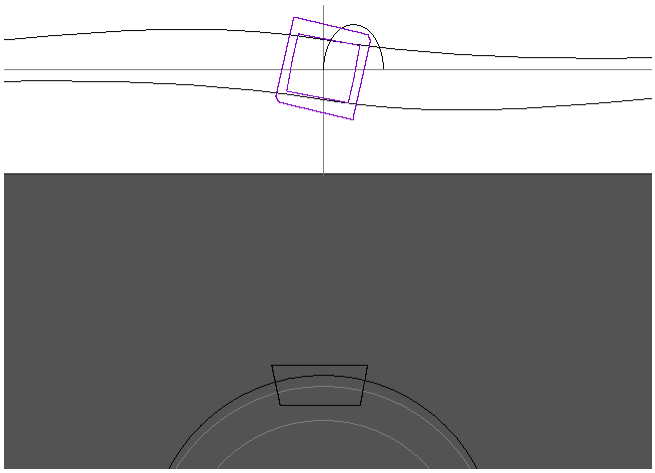
- Select **Edit** for the **TaperedRound** model from the **Project** tree.



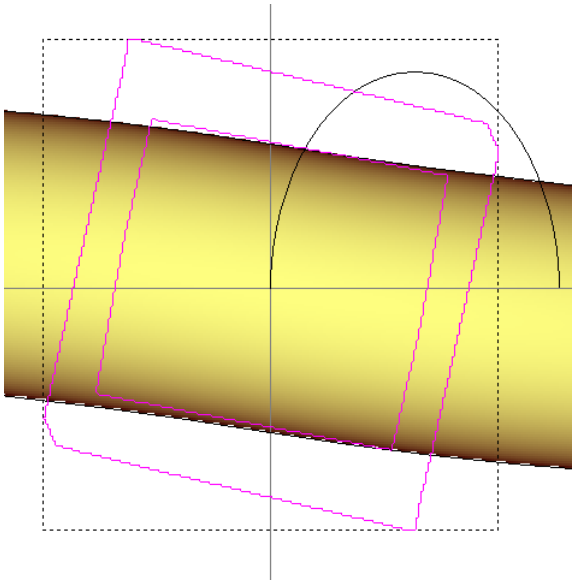
- Switch to the **Project** tab and **Hide** the **TaperedRound** assembly.



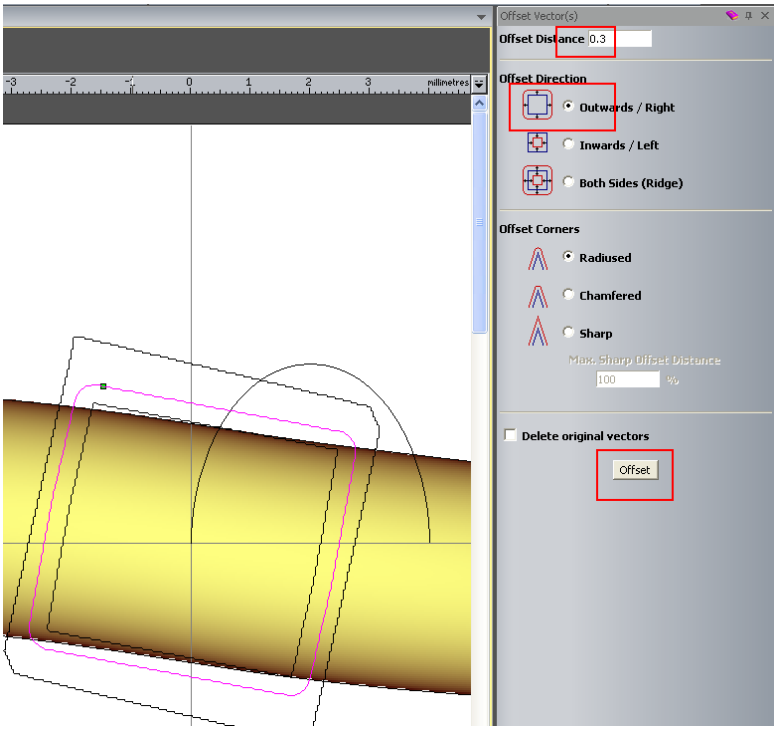
- Select **Create Assembly Silhouette** from the **Tools** area.



You've created a **silhouette** of the **setting**. The **Shank** was ignored as it was hidden in the **assembly** prior to calculation.

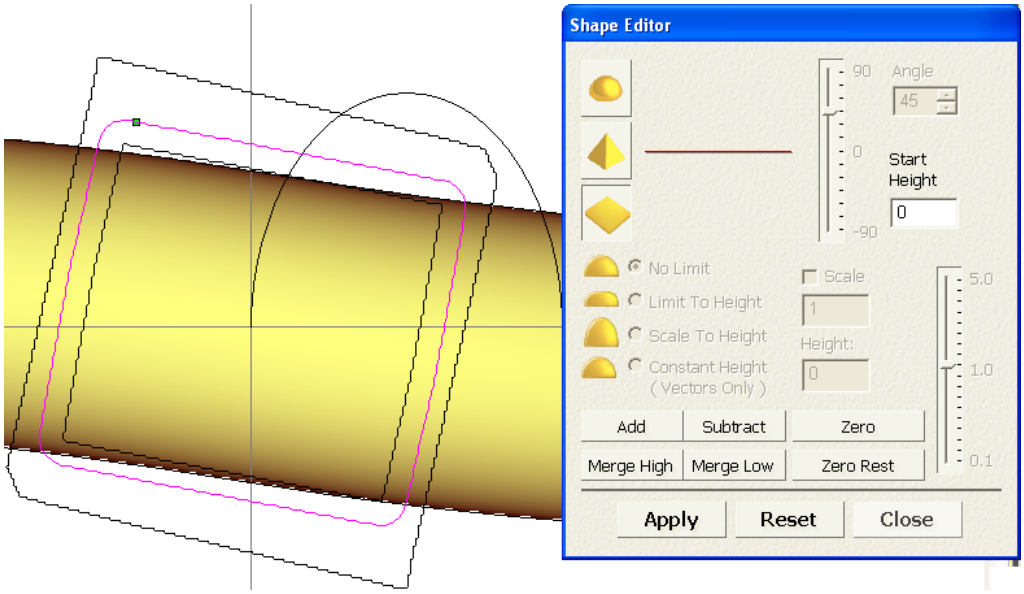


- Select the **two grouped vectors** and press **Ctrl+U** on the keyboard to **Ungroup** them.

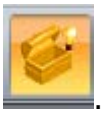


- Select the **inner rectangle**.
- Select **Offset vectors** .
- Enter the settings shown on the image above.
- Select **Offset**.

- Close the form.
- Press **F12**.

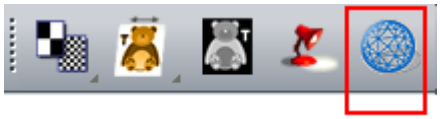


- Select **Zero**.
- Close the **Shape Editor** form.

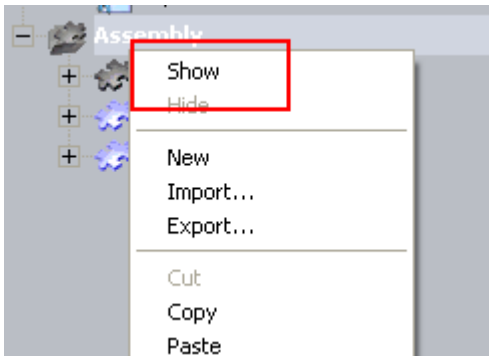
- From the **3D View**, select **Toggle Assembly Visibility**  .
- Press **F3**.

The **Relief** now includes a suitable pocket to accommodate the **Gem setting**.

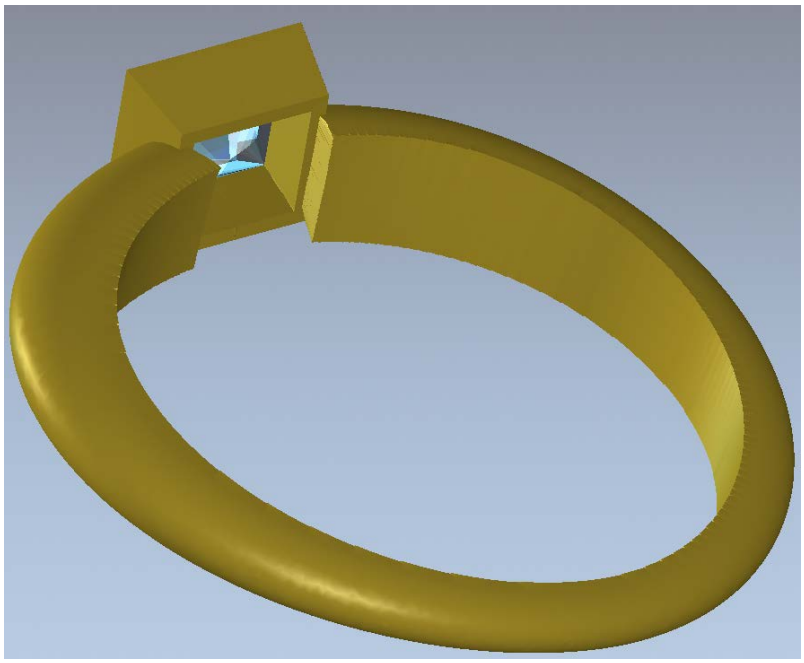
You will create a new **Triangle Mesh** and **add** it to the **Project**.



- Select **Create Triangle Mesh** from the top toolbar.
- Select the option **Close With a Flat Plane** and then select **Create Triangles**.
- Select the option **Add To Project** and then **Close** the **Mesh Creator** form.
- Select **File** – **Close Model**.
- Select **Yes** to update changes in the **Project**.



- Right mouse click on the **Assembly** folder from the **Projects** area and select **Show**.
- Right mouse click on the **TaperedRound** triangle model below the **Assembly** folder and select **Delete**.



By rotating the **ring**, you can see the new **Shank** in place accommodating the **setting**.

- Select a material for the assembled model at your choice.
- Select **File – Save As**.
- Browse: **D:\users\training\COURSEWORK\JewelSmith-Jobs**.
- Type the name **Custom Shank** and select **Save**.
- Select **File** – **Close Project**.

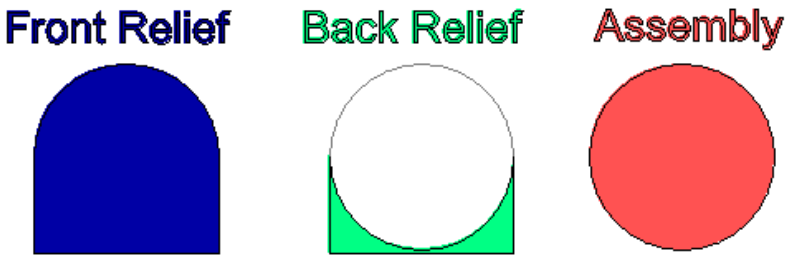
13. Front and Back Reliefs

Introduction

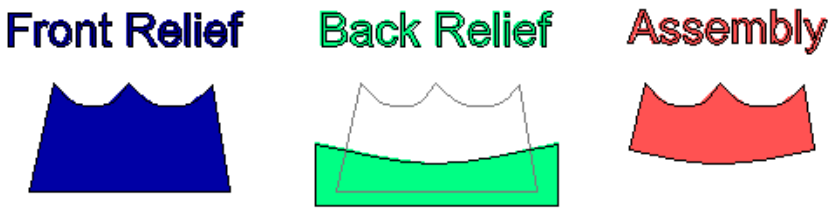
In **JewelSmith**, you have the ability to display, in an **ArtCAM** model, either the **Front** (which is the top of the ring) or the **Back Relief** (which is the inside of the ring). These two when combined make a new assembly model. This new **Assembly** model is machined using the **Multi-Sided Wizard**. The default mode for **JewelSmith** is to have no **Back Relief** when generating a **basic Ring** or **Flat 3D shape**.

The **Front** and **Back Relief** is not exclusively for rings, it is a feature of **JewelSmith** and can be used on **Flat** pieces as well. Both the **Front** and **Back Relief** can be made using **ArtCAM** techniques or be loaded in from an existing **Relief**. An **Assembly** model is made from removing the **Back Relief** from the **Front Relief**.

The **Back Relief** can also be **negative**, to produce a court-ring.

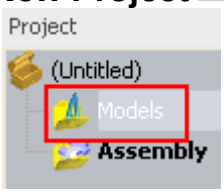


The **Front Relief** is the master, from which the **Back Relief** is removed. This means that as long as the **Back Relief** covers the **Front Relief** the area will be removed, as this **Flat** piece diagram shows.

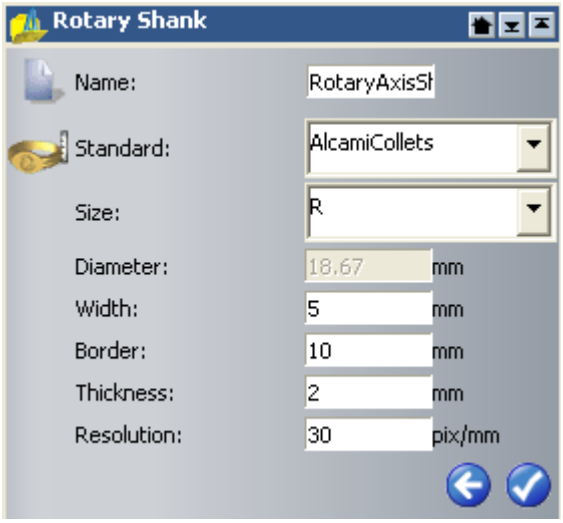


Back Relief Ring

- Select **Create New Project**

.
- Select **Models** 

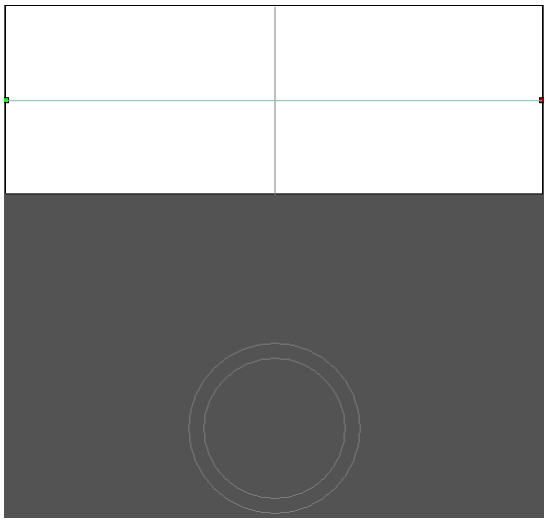
from the root **Project** folder.
- Select **Create a Rotary Axis Blank**
.



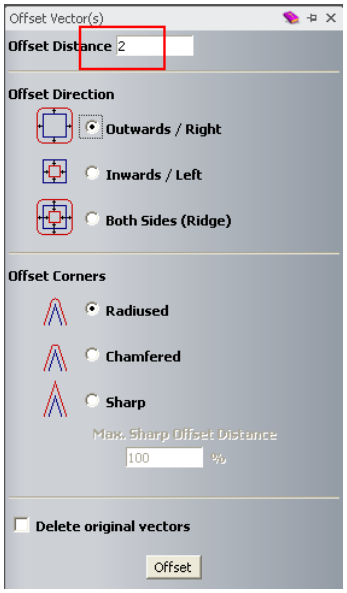
Note: In this case the ring is one size bigger to allow for shrinkage.

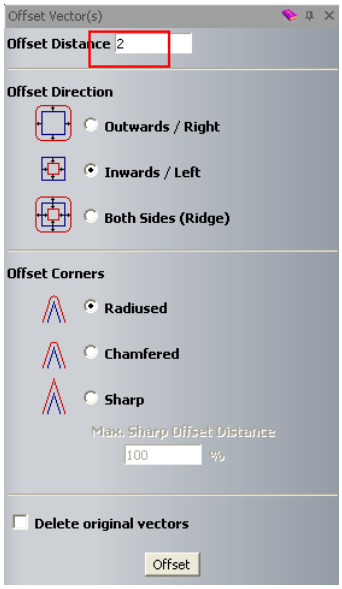
You can **Offset** copies of the centre line vectors to create the correct ring **Shaft Width**.

- Enter the values as shown and select **Accept**
.

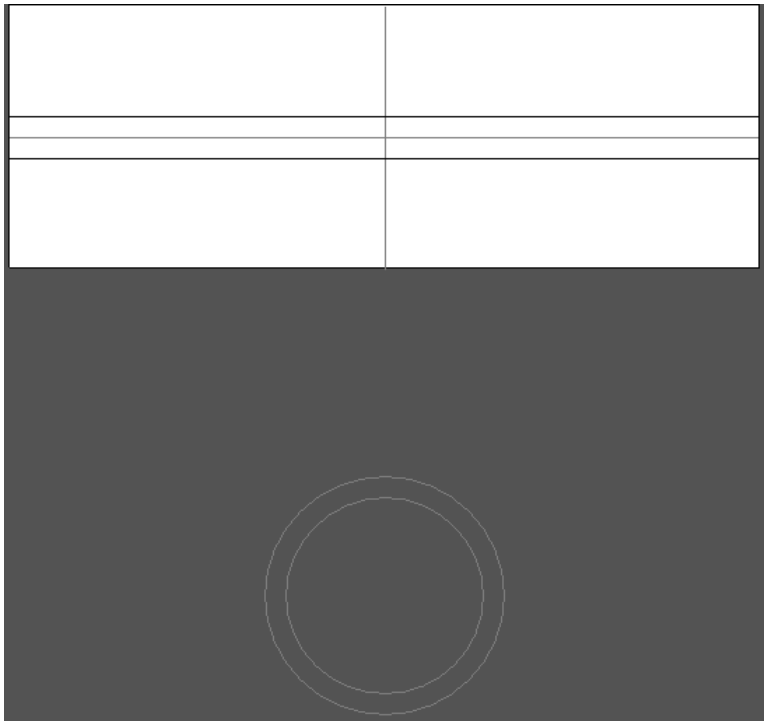


- Select the **centre horizontal locked vector line**.
- Select **Offset Vector(s)** .

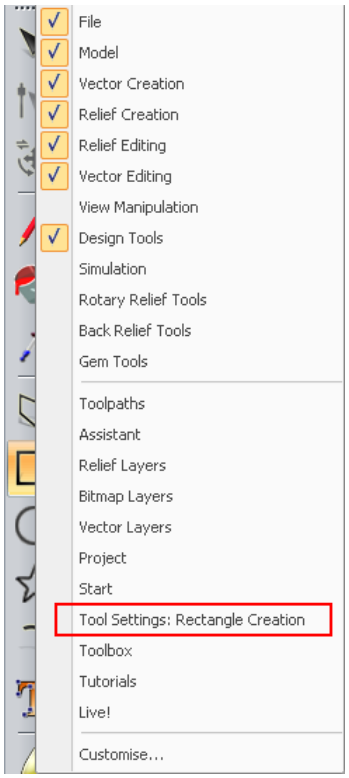




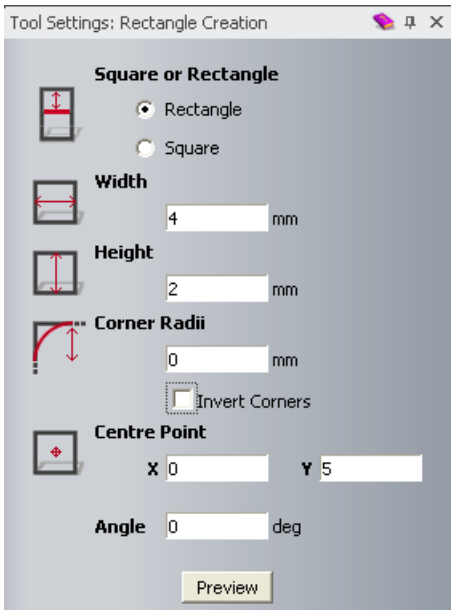
- Select an **Offset Distance** of **2mm** and select **Outwards / Right**.
- Select **Offset**.
- Select the **centre horizontal locked vector line**.
- Select an **Offset distance** of **2mm** and select **Inwards** / **Left**.
- Select **Offset**.
- Close the **Offset** form by pressing .



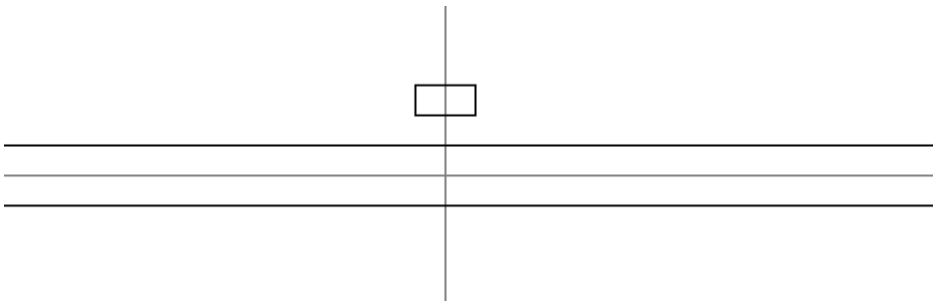
- Select **Create Rectangle** .



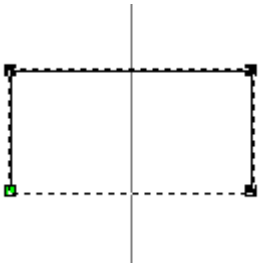
- Right mouse click on the left hand corner of the screen and select **Rectangle Creation**.



- Enter a **Width** of **4mm**, **Height** of **2mm** at a **Centre Point** of **X0 Y5**.



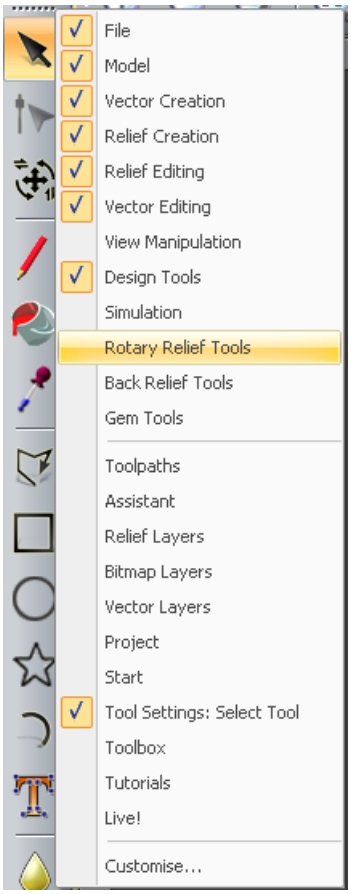
- Select **Preview** and then **right mouse click** on the graphics area (white area) to close the form.
- Select the rectangle and press **N** on the keyboard.



- Hover the mouse to the bottom span of the rectangle and when the cursor is white press **R** on the keyboard. The lower span will be removed.

- Select .

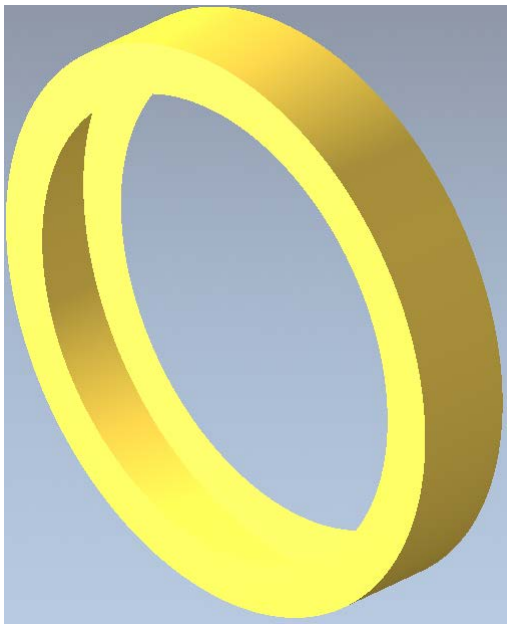
- Hold down **shift** and select the **Drive Rail** vectors, the **Section** vector and finally the **ring profile vector**.



- Right mouse click on the left hand corner of the screen and select **Rotary Relief Tools**.

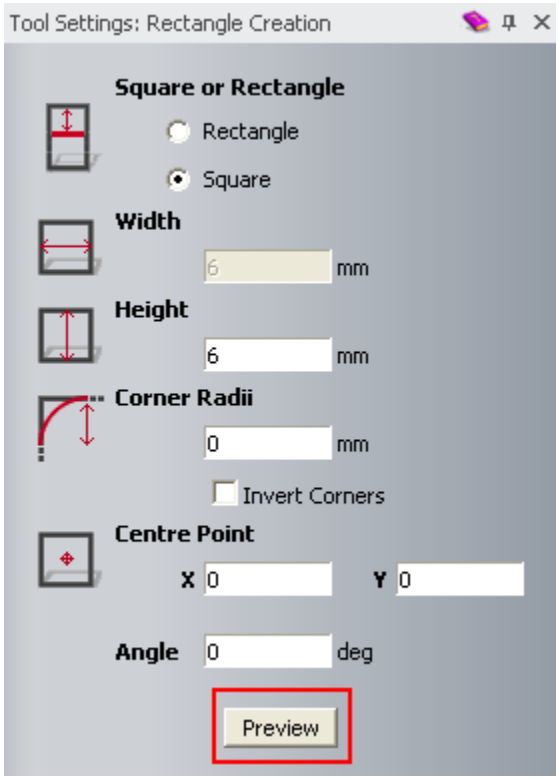
- Select **Sweep Profile**.
- Close the **Rotary Relief Tools** form.
- Press **F3**.

- Select **Draw Zero Plane** .

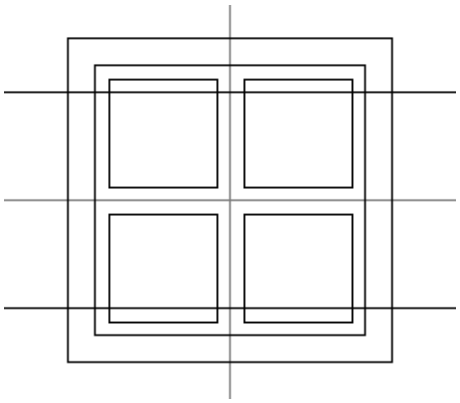


You will now **merge** a **Square shape ring** and **remove** some material.

- Press **F2**.



- Select **Create Rectangle** .
- Display the **Rectangle Creation** form.
- Select **Square** and enter a **Height** of **6mm** at **Centre Point** of **X0 Y0**.
- Select **Preview**.
- Left mouse click on the graphics area to leave the form open.
- Enter a **Height** of **5mm** at a **Centre Point** of **X0 Y0**.
- Select **Preview**.
- Enter a **Height** of **2mm** at a **Centre Point** of **X1.25 Y1.25**.
- Select **Preview**.
- Left mouse click on the graphics area to leave the form open.
- Change the **Center Point** to **X-1.25 Y 1.25**.
- Select **Preview**.
- Left mouse click on the graphics area to leave the form open.
- Change the **Centre Point** to **X1.25 Y-1.25**.
- Select **Preview**.
- Change the **Centre Point** to **X-1.25 Y-1.25**.
- Select **Preview** and then right mouse click on the graphics area to close the form.

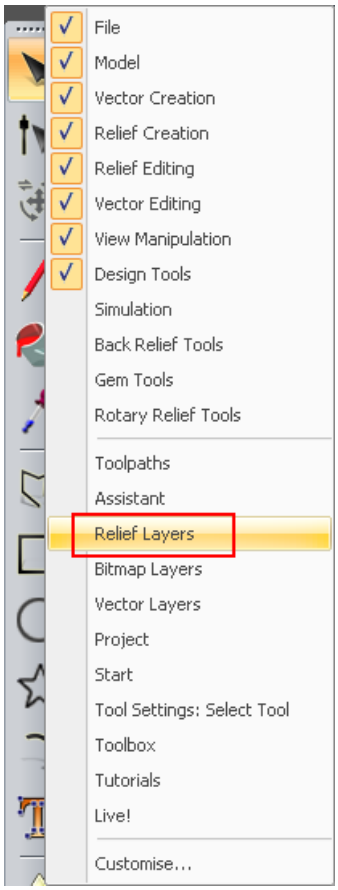


You'll **merge** a **geometric design** onto the ring.

- Select the **biggest Square** vector and press **F12**.
- Select a **Flat shape**, **Start Height** of **2.5mm** and **Merge High**.
- Select the **Square** vector of **Height 5mm**.
- Select a **Flat shape**, **Start Height** of **0.5mm** and **Subtract**.
- Shift select the **four small** square vectors.
- Select a **Flat shape**, **Start Height** of **0.25mm** and **Add**.
- Select **Close**.

The **outer design** of the ring is finished. You will now create an **inside design** on the **Back Relief**.

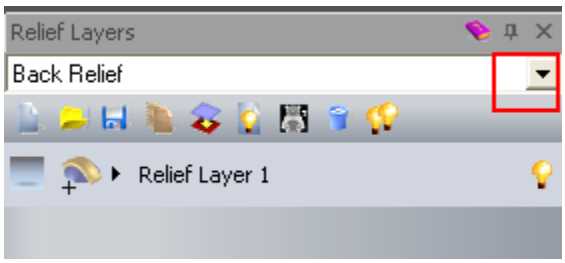
- Press **F2**.



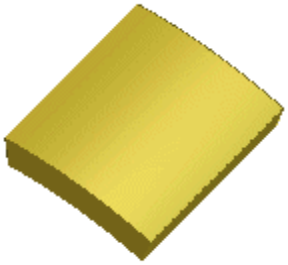
- Right mouse click on the left hand corner of the graphics area and select **Relief Layers**.

- From the **Relief Layers** pull down menu, select **Back Relief Tools**.

The **Back Relief** is empty by default.

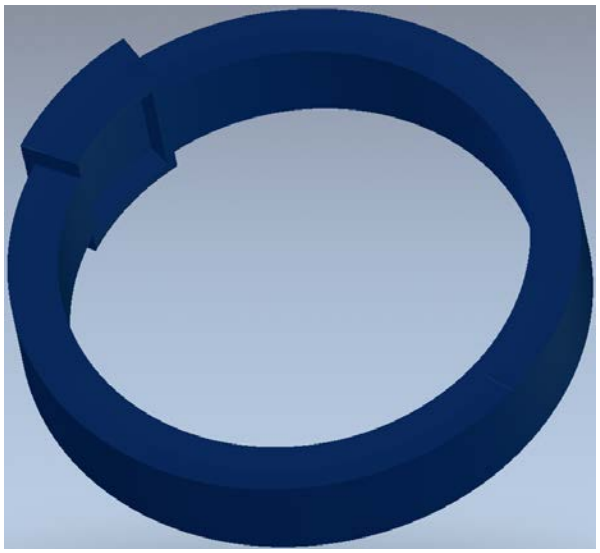


- Select the **chevron** and select **Back Relief** to make it active.
- Select the **Square vector** of **5mm Height** and press **F12**.
- Select a **Flat Plane** shape with a **Start Height** of **1mm**.
- Select **Add** and then **Close**.
- Press **F3**.



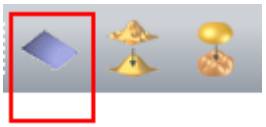
The **Back Relief** is shown as the **small square**. You will remove this part of the model, when the new master model is generated.

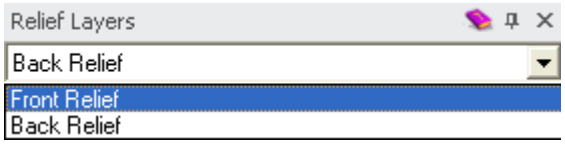
- Select **Create Triangle Mesh** .
- Select the option **Close with Back Relief** and then select **Create Triangles**.



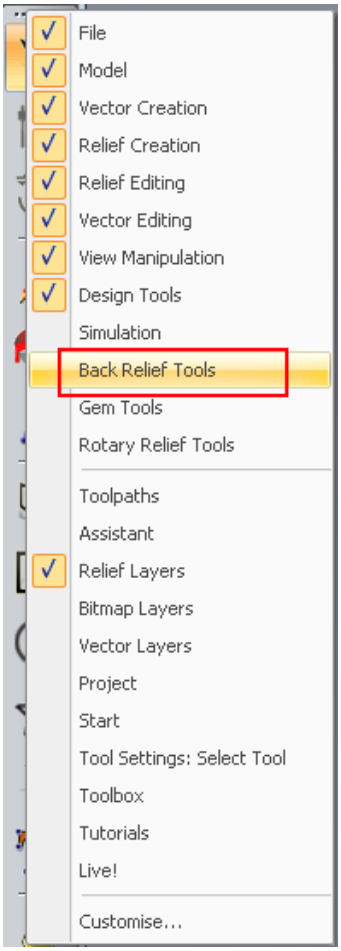
By rotating the model around, you can see the area removed underneath the square top.

As this is not what is required, then the model will not be accepted and a new **Back Relief** generated.

- Select **Close**.
- From the **Relief Layers** pull down menu, select **Back Relief**.
- From the top toolbar, select **Reset Relief**  .

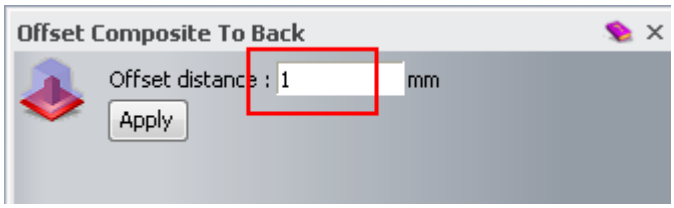


- From the **Relief Layers** pull down menu, select **Front Relief**.



- From the left hand corner of the graphics area select **Back Relief Tools**.

- Select **Offset Composite to Back** from the **Back Relief Tools** toolbar.



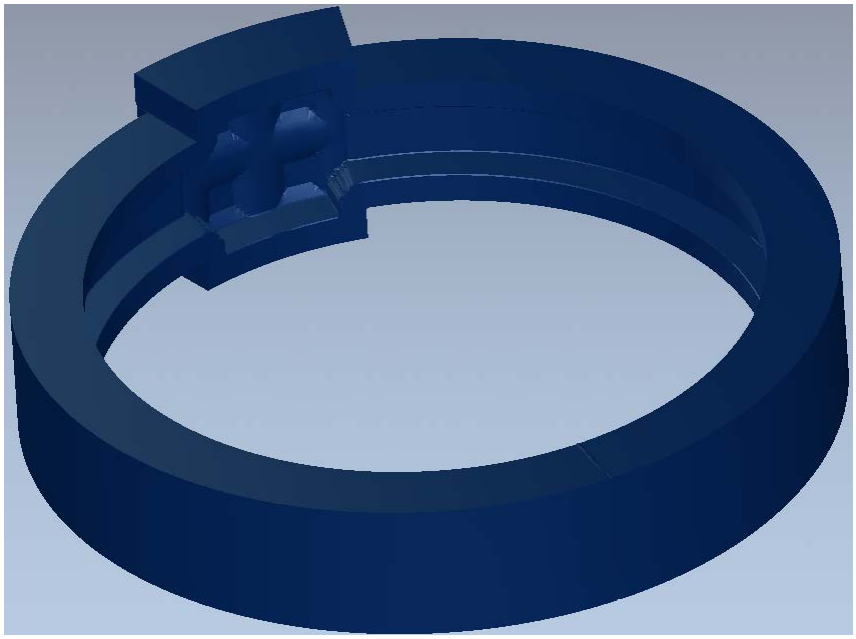
The value is a measurement of the thickness that will be left in the new master model.

- Enter **1mm** for the **Offset distance** and select **Apply**.
- Close the form.

The new **Back Relief** is automatically created and displayed.
You will now **add** a new combined model.

- Select **Create Triangle Mesh** .

- Select the option **Close with Back Relief** and then select **Create Triangles**.



By rotating the model around, you can see the area removed underneath the whole model.

Note: Selecting the operation **Close with Offset** in the mesh creator page would have created the same result directly.

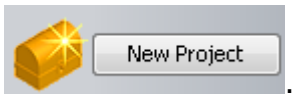
- Select the option **Add To Project**.
- Select **OK**.
- Select **Close**.
- Select **File – Save As**.
- Browse: **D:\users\training\COURSEWORK\JewelSmith-Jobs**.
- Enter the name as: **Back relief** and select **Save**.
- Select **File** – **Close Project**.

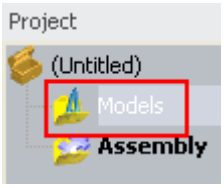
14. Heart Pave Pendant

Introduction

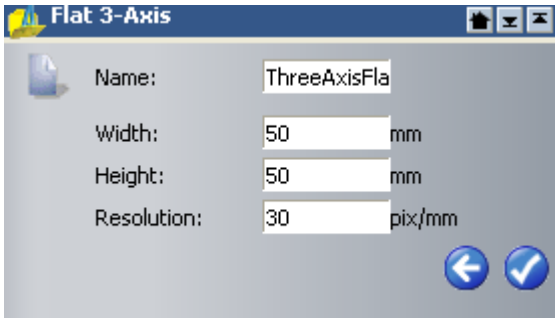
This tutorial demonstrates the model creation of a **Heart shaped pendant** with **Gem settings**. This exercise shows a range of functionality including **Back Reliefs**, **Gem vector creation**, **Pave Wizard** and **Fade Relief**.

Heart Pendant Exercise

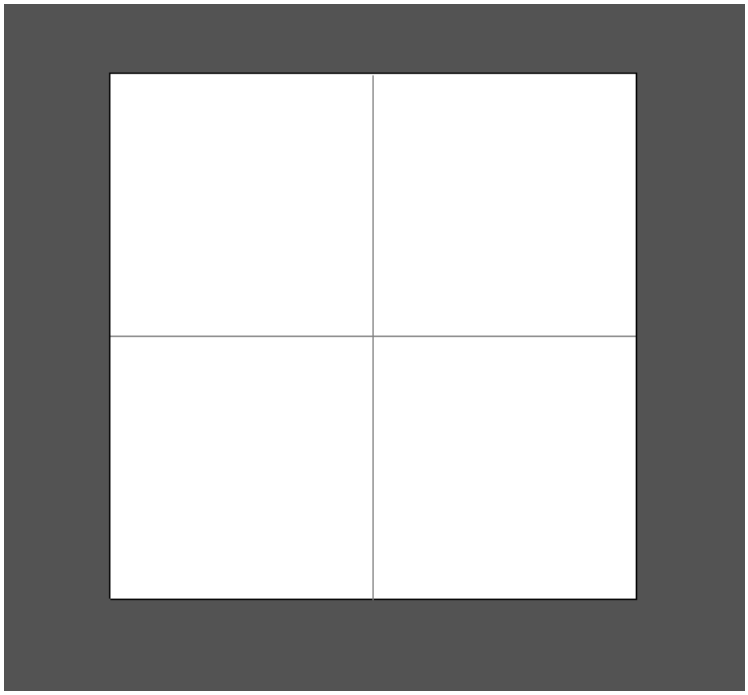
- Select **Create New Project** 

.
- Select **Models** from the root **Project** folder 

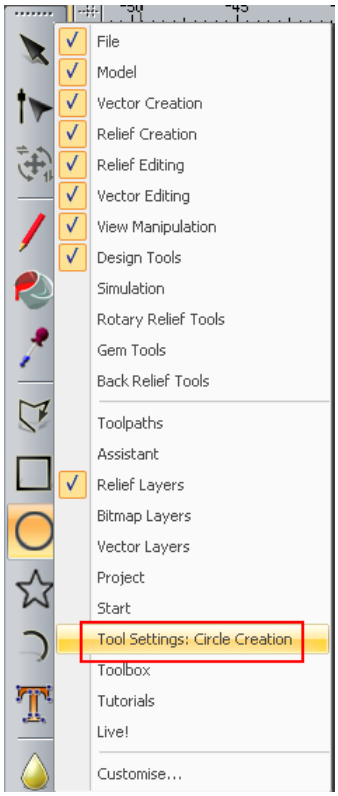
.
- Select a **3-Axis Flat Blank**
.



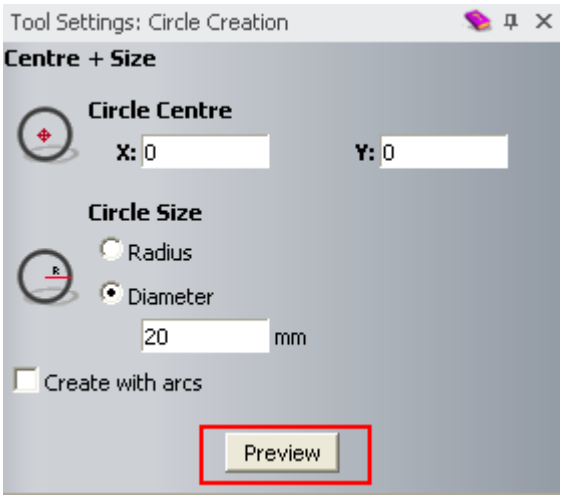
- Select **Accept** to the **Default** values.



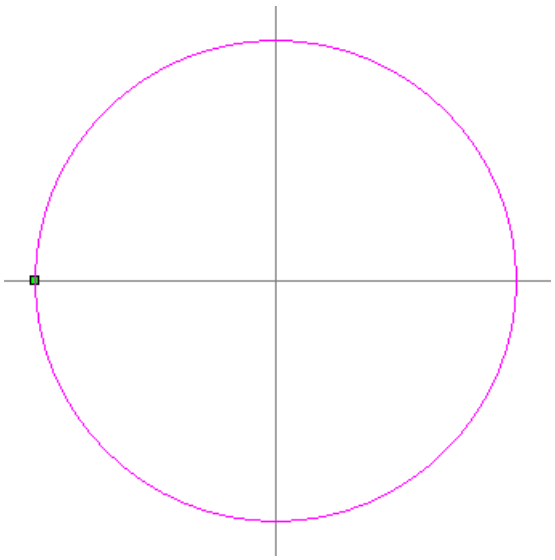
- Select **Create Circles** from the left toolbar.



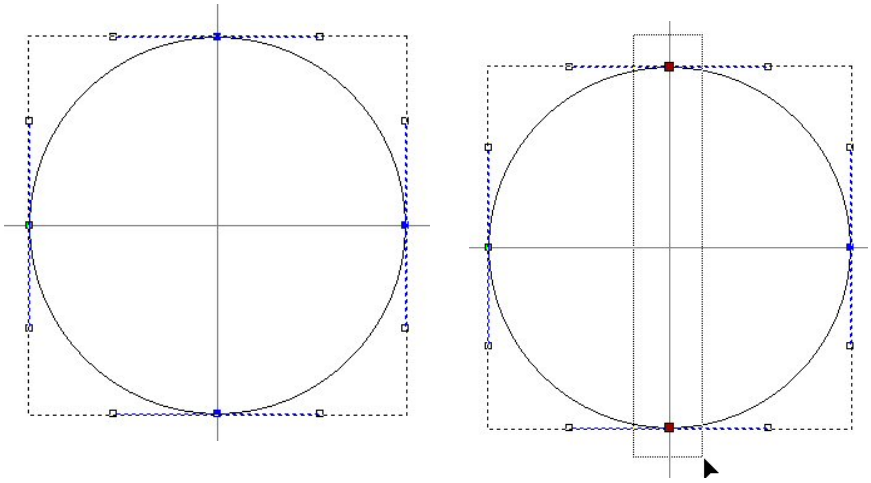
- Right mouse click on the left hand corner of the graphics area and select **Circle Creation**.



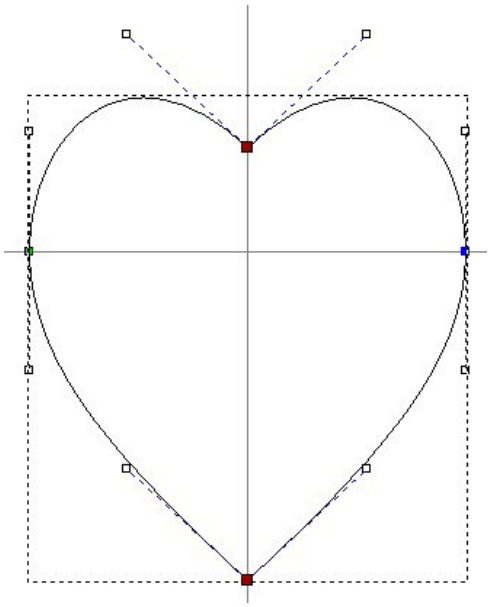
- Create a **Circle** with a **Diameter** of **20mm** at **X0 Y0**.
- Select **Preview**.
- Right mouse click on the graphics area to close the **Circle Creation** form and accept the **circle**.



- Make sure the circle is selected (highlighted in pink).
- Press **N** on the keyboard to enter the **Node Editing** mode.



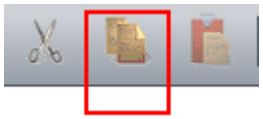
- Drag a box around the **top and bottom central nodes** as shown on the image above.



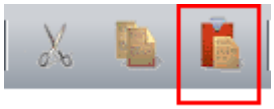
The **two node squares** turn **red** in colour.

- Press the **down arrow** on the keyboard until the shape looks like a **heart shape**, as shown in the image above.
- Select to exit the **Node Editing** mode.

- Select **F9** to **centralise** the **heart shape** in the page.

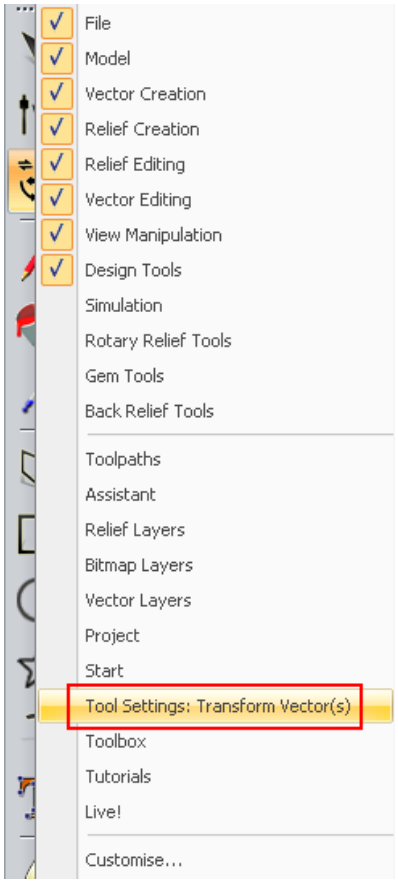


- Ensure the **heart vector** is selected then select **Copy**.



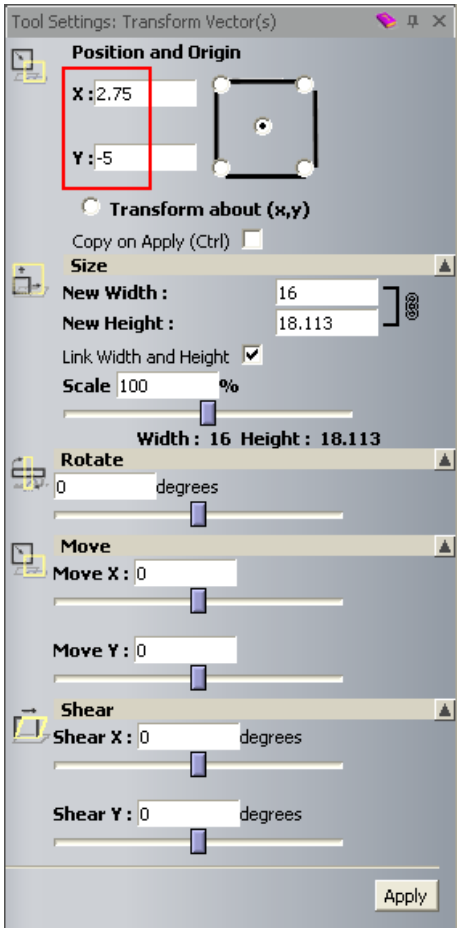
- Select **Paste**.

- Select **Transform Vector(s)** from the left toolbar.

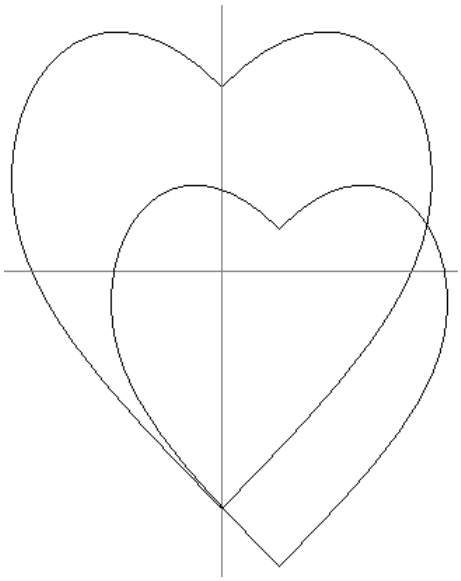


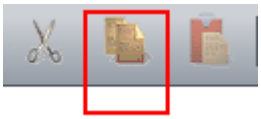
- Right mouse click on the left hand corner of the graphics area and select the option **Transform Vector(s)**.

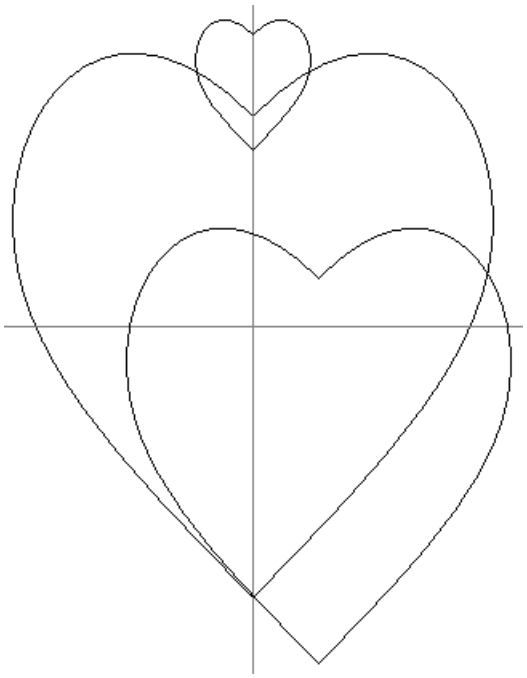
- In the **Transform Vector(s)** form, enter **X2.75mm** and **Y-5m** and apply a **Scale** of **80%**.
- Select **Apply**.



- Left mouse click on the graphics area to close the form.

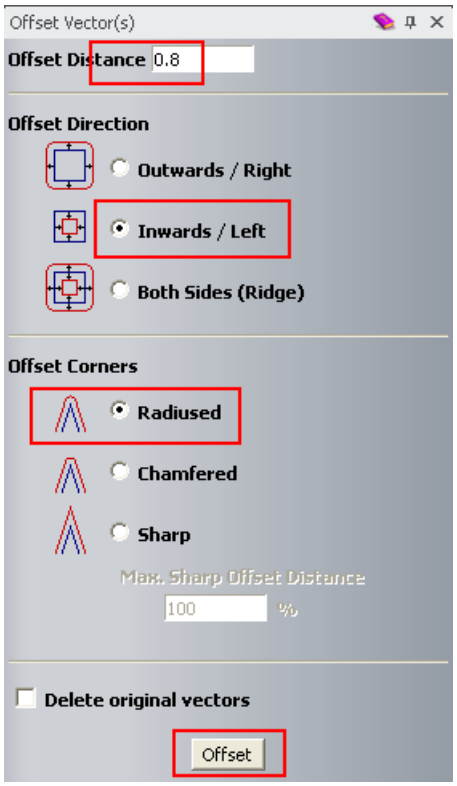


- Select the **scaled heart vector**.
- Select **Copy**  followed by **Paste** .
- Double left mouse click on **Transform Vector(s)** .
- In **Position** and **Origin**, enter **X0** and **Y10mm**.
- Enter a **Scale** of **30%**, select **Apply** and then left mouse click on the graphics area to close the form.

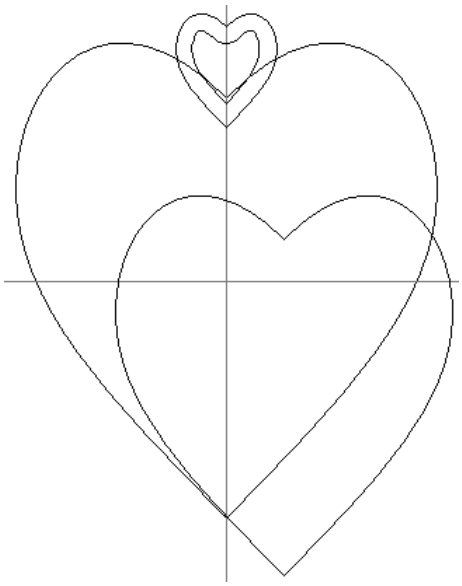


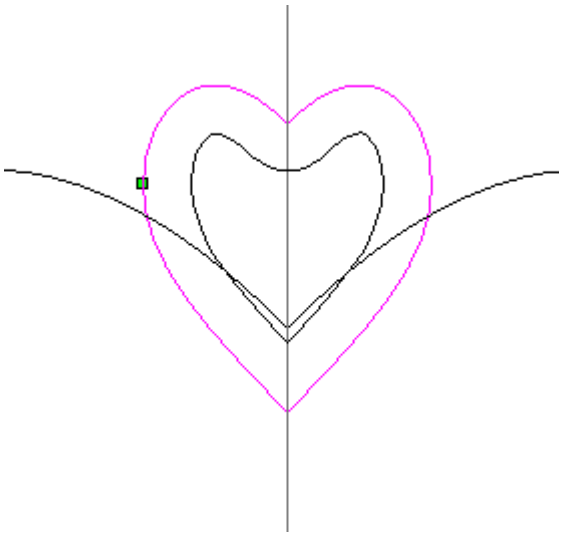
This forms the **first part** of the **Jump Ring** design.

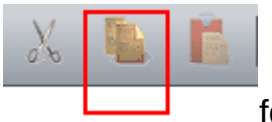
- Select the **new small heart shape**.
- Select **Offset Vectors(s)** .

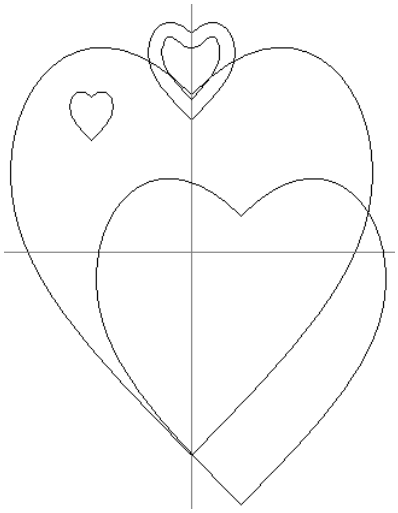


- Enter **Offset Distance** as **0.8mm**, select the options **Inwards / Left** and **Radiused**.
- Close the form.



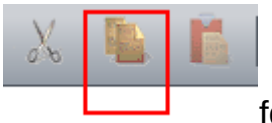


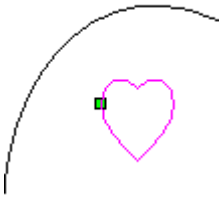
- Select the vector indicated on the image above.
- Select **Copy**  followed by **Paste** .
- Double left mouse click on **Transform Vector(s)** .
- In the **Transform Vector(s)** form, enter **X-5.5mm** and **Y7.5mm**.
- Enter a **Scale** of **50%** and select **Apply**.
- Left mouse click on the graphics area to close the form.



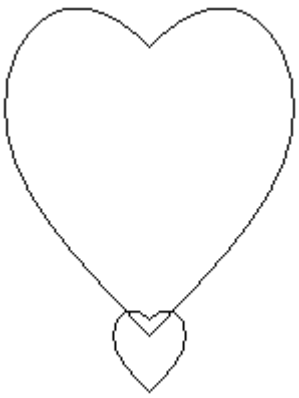
The **new vector** will be used to create a **small heart shaped gem**.

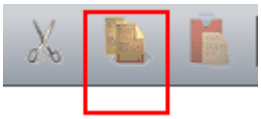
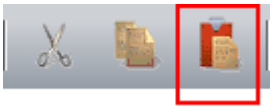
- Make sure this last vector is selected.

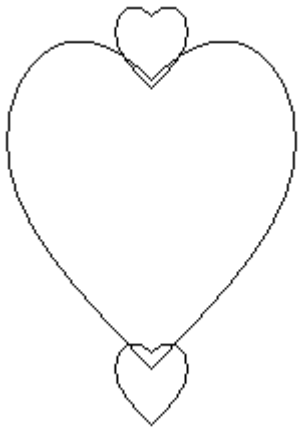
- Select **Copy**  followed by **Paste** .



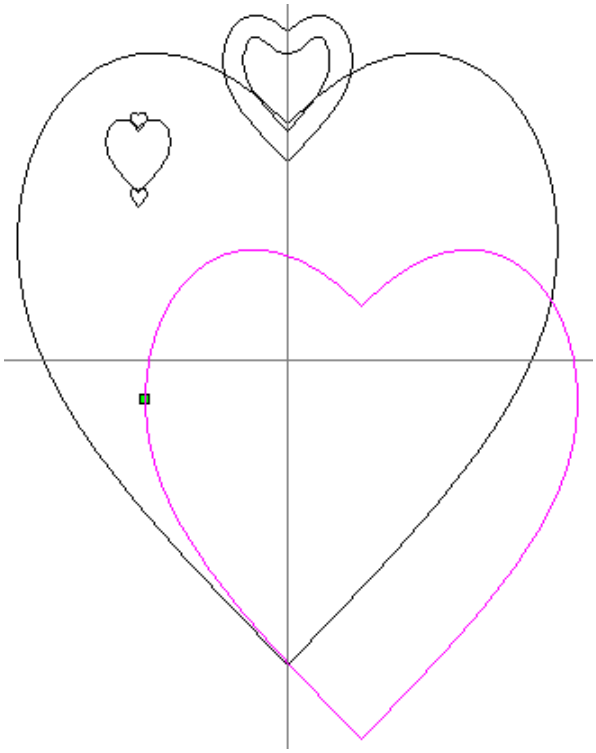
- Double left mouse click on **Transform Vector(s)** .
- In **Position and Origin**, enter **X-5.5mm** and **Y6.0mm**.
- Enter a **Scale** of **25%**.
- Select **Apply** and then **Close** the form.



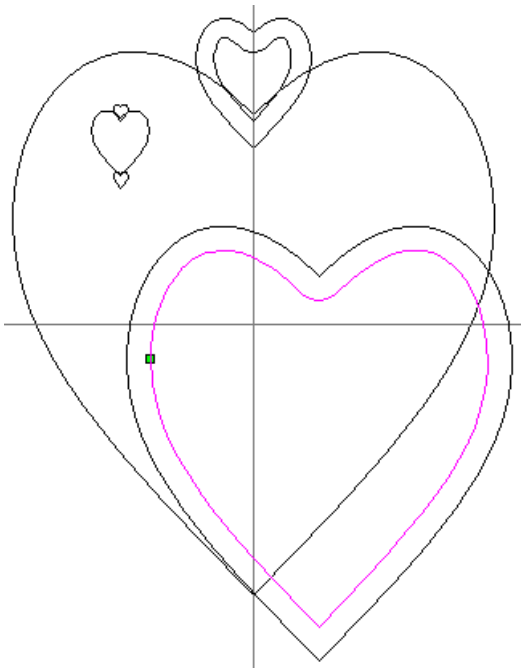
- Ensure this **new vector** is selected, then **Copy**  and **Paste**  .

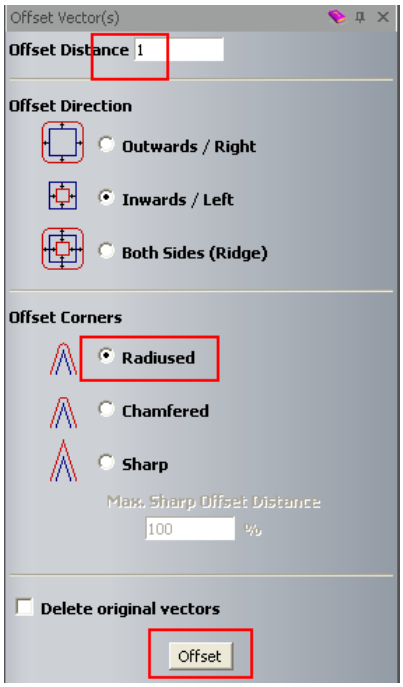


- Select **Transform Vector(s)** .
- In **Position and Origin**, enter **X-5.5mm** and **Y8.8mm**.
- Select **Apply** and then **Close**.



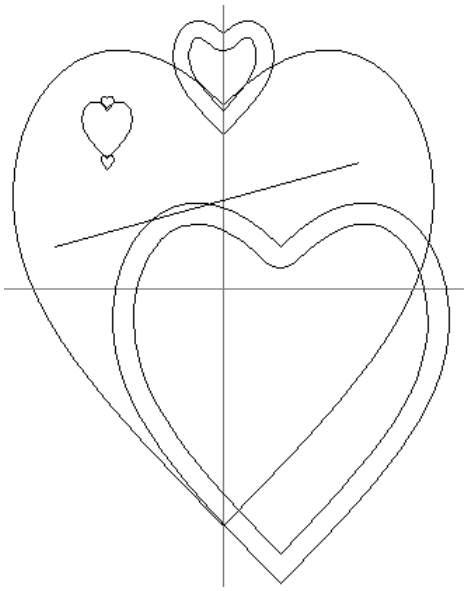
- Select the **second largest vector** as shown above.





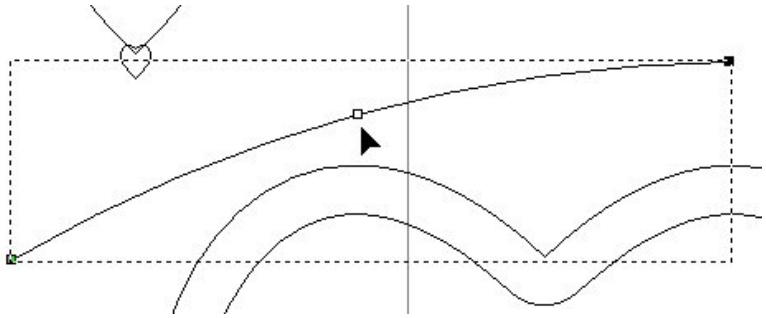
This forms the area where you will create the **Pave Settings**.
You'll also add **Text** to the design.

- Select **Offset Vectors(s)** .
- Enter an **Offset Distance** of **1.0mm**, select the options **Inwards/Left** and **Radiused**.
- Select the **Offset** button then **Close**.

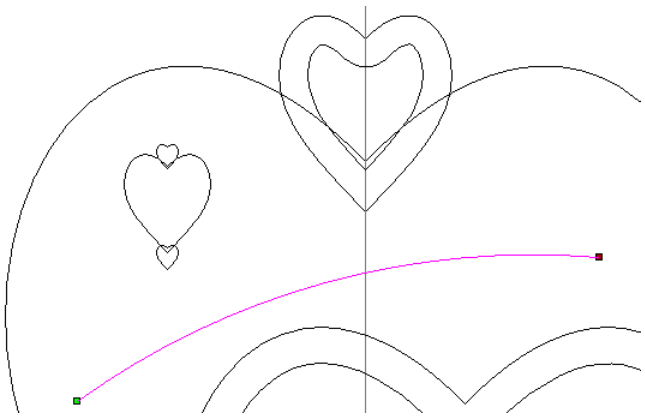


The **Line** will be used to **wrap** the text along. But first it needs to have a **Curve** applied to it.

- Select **Create Polyline** .
- Enter **X–8mm** and **Y2mm** and select **Add**.
- Enter **X6.5mm** and **Y6mm** and select **Add** to complete the **Line**.
- Select
- Close the form.
- Select the **new line**.
- Select **Node Editing** .

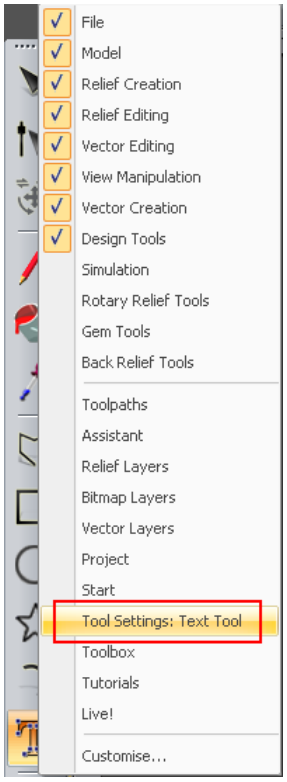


- Position the mouse pointer in the **middle of the Line** and select **A** to apply an **Arc** to the **Line**.

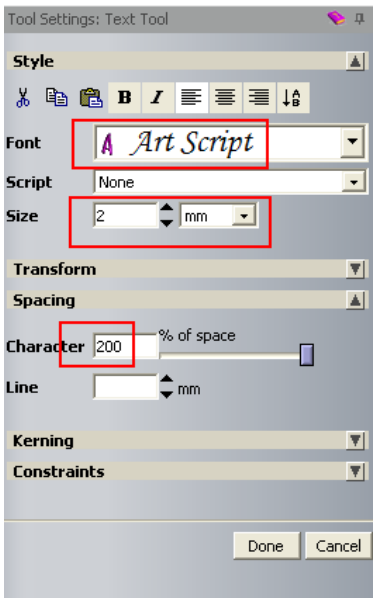


- Drag the **middle node** on the **Arc** to create a shallow **Curve** similar to that shown above.
- Select .

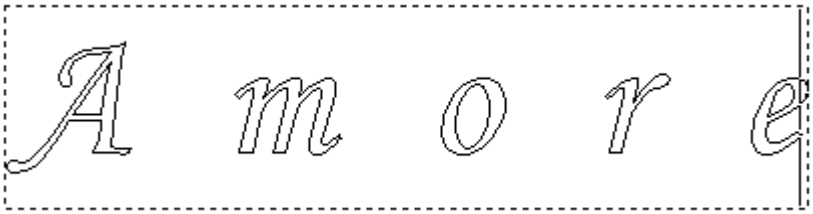
- Select **Create Vector Text** .



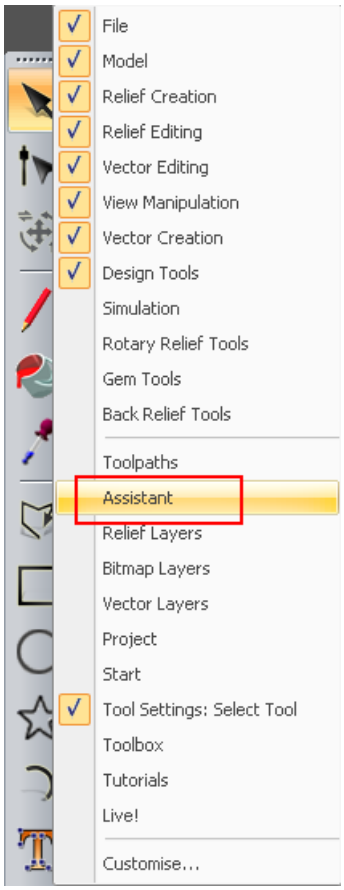
- Right mouse click on the left hand corner of the graphics area and select **Text Tool**.



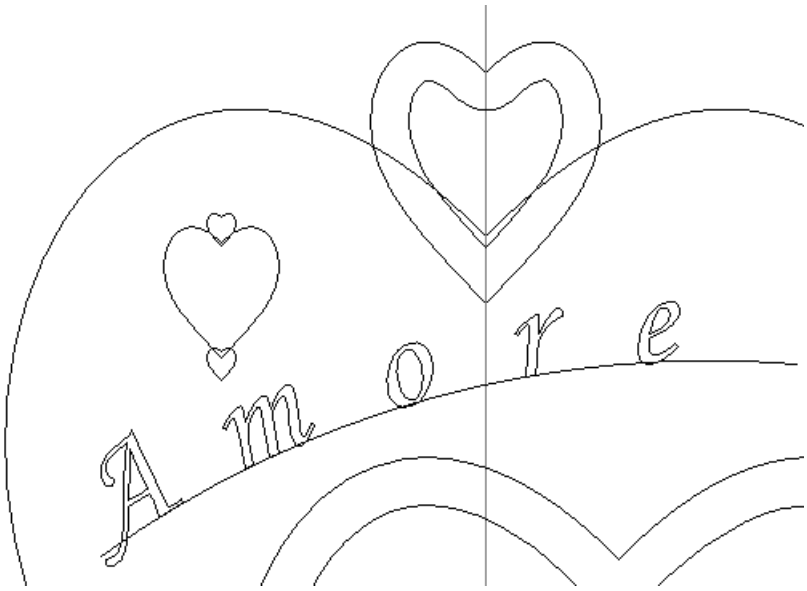
- Select **Font Art Script**, **Size** of **2mm** and **Spacing** of **200%**.



- Click anywhere in the graphics area and type the word **Amore**.
- Select **Done** to exit the page.
- With the **Amore** text selected, **shift select** the curved **Polyline** created earlier.

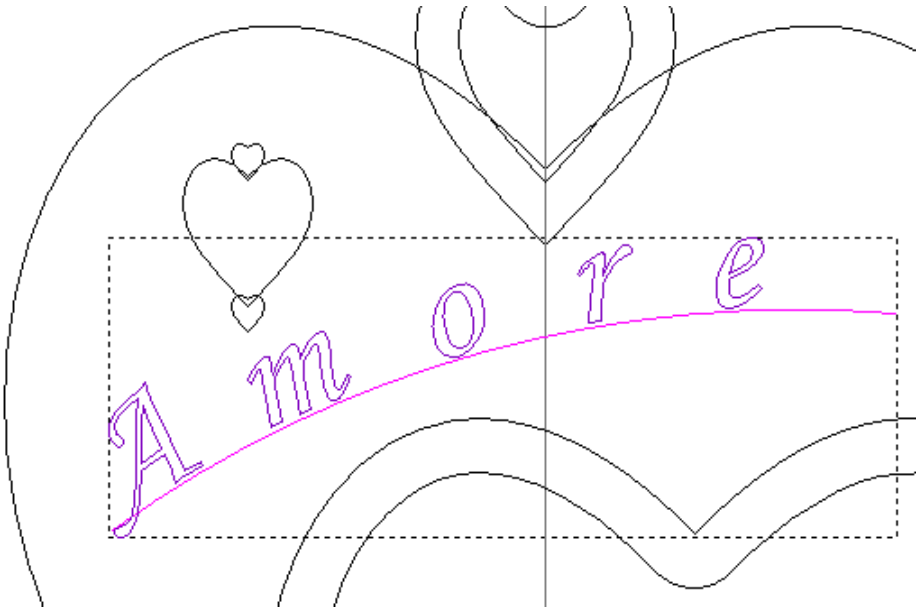


- Right mouse click on the left corner of the graphics area and select **Assistant**.



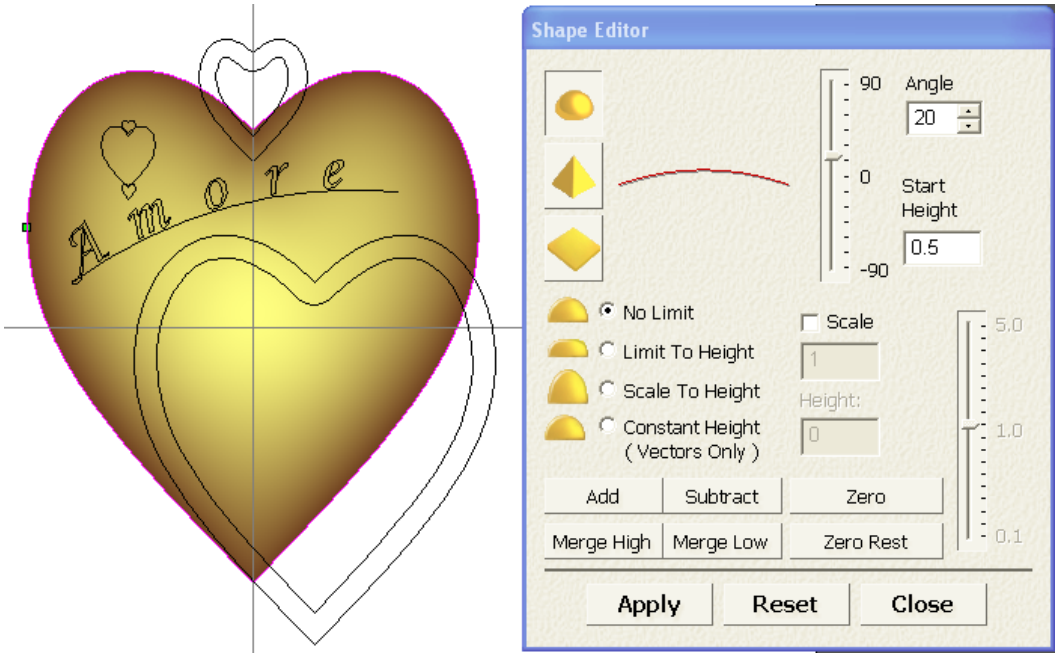
The **Amore** text automatically wraps itself to the selected curve.

- Select **Wrap text round a curve** .
- Use text settings if required to position the text above the line.
- Select **OK** to close the form.

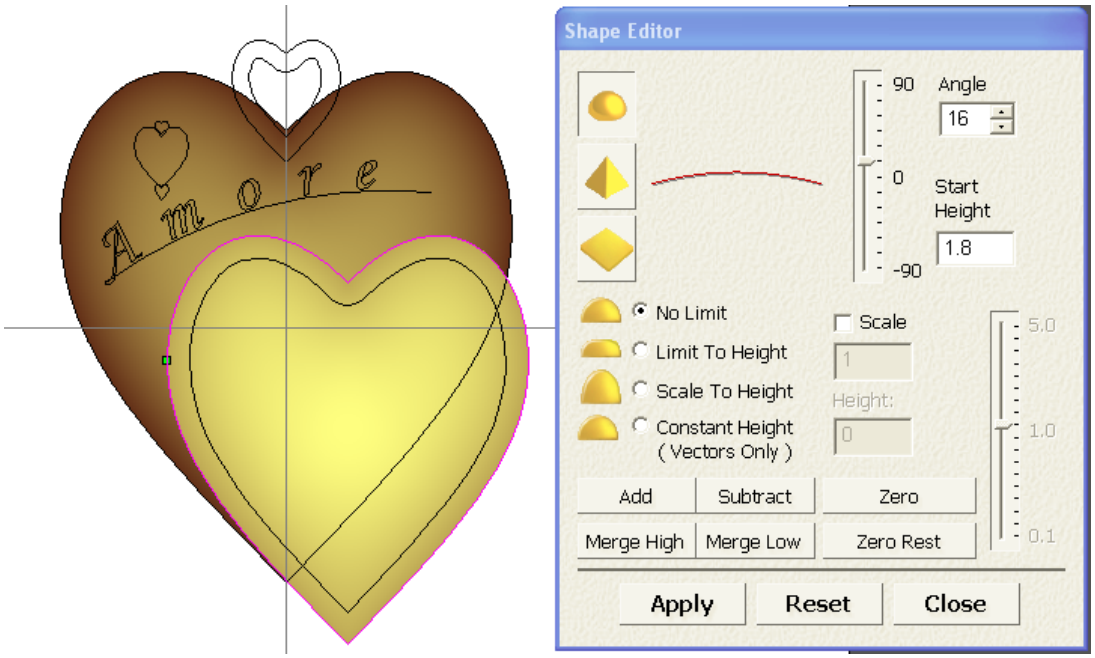


All the required vector **Artwork** is now complete. You can now create the **model** using the **Shape Editor**.

- Close the **Assistant**'s page.

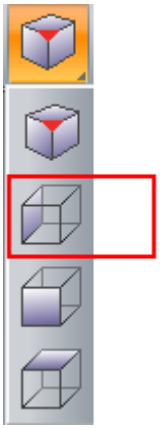


- Select the **largest heart vector** and press **F12** to open the **Shape Editor**.
- Add a **Dome** shape of **20 degrees** with a **Start Height** of **0.5mm**.
- Select **Preview Relief Layer** .

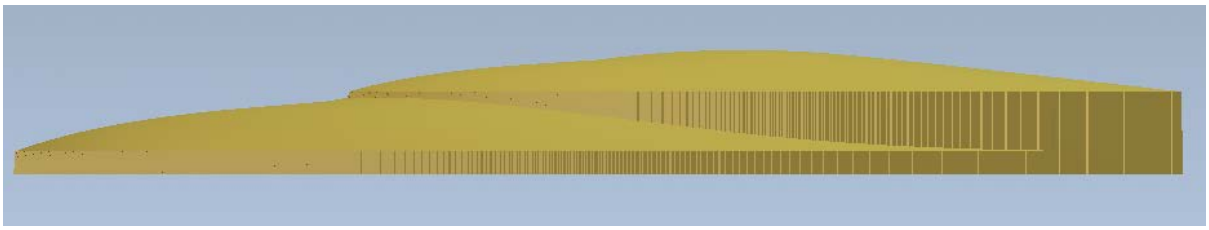


- Select the **inner heart** shape vector as shown below, and **Merge High** a **Dome** shape of **16 degrees** with a **Start Height** of **1.8mm**.
- Close the **Shape Editor** form.

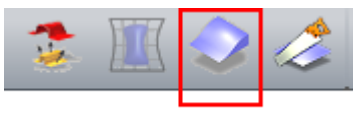
- Press **F3**.
- Select **Draw Zero Plane** .



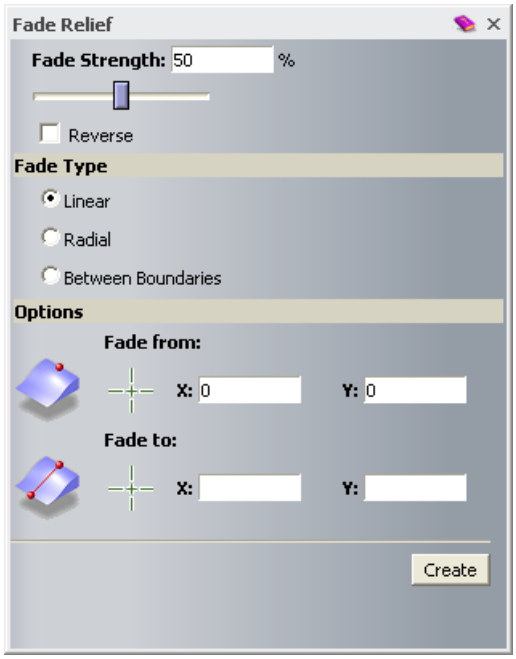
- Keep pressing with left mouse button the **Isometric View** button to display the other view options and select **View Along X**.



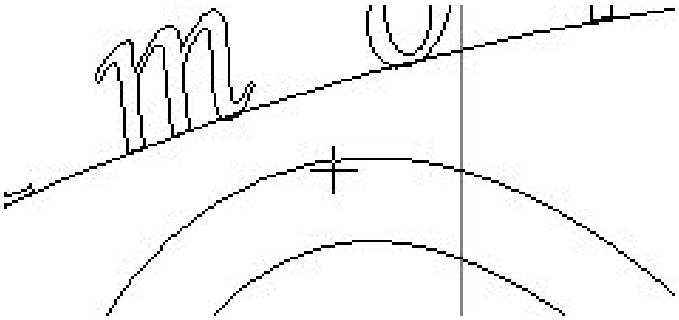
- Press **F2**.



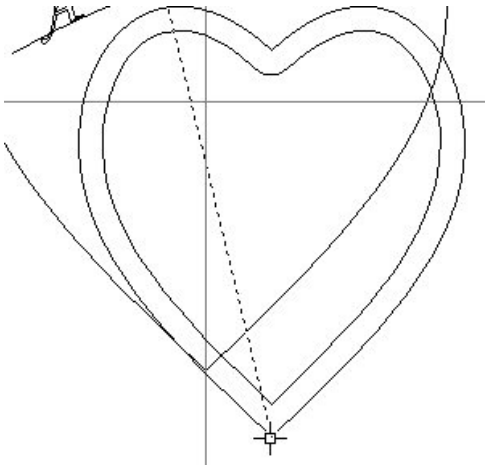
- Ensuring the **heart vector** is still selected from before; select **Fade Relief** from the top toolbar.



- Enter a **Fade Strength** of **50%** .

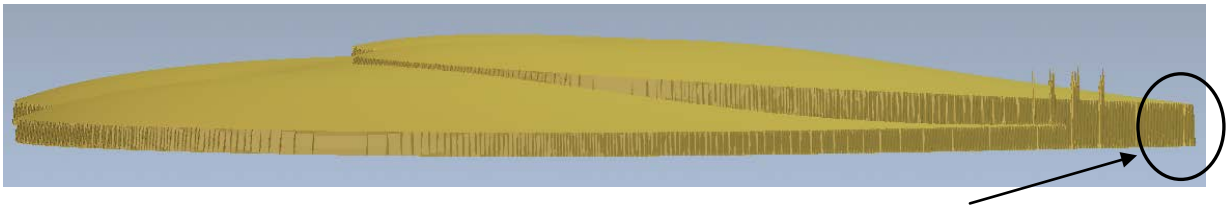


- Drag the icon from the **Fade From** field to the position shown on the image above.
- Click on a point when the **Fade from** values read approximately **X-1.5 Y3.9**.

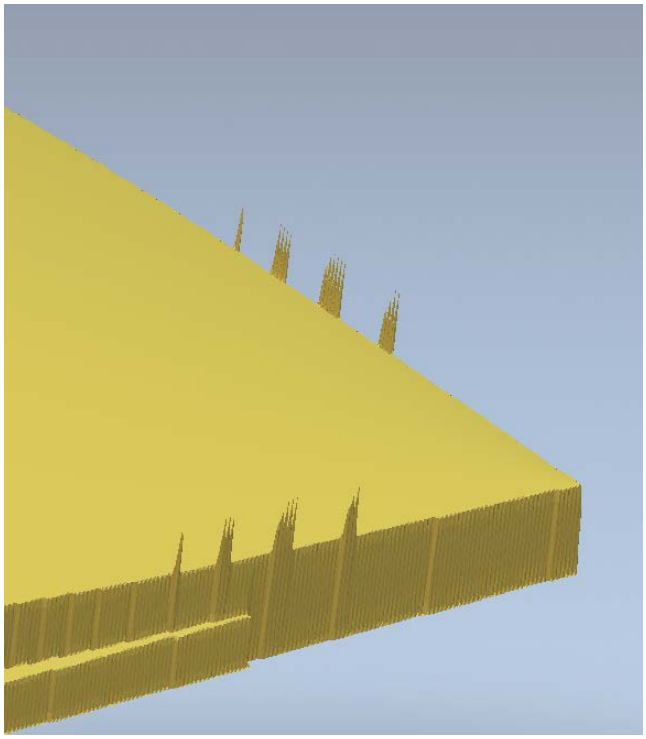


The second **point needs** to be defined at the **bottom tip of the heart**.

- Select the **second point** at the **snap node** cursor at the bottom, as shown.
- Press **F3**.
- Select **Create** and then **Close**.



The **tip** of the heart is **Faded** and reduced to a more acceptable height.



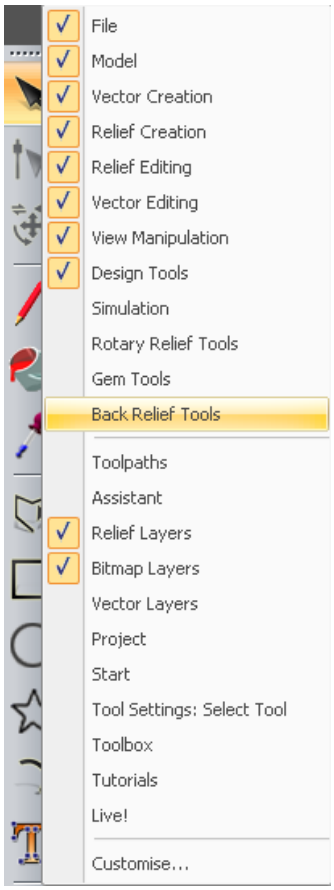
The Fade Relief operation has resulted in ‘spiked’ areas as shown.

- **Zoom** into the area shown.

To remove the “spikes” you will use the **Smooth Relief** option.

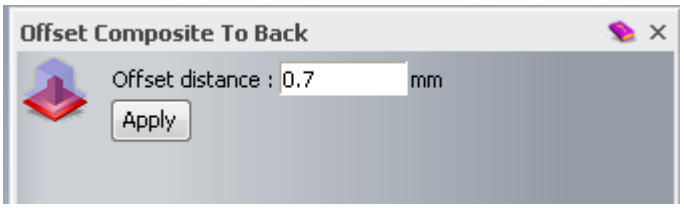
- Select **Smooth Relief** .

- Apply **20 Smoothing Passes** to the relief.
- Select **Cancel** to close the form.

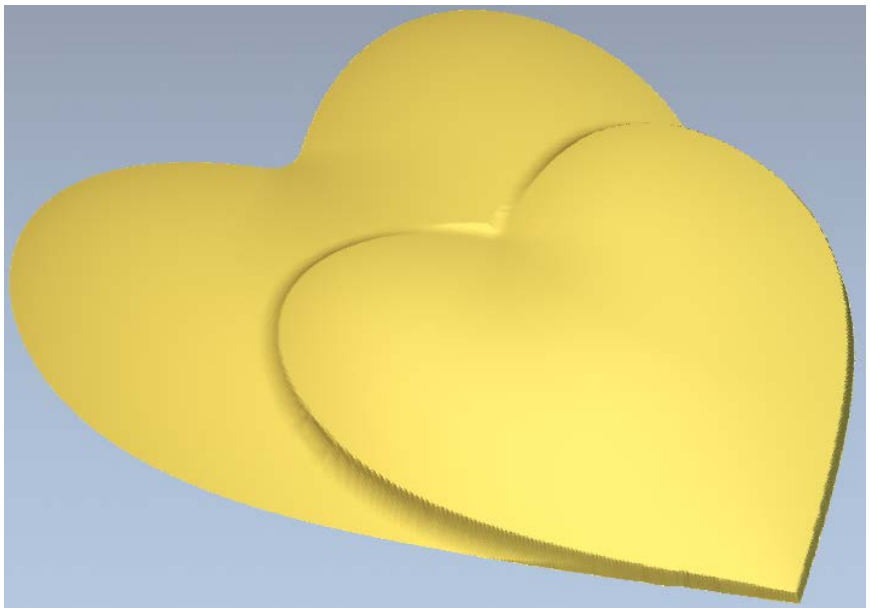


- Right mouse click on the left hand corner of the graphics area and select **Back Relief Tools**.

- Select **Offset Composite To Back**.

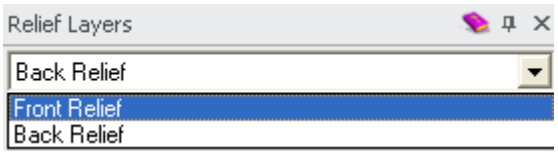


- Enter **0.7mm** as **Offset distance** and select **Apply**.

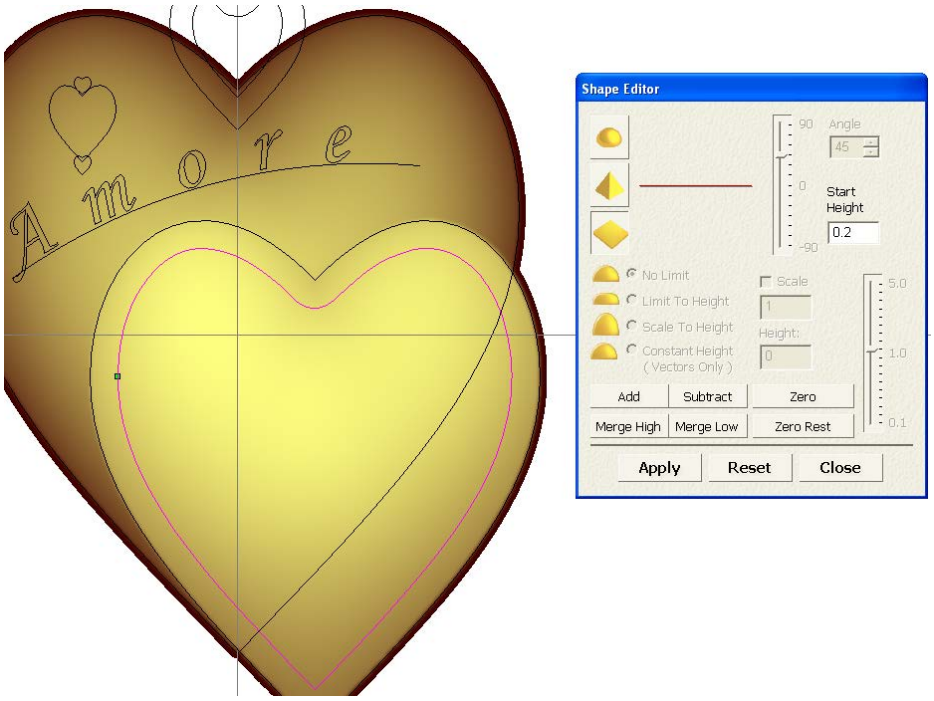


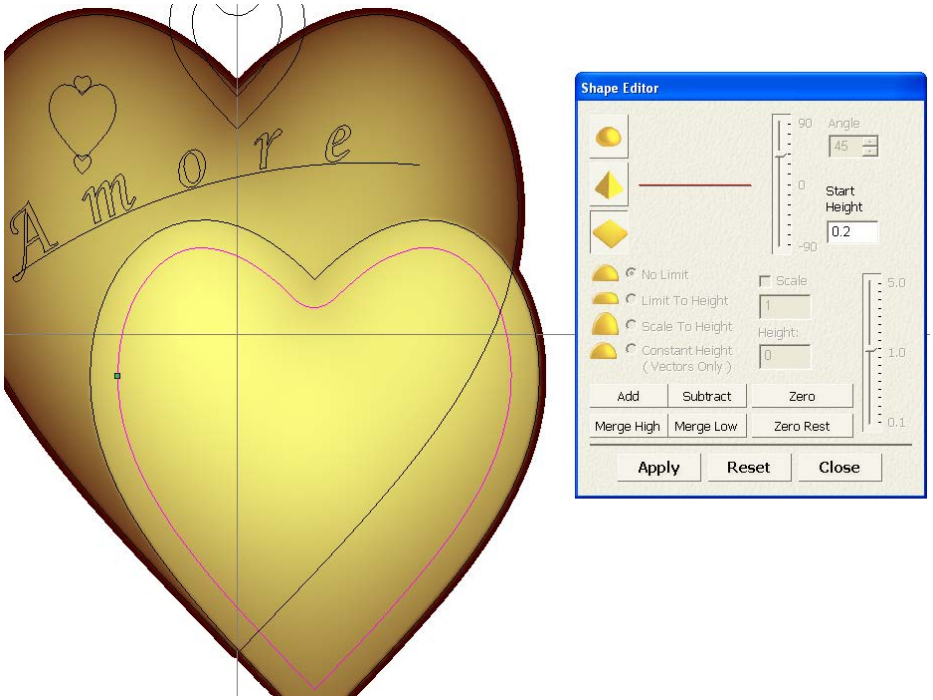
The **Relief** has been **offset** (as a **Back Relief**).

This will be used to **Subtract** from the **Front Relief** to **hollow** the **pendant**.



- Select **Front Relief** from the **Relief Layers** pull down menu.
- Press **F2**.
- Close the **Back Relief Tools** form.

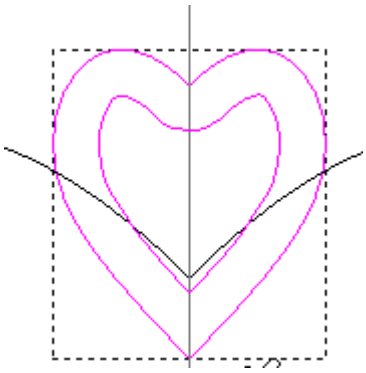




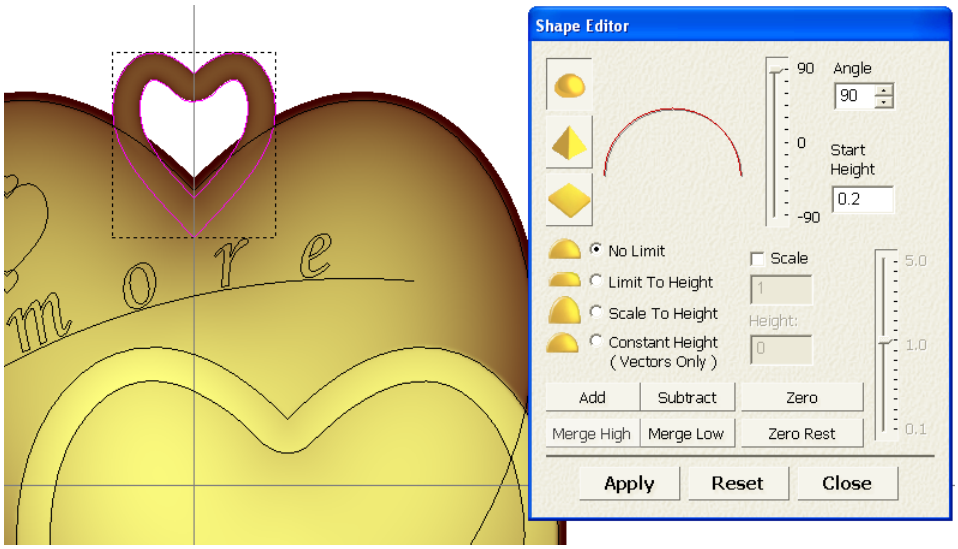
- Select the **vector shown** and press **F12**.
- Enter a **Start Height** of **0.2mm** and select **Subract**.
- Close the **Shape Editor** form.
- Press **F3**.

This 0.2mm recess will receive the Pave settings.

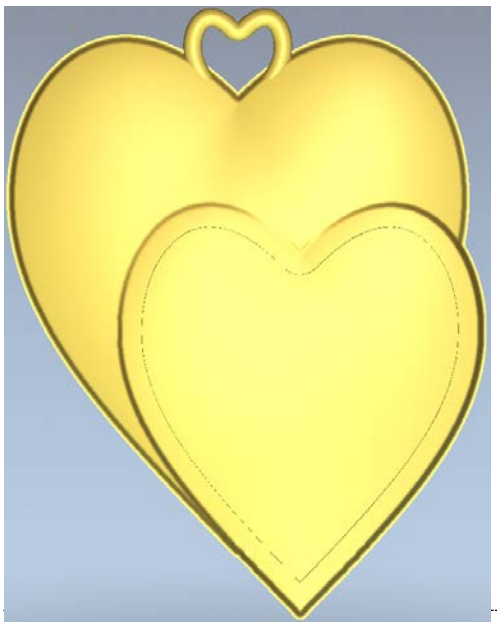
- Press **F2**.



- Select **both the ring vectors** as shown above.
- Press **F12**.



- Apply a **Dome shape** of **90 degrees** with a **Start Height** of **0.2mm**.
- Press **F3**.



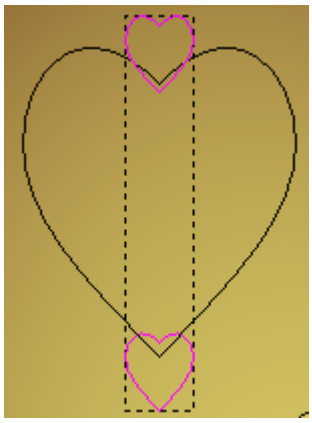
By using **Merge High**, the Jump Ring blends into the main body correctly.

- Press **F2**.
- Select the **Amore text**.

Note:

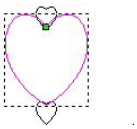
If you prefer a slightly higher text, you can add a height of 0.1mm or 0.2mm.

- Add a **Dome** shape of **90 degrees**.
- Press **F3**.

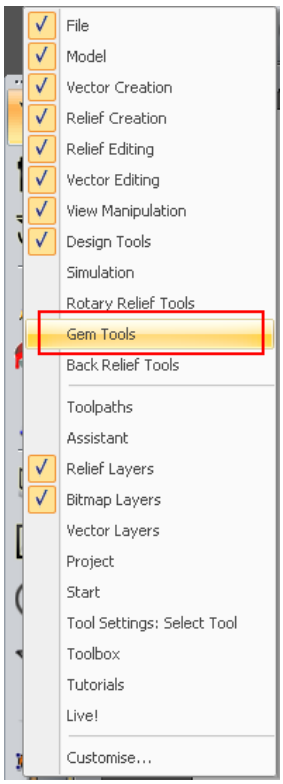


- Press **F2**.
- Select the **two smallest hearts** and **Add** a **Dome** shape of **90 degrees**.
- Select **Close** to exit the **Shape Editor** form.
- Press **F3**.

- Press **F2**.

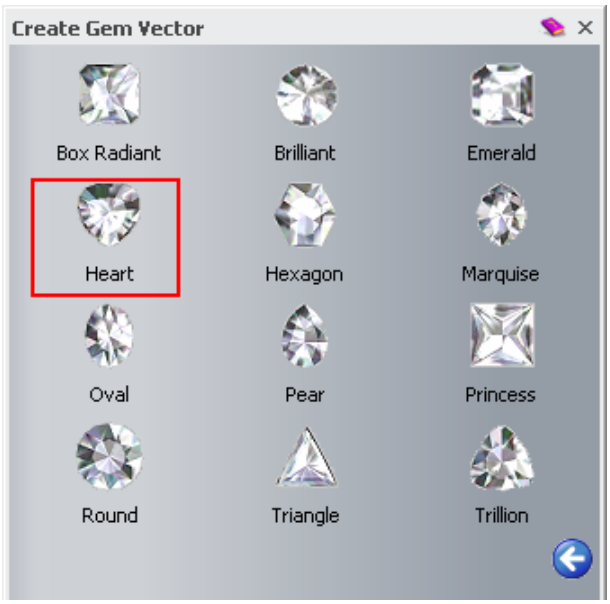


- Select the **heart vector** between the two smallest heart vectors.

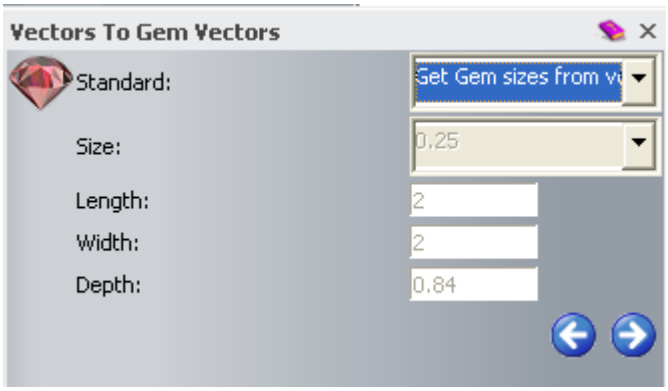


- Right mouse click on the left hand corner of the graphics area and select **Gem Tools**.

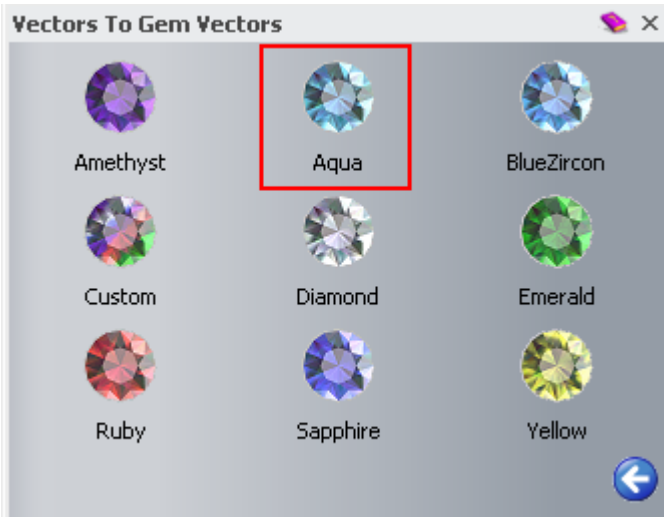
- From the **Gem Tools** toolbar, select **Convert Vectors to Gem Vectors**.



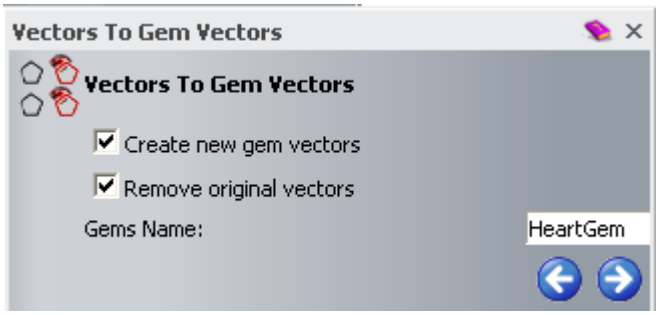
- Select **Heart** shaped **gem**.



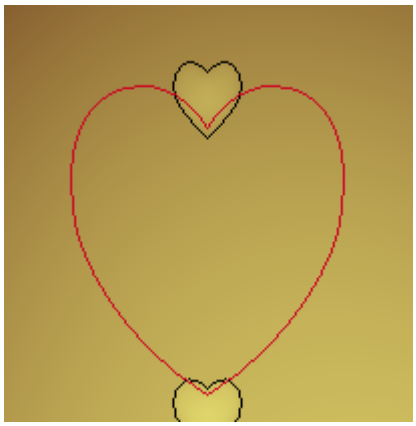
- Select **Get Gem sizes from vectors** from the **Standard** options.
- Select **Forward** .



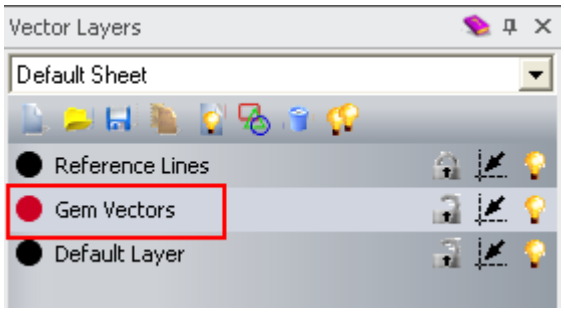
- Select **Aqua** for the gem colour.



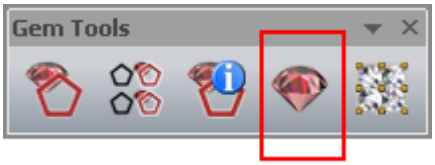
- Leave the options selected.
- Close the form by selecting the cross icon .



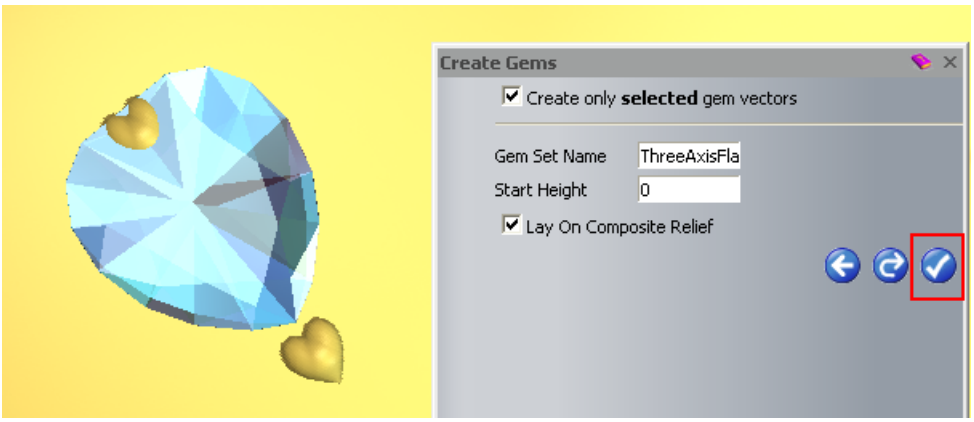
The gem vector appears highlighted in red and it saved in a new vector layer called **Gem Vectors**.



To visualize the **Gem Vectors** layer under **Vector Layers**, right mouse click on the left hand corner of the graphics area and select the option **Vector Layers**.

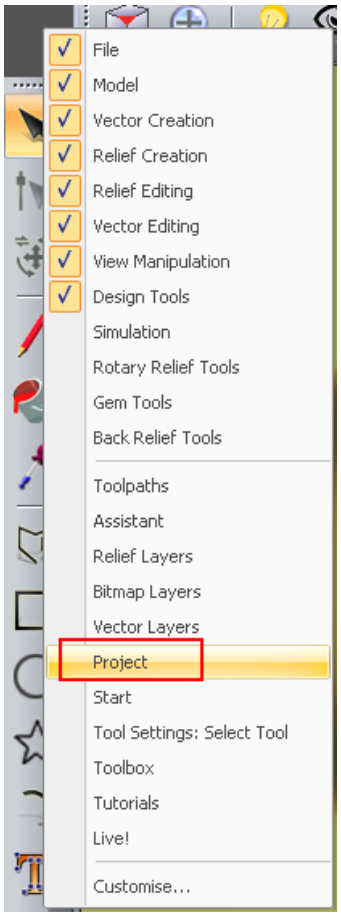


- Make sure the new gem vector is select and select the option **Create Gems**.
- Select the option **Lay On Composite Relief**.
- Press **F3** to see the gem on the relief.

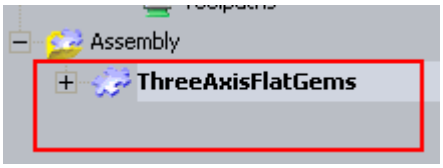


The **Gem** is positioned and sized using the heart gem vector and the **Lay On Relief** angles it to the curved surface.
However, because the centre of the heart gem aligns itself with the centre of the heart vector it has shifted slightly so you need to **Nudge** it back into position.

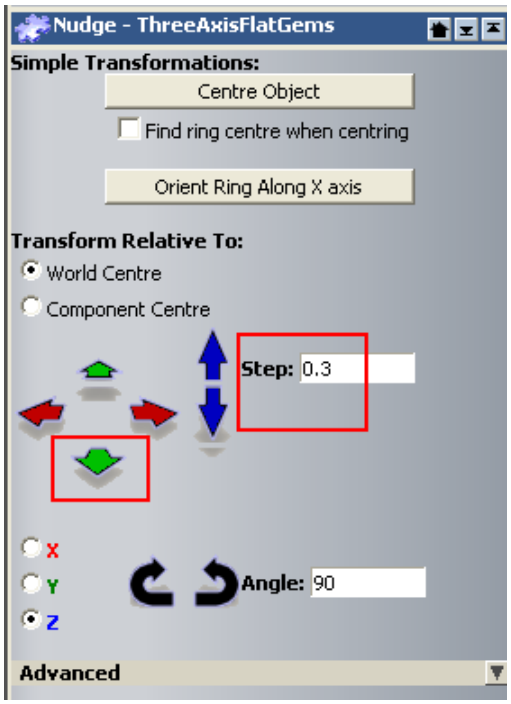
- Select **Accept** on the **Create Gems** form and then close the form.
- Close the **Gem Tools** form.



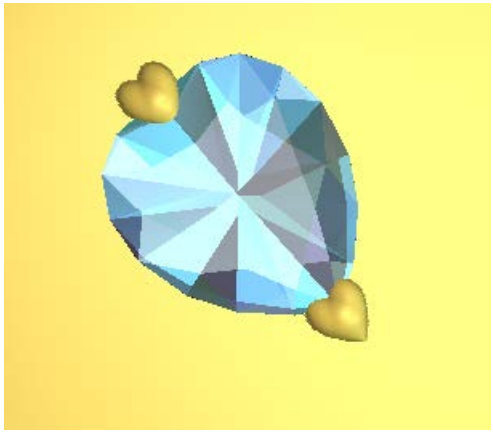
- Right mouse click on the left hand corner of the graphics area.
- Select **Project**.



- From the **Assembly** folder select **ThreeAxisFlatGems**.
- Double left mouse click to select **Nudge** from the **Assembly** area.

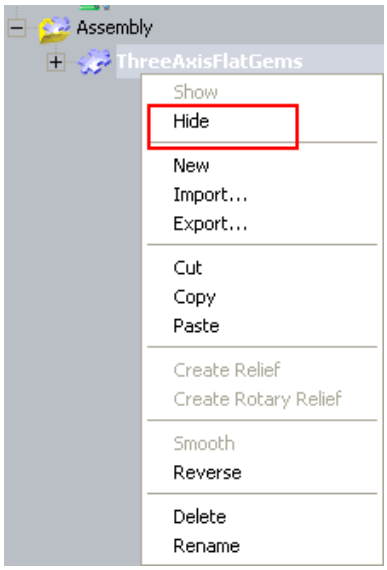


- Type **0.3mm** in the **Step** box and then select the down green Y arrow button to position the gem.

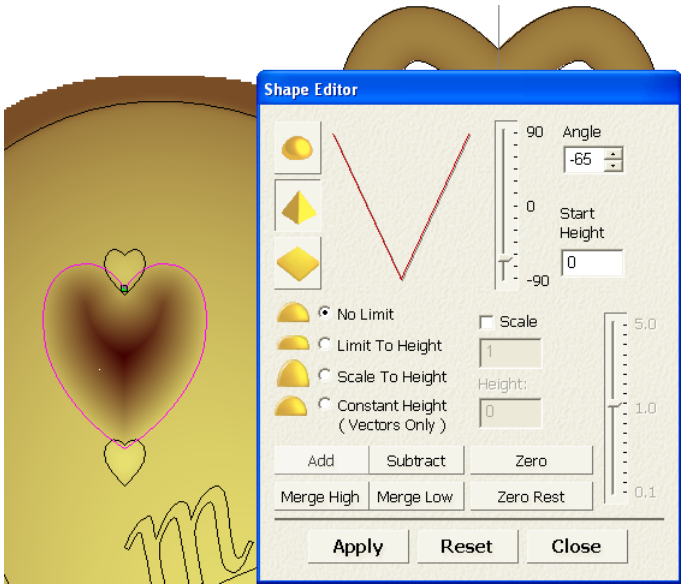


The **Gem** is now **positioned** correctly.

- Select the **icon highlighted** on the image above to close the **Nudge** form when the gem is at a convenient position.



- Select **ThreeAxisFlatGems** below the **Assembly** folder under the **Project** tree.
- Right mouse click on it and select **Hide** from the menu.
- Press **F2**.

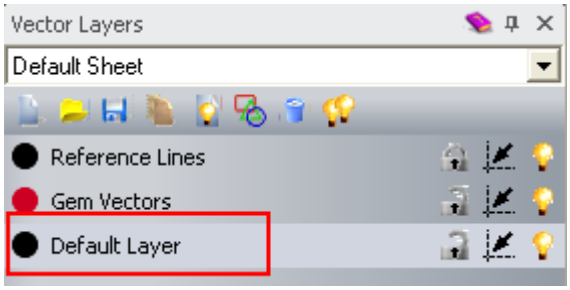


The **hole for the setting** will be created automatically when the **Back relief** is **removed** from the **Front relief**.
This will be shown later.

- Select the **heart gem vector** and press **F12** to display the **Shape Editor**.
- Add a **-65 degrees Pyramid** shape to create a setting.

You will now create the **Pave setting** vectors.

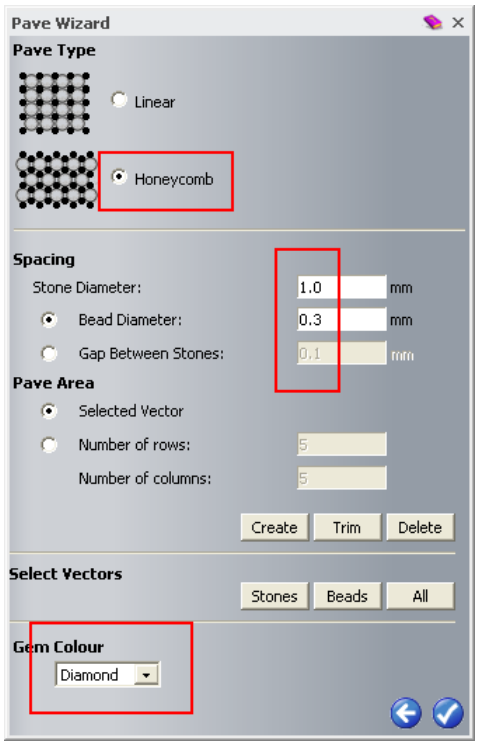
- Right mouse click on the left hand corner of the graphics area.
- Select **Vector Layers** from the menu.



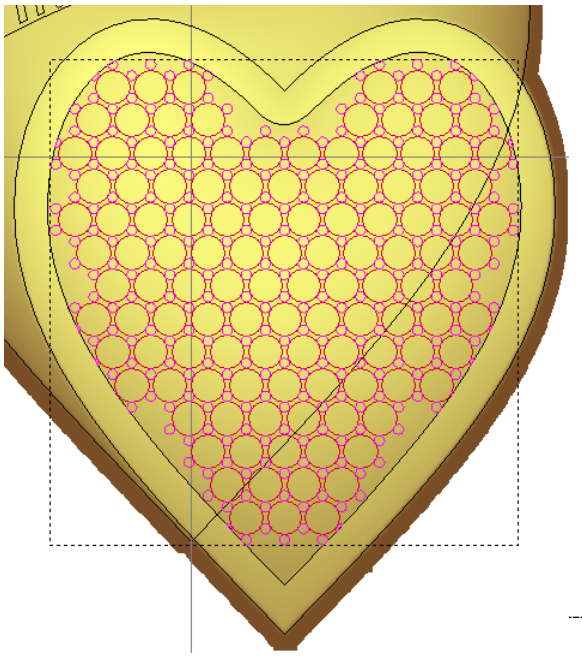
- Highlight the **Default Layer** to make it active.

- Select the **inner heart** shape vector as shown above.
- Right mouse click on the left hand corner of the graphics area and select **Gem Tools**.

- In the **Gem Tools** toolbar, select the **Pave Wizard** .



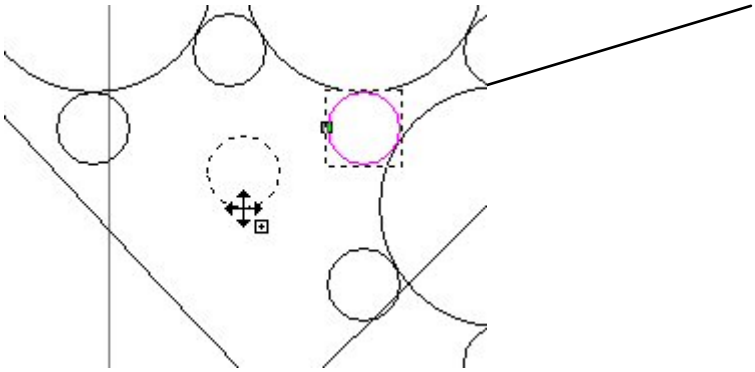
- Select **Pave Type** as **Honeycomb**, **Stone Diameter** of **1mm** and **Bead Diameter** of **0.3mm**.
- Select a **Gem Colour** of **Diamond**.
- Ensure **Selected Vector** is **highlighted** in the **Pave** area and then select **Create**.
- Select **Trim** to remove unwanted vectors.



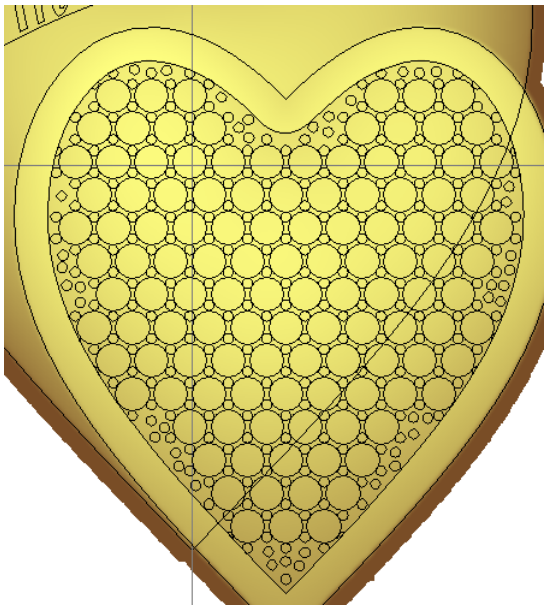
At this stage, you can **add** further **Beads** or **Stones** to fill the **gaps**.
Selecting either **Stones** or **Beads** highlights the corresponding vector group.

Note: This can be carried out whilst the **Pave Wizard** page is still open.

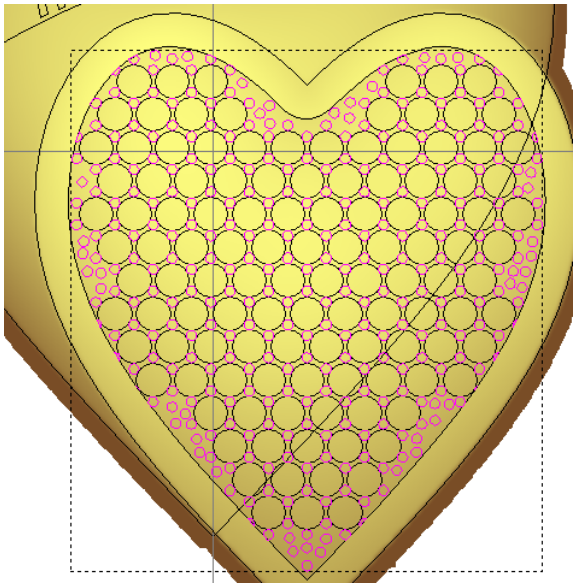
- Click in the **2D View** to deselect the vectors.
- Select and hold a **single bead vector**.



- Selecting **Ctrl** at the same time creates a **copy of the selected vector**.
- Drag the **newly copied** bead vector into an empty space as shown.

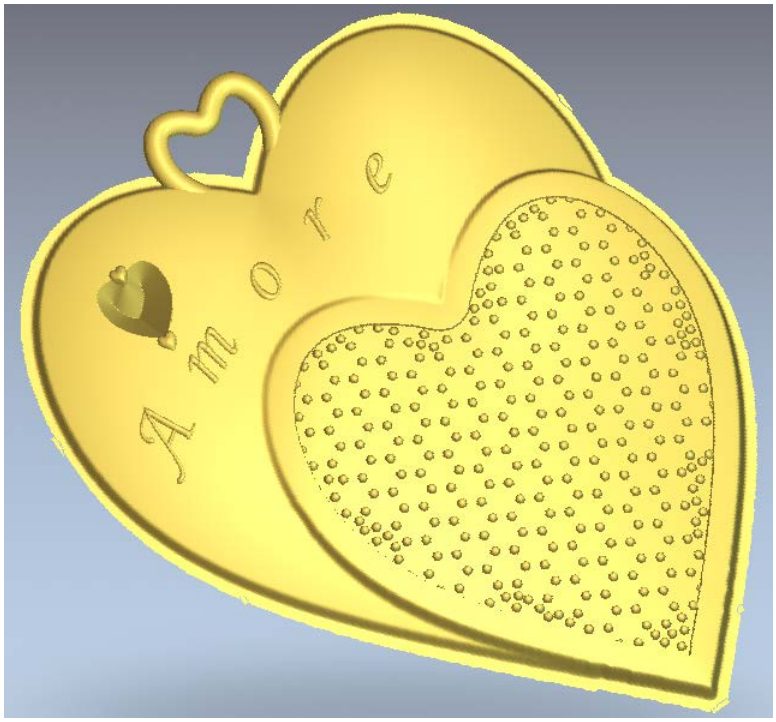


- Continue **copying bead vectors** until you fill the vacant areas within the heart shaped vector.



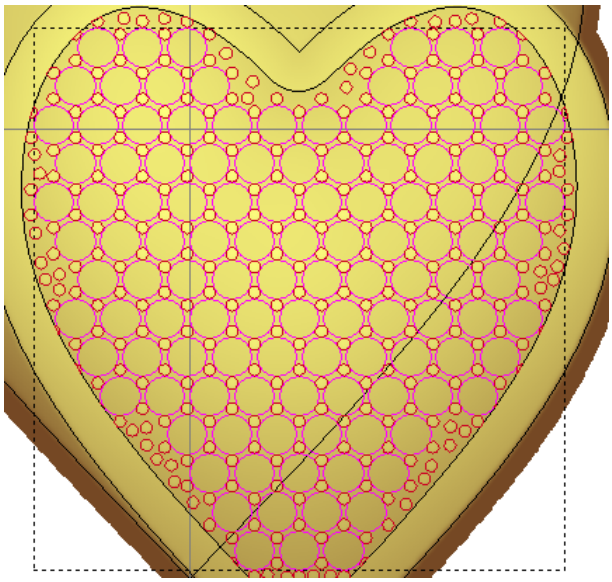
The **bead vectors group** have been selected for modelling.

- Select **Beads** on the **Pave Wizard** form.
- Select **Accept** on the **Pave Wizard** form.
- Press **F12**.

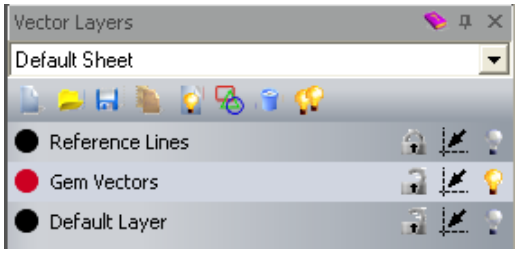


- Add a **Dome** shape of **90 degrees** with a **Start Height** of **0.1mm**.
- Close the **Shape Editor**.
- Press **F3**.

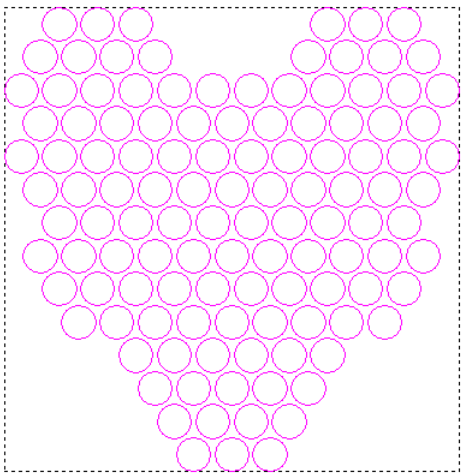
- Press **F2**.



- Close the **Pave Wizard** form.

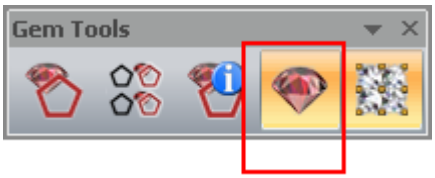


- Switch off the visibility of the layers – **Reference Lines** and **Default Layer** by clicking on the bulb next to them.

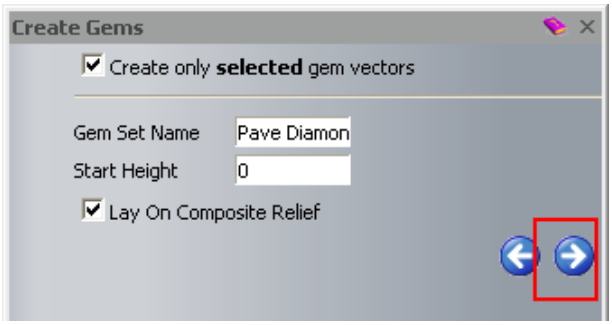


- Drag a box to select only the **circular gem vectors only**.

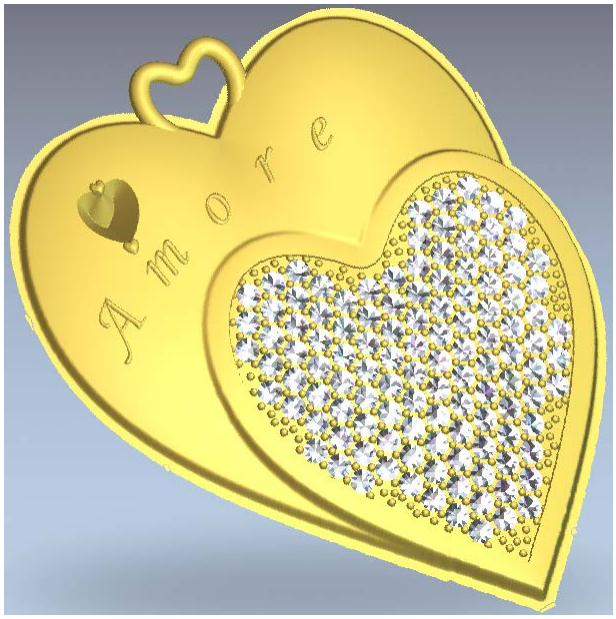
- Right mouse click on the left hand corner of the graphics area and select **Gem Tools**.



- Select **Create Gems** from the **Gem Tools** toolbar.

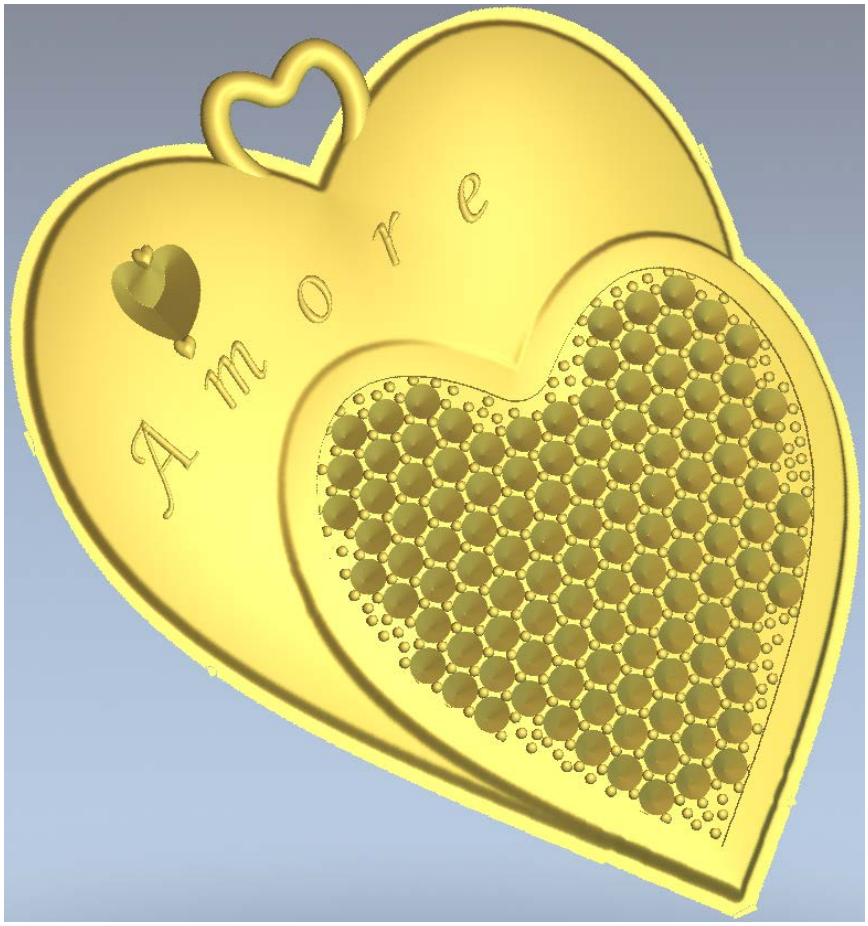


- In **Gem Set Name**, type **Pave Diamonds**.
- Ensure **Lay On Composite Relief** is selected.
- Select **Accept** .
- Close the **Create Gems** form.
- Close the **Gem Tools** form.

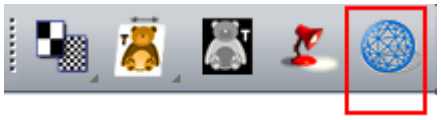


The **Diamonds** have been positioned within the vectors and angled correctly to suit the curved face.
The **Angle** is achieved because the option **Lay On Composite Relief** was selected.

- Press **F2**.
- Ensure the **Diamond gem vectors** are still selected, then press **F12** to open the **Shape Editor**.
- Add a **–65 degrees Pyramid** shape to create the setting.
- Press **F3**.



- Select **Create Triangle Mesh** .



- Select the option **Close with Back Relief** and then select **Create Triangles**.
- Select the option **Add To Project** and then **Close** the **Mesh Creator** form.
- Select **File** – **Close Model**.

- Select **Save** .
- Browse: **D:\users\training\COURSEWORK\JewelSmith-Jobs**.
- Enter the name **Heart pendant** and select **Save**.

- Under the **Assembly** folder within the **Project** tree, select **ThreeAxisFlatGems**.
- Right mouse click on the **ThreeAxisFlatGems** and select **Show**.
- Add a **Material** by selecting **Edit Object Shading** .
- Select **File** – **Close Project**.

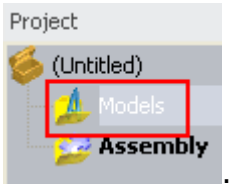
15. Customised settings

Introduction

As well as being able to alter the Shank and press rebuild, the settings can also be changed to produce an inner step. Other profiles can be used to generate other effects. In this example the setting will be produced at zero so that it can easily be nudged in the project view for a variety of different ring sizes.

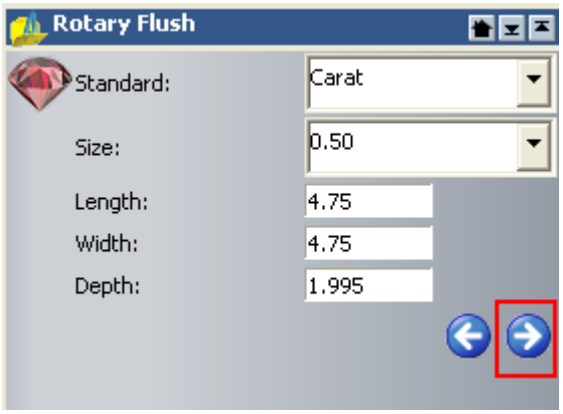
Stepped Setting

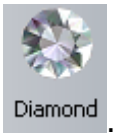
- Select **Create New Project**

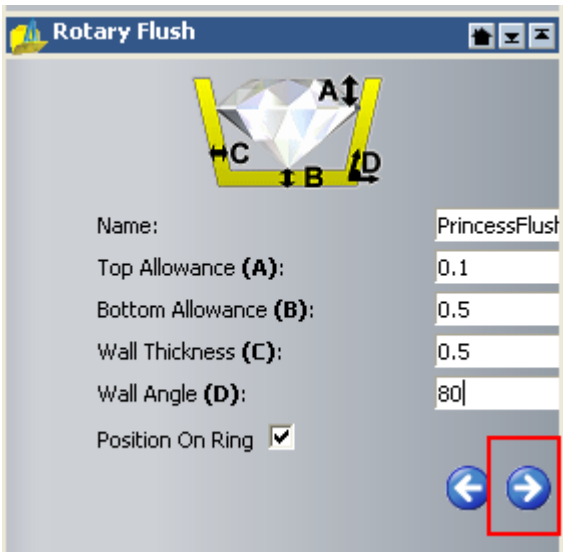
.
- Select **Models** from the root **Project** folder 

.
- Select **Create Rotary Flush Blank**
.
- Select **Princess**

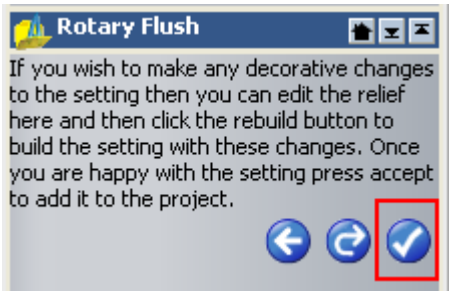
.



- Select a **Carat** of **0.50** and accept the values as shown above.
- Select **Next** .
- Select **Diamond** 
.

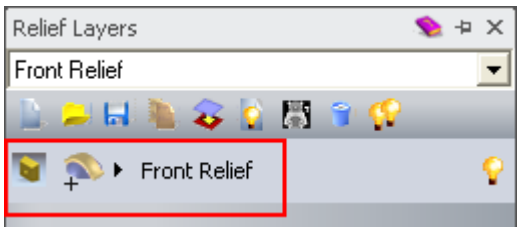


- Select **Next** .

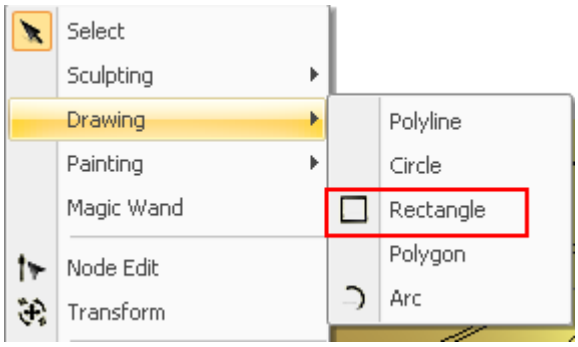


The rotary setting could be modified and rebuilt but in this example we are going to recreate our own by borrowing the automatically generated geometry and reliefs. The Rotary Setting is made up of a Front and Back Relief. These can be viewed by switching the layers view.

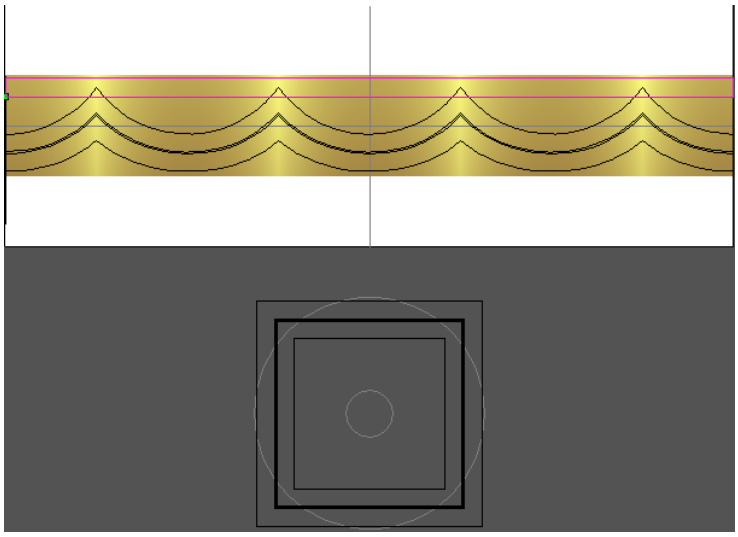
- Select **Accept** .



- Ensure the **Front Relief** is selected.

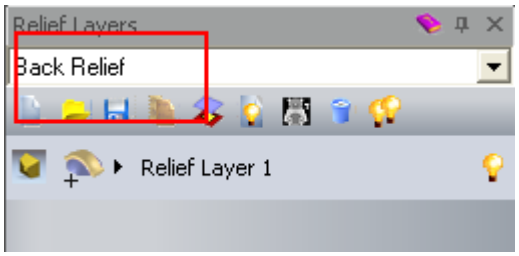


- Right mouse click on the graphics area and select **Drawing** – **Rectangle**.
- Enter a **Width** of **18.663mm**, an **Height** of **0.5mm** and a **Centre Point** of **X0 Y1**.
- Select **Preview**.
- Right mouse click on the working area to accept the **Rectangle** shape and to close the form.

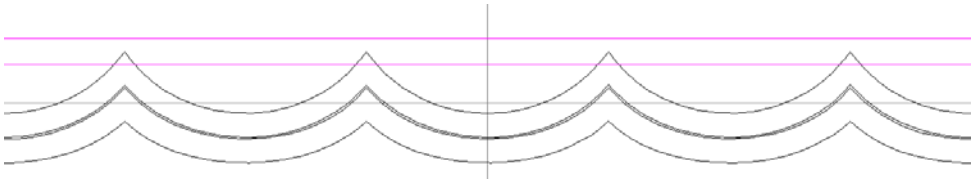


The rectangular vector is generated with the front relief shown to visually check it is in the right place. The internal groove will be generated by adding this as a positive to the back relief. The groove width is 0.5mm, about 0.5mm down from the top edge of the setting.

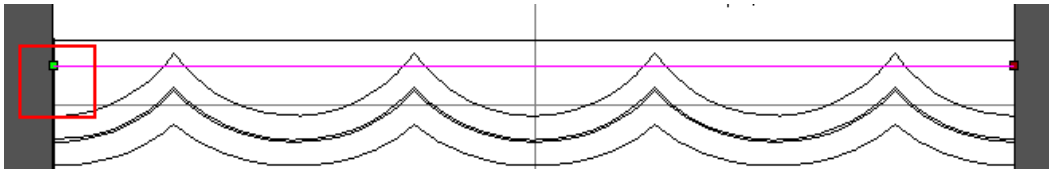
By giving a height of 0.25mm to this vector on the back relief, the groove will become 0.25mm deep.



- Switch to the **Back Relief**.



- With the **Rectangle** vector selected, press **N** for **Node Editing**.
- Remove the **vertical sides** of the rectangle.

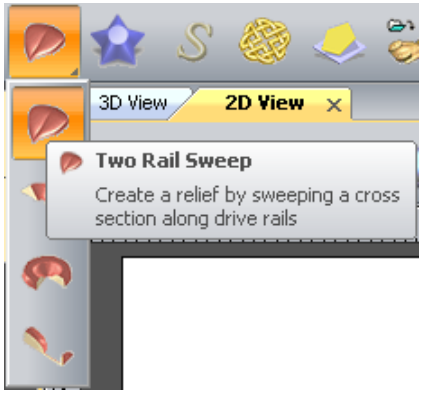


- Select **Reverse Vector(s)** for the bottom line.

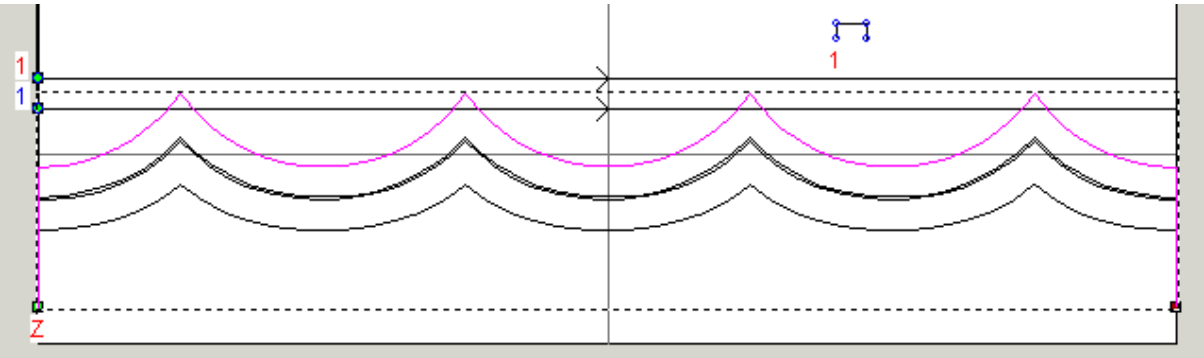
A section needs to be created for the two rail sweep.

- Create a new **Rectangle** .
- Enter a **Width** of **0.5mm**, an **Height** of **0.25mm** and a **Centre Point** of **X4 Y2**.
- Accept the **Rectangle** vector and close the form.

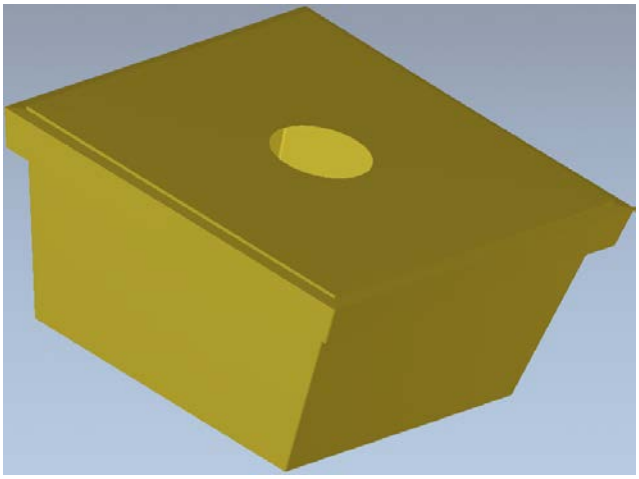
- Remove the **lower span** of the **Rectangle**.



- From the **top toolbar** select **Two Rail Sweep** and assign the **vectors** as shown below.

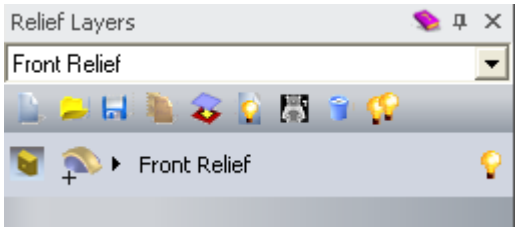


- Ensure the form is set to **Add** before selecting **Calculate** to create the relief then **Close**.

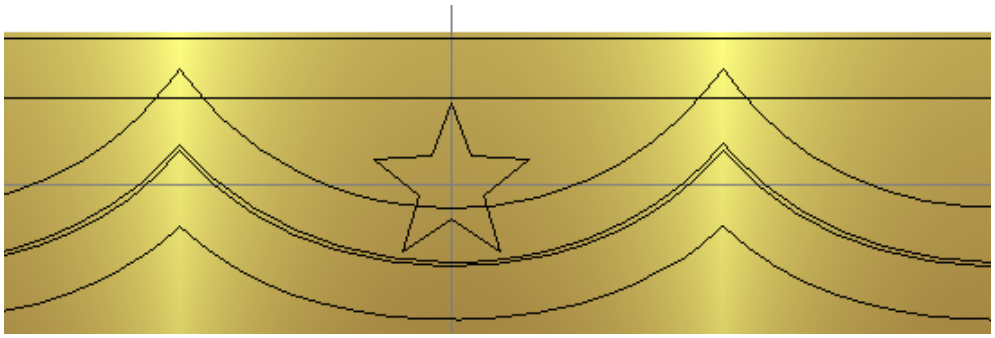


This is how the **Back Relief** looks if the **Wrapped Ring** view is applied.

The **Front Relief** can be given a custom- effect.

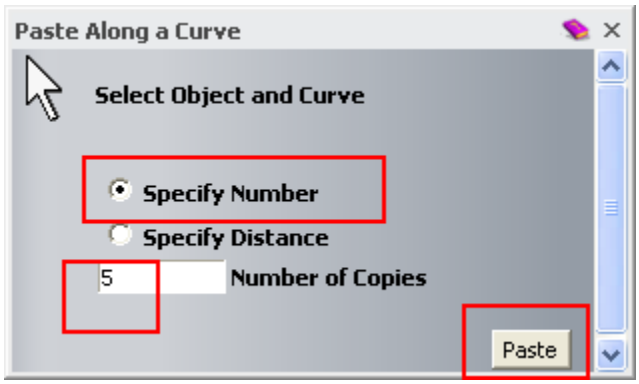


- Switch to the **Front Relief**.
- Select **Create Stars** .
- Select **No points** as **5**, **Star Centre** as **X0 Y0**, **Radius of First Points** as **0.7mm** and **Radius of Second Points** as **0.3mm**.
- Select **Preview**.

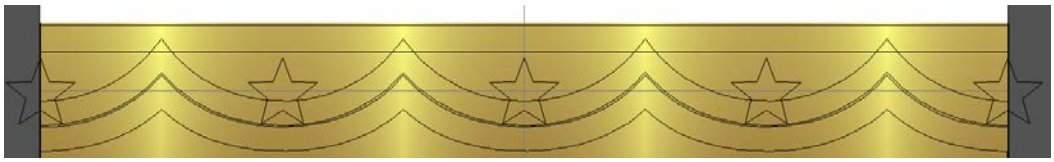


This star can be copied equally along the horizontal vector.

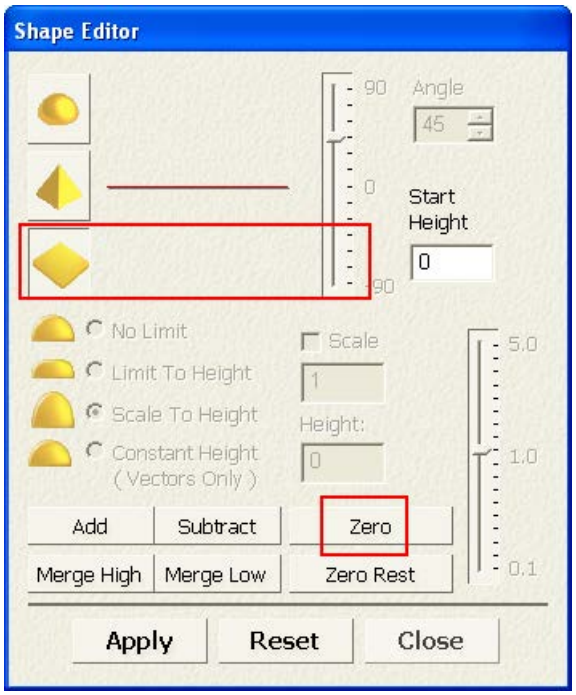
- Accept the new **Star vector** and **Close** the form.
- Select the **Star vector** and then the **horizontal guide vector**.



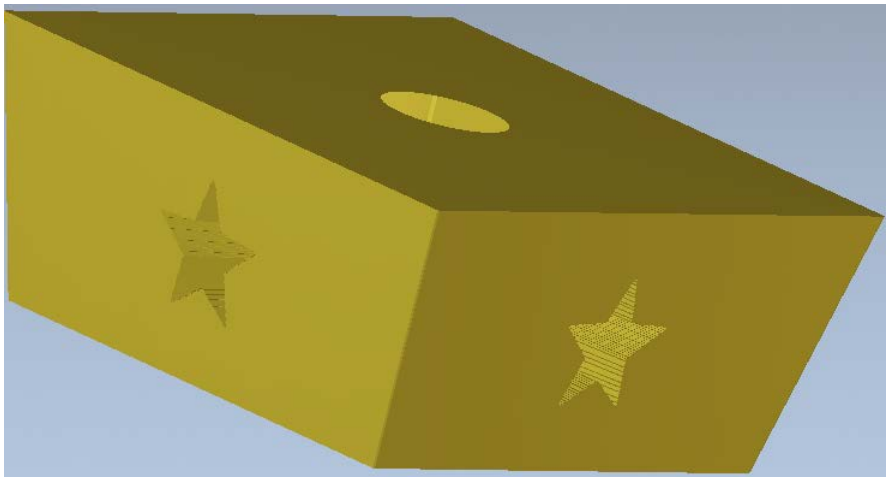
- Select **Paste along curve** .
- Select **Specify Number** and **5 copies** and press **Paste**.
- Select **Close**.



- **Select** the **new group** of **star vectors**.
- Press **F12**.



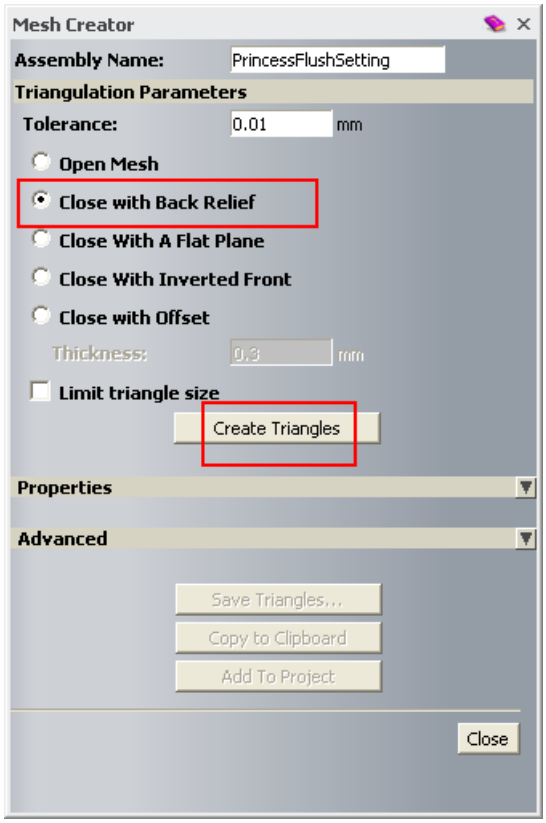
- Select a **Flat shape**, followed by **Zero**.
- Select **Close**.
- Press **F3**.



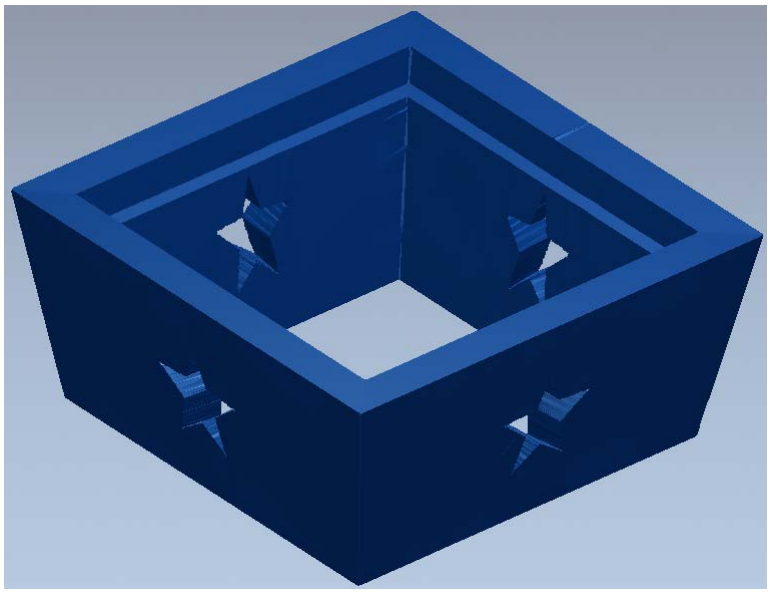
The outer setting has a cut out in the middle of each face.

The new master model can now be generated.

- Select **Create triangle mesh** .

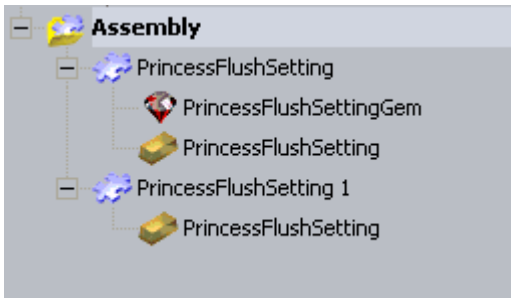


- Select **Close with Back Relief**.
- Select **Create Triangles**.



The finished custom setting is generated.

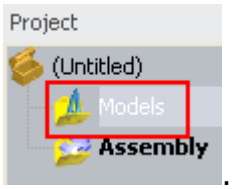
- Select **Add To Project**.

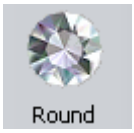


- In the **Assembly** tree, you can see displayed the original setting from the library and the one you've customised.
- Select **File** – **Close Project**.
- Browse: **D:\users\training\COURSEWORK\JewelSmith-Jobs**.
- Enter the name **Stepped setting** and select **Save**.

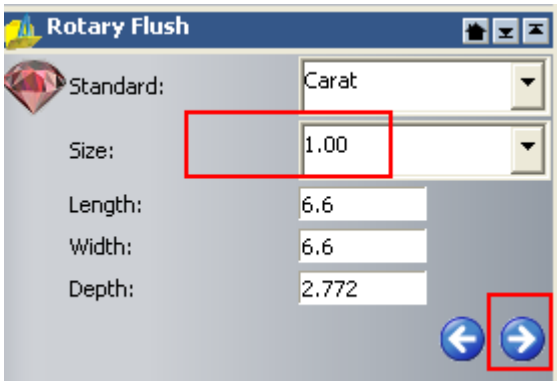
Custom Basket

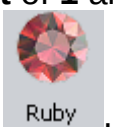
- Select **Create New Project**

.
- Select **Models** from the root **Project** folder 

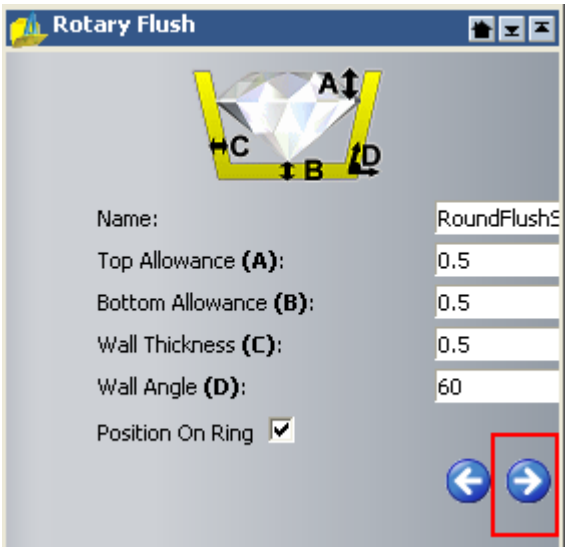
.
- Select **Create Rotary Flush Blank**
.
- Select **Round** 

.

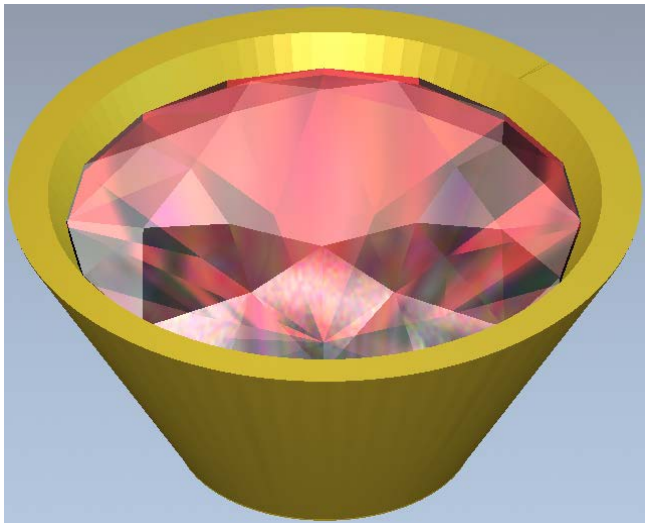


- Enter a **Carat** of **1** and press **Next**
.
- Select **Ruby** 

.

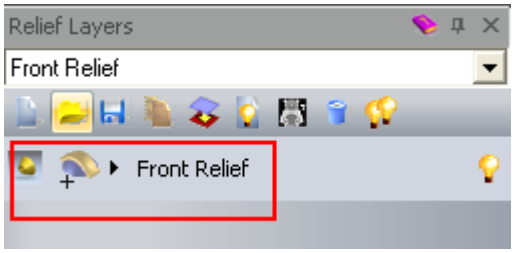


- Enter the **values** shown to specify the dimensions for the gem setting.
- Select **Accept** .
- Press **F3**.

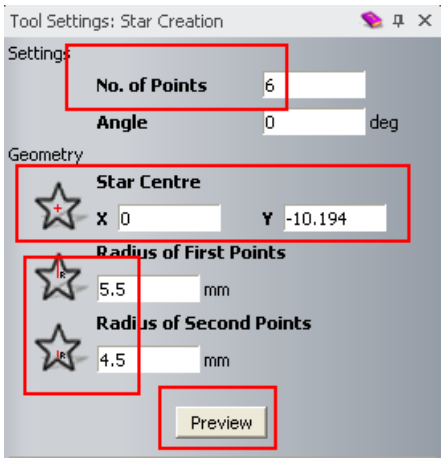


- Select the **Project** tab.

- Select **Toggle Assembly Visibility** .
- Select the **Relief Layers** tab.

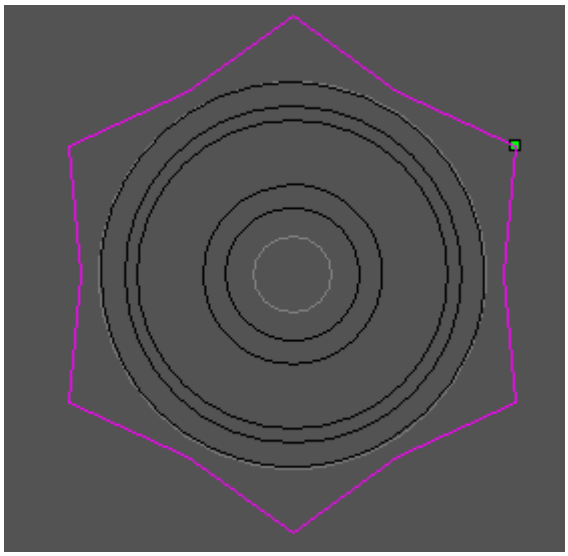


- Make sure the **Front Relief** is active.
- Press **F2**.
- Select **Create Stars** .



- Select **No. of Points** as **6**, **Star Centre** as **X0 Y-10.194**, **Radius of First Points** as **5.5mm** and **Radius of Second Points** as **4.5mm**.

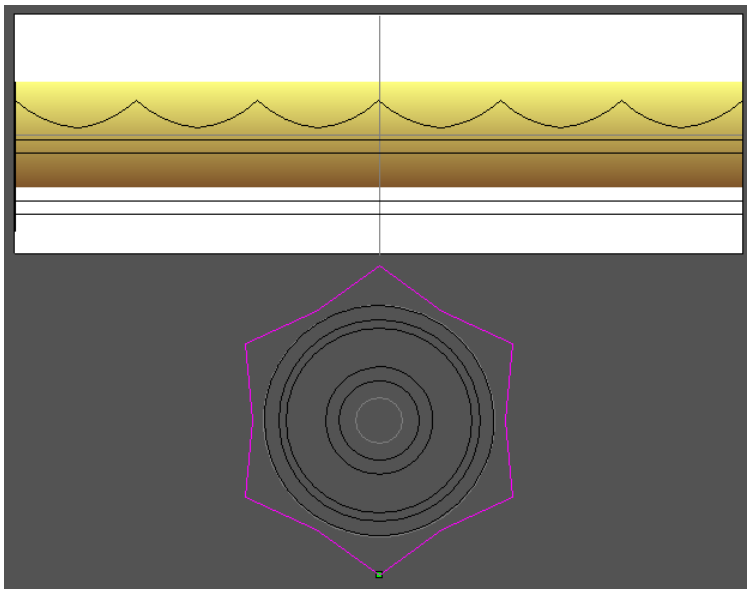
- Select **Preview**.



By using the ring profile view, you can generate any shape and then unwrap it into the flat view so that it can be used.

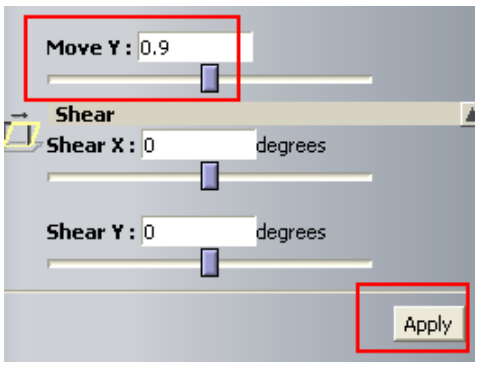
- Make sure the **Star vector** is selected.
- Right mouse click on the left hand corner of the graphics area and select **Rotary Relief Tools**.

- From **Rotary Relief Tools**, select **Unwrap Profile**.

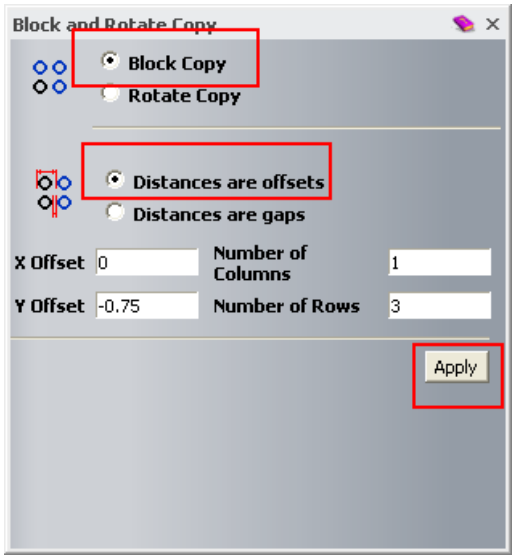


A new vector appears in the **2D View**, which is the unwrapped star vector. This new vector can be used to make a new basket like shape.

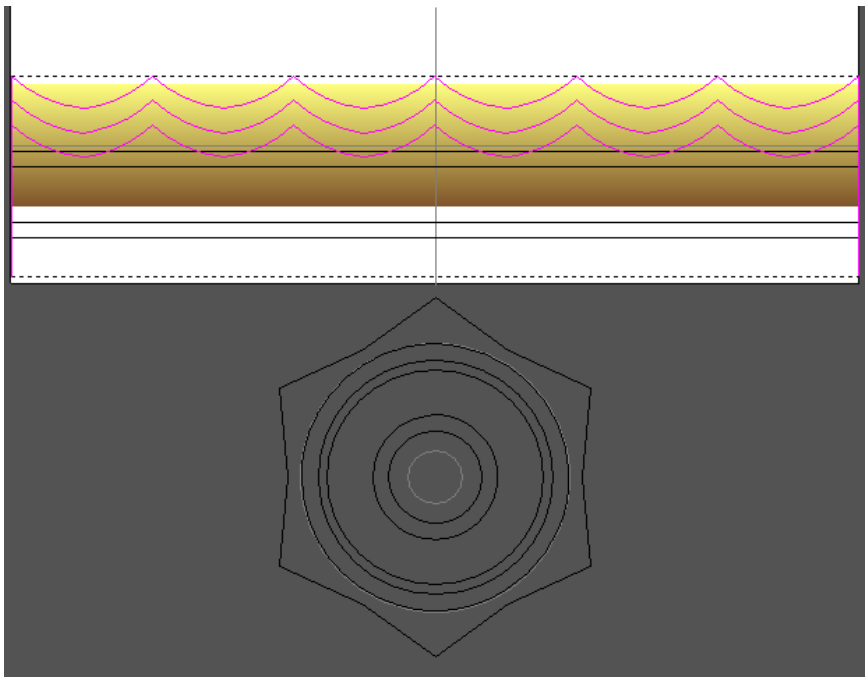
- Select the **unwrapped vector**.
- Select **Transform Vector(s)** from the left toolbar.



- In **Move Y** enter **0.9** and select **Apply**.
- Close the form.
- Select .
- Press **Ctrl + C** and then **Ctrl + V** (makes a copy, which is selected).
- Select **Block Copy/Rotate** .

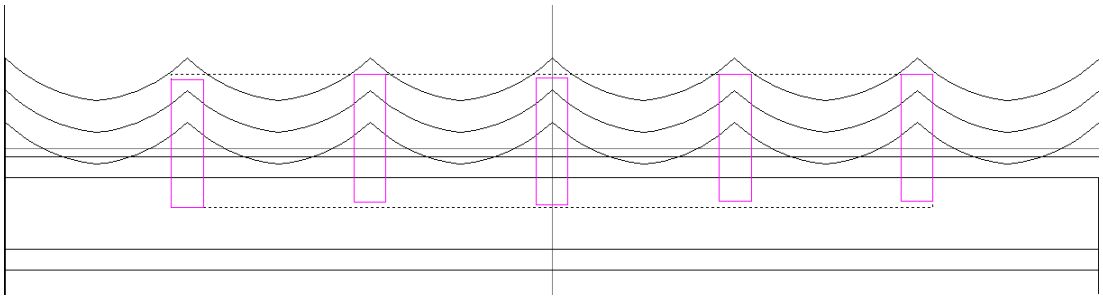


- Select **Block Copy**, **Distances are offsets**, **X Offset** as **0**, **Number of Colums** as **1**, **Y Offset** as **–0.75** and **Number of Rows** as **3**.

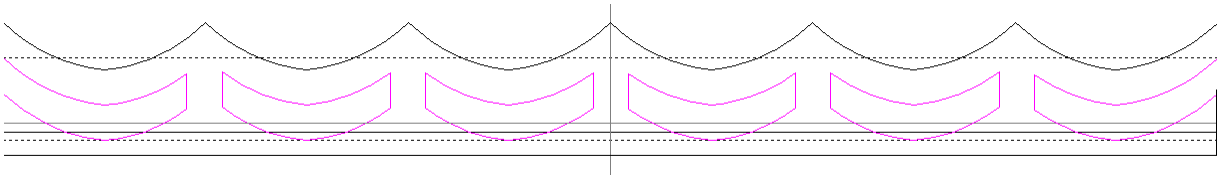


There are now three vectors, with a constant offset.

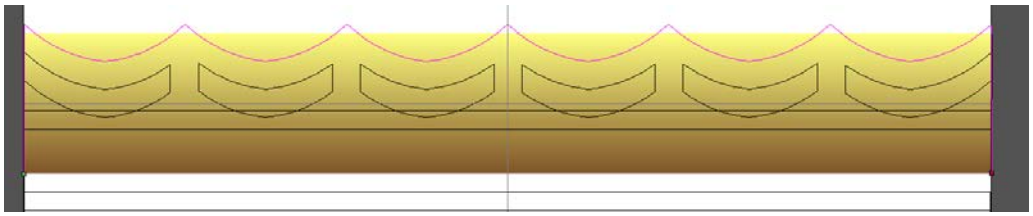
- Select **Apply** and then **Close**.
- Select **Create Rectangle** .



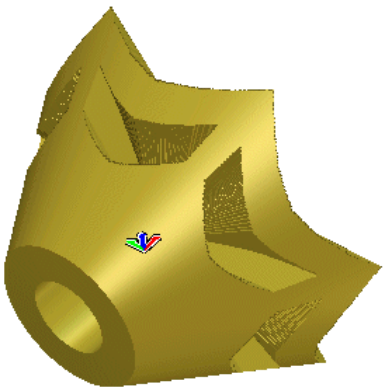
- Create **5 Rectangles** of **Width 0.75mm** and **Height 3mm**, using the **high points** of the **lower vector** for the **centre points** of the rectangles.



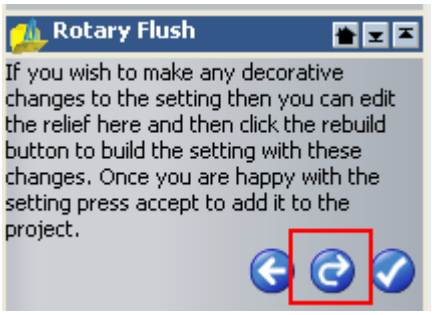
- Trim the vectors, **Join** and **close** to produce the following closed vectors.



- Select only the **outer vector** as shown above.
- Press **F12**.
- Select **Zero Rest**.
- Select the **7 smaller vectors** and select **Zero**.
- Select **Close**.
- Press **F3**.

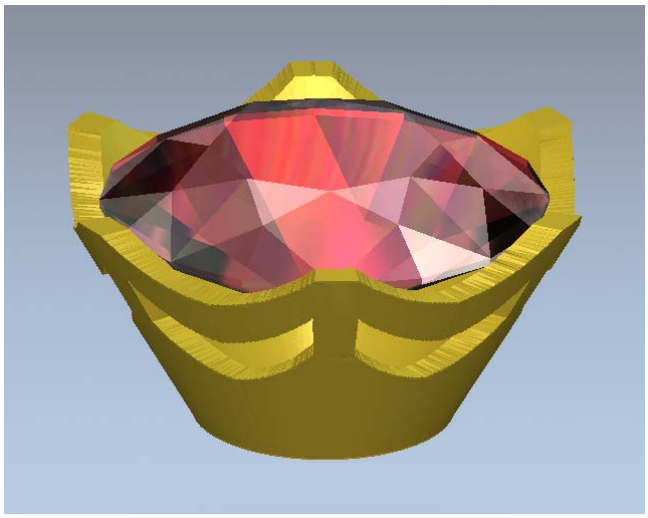


The custom basket is displayed.



The **Front** and **Back Relief** of the original model and project have been updated with the decorative changes you've made on the setting.

- Select the **Rebuild** button from the **Project** tab.

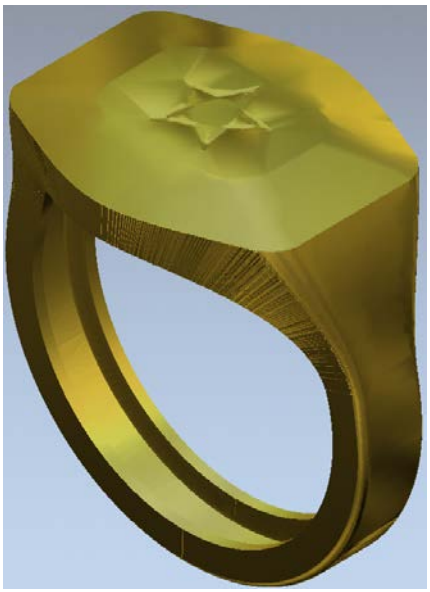


The complete finished assembly is shown.

- Select **File** – **Close Project**.
- Browse: **D:\users\training\COURSEWORK\JewelSmith-Jobs**.
- Enter the name **Custom basket** and select **Save**.

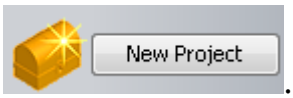
16. Signet Ring

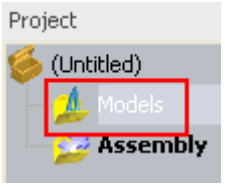
Introduction



In this exercise you will create a **multi-component** model, consisting of a basic **Shank** including a **Back Relief** and two interchangeable **Head** designs to provide a **Class Ring**.
This method can be used to make sovereign and other large rings.

Signet Ring Exercise

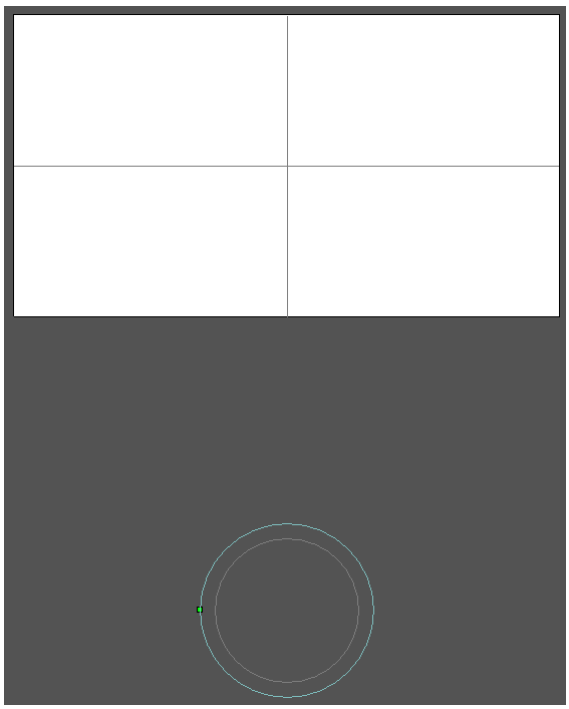
- Select **Create New Project** 

.
- Select **Models** from the root **Project** folder 

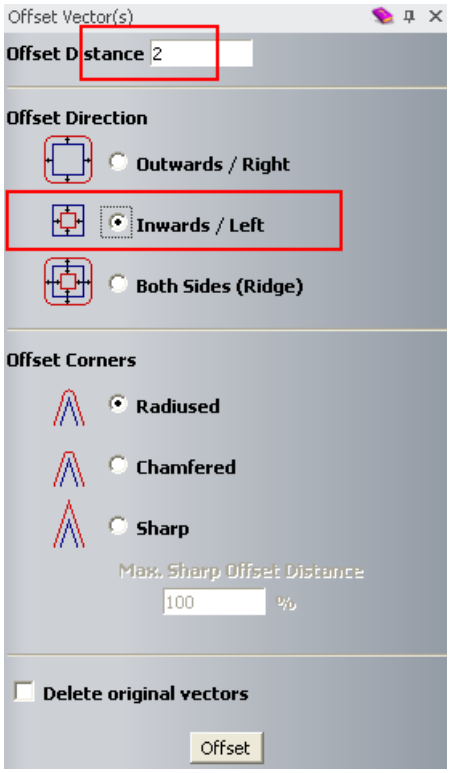
.

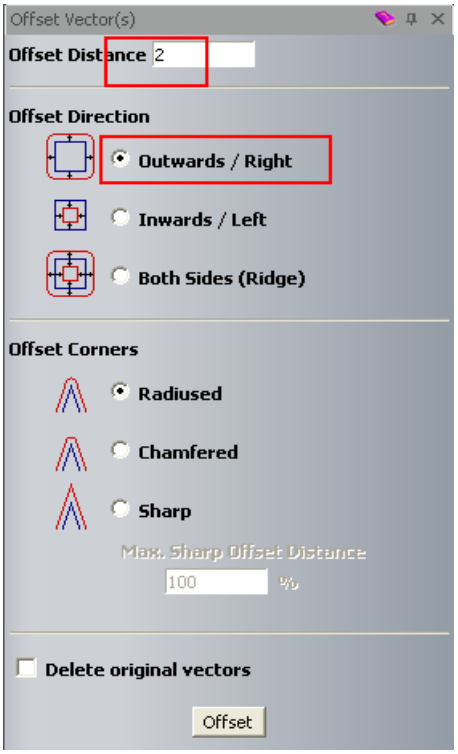
- Select **Create a Rotary Axis Blank** .

- Leave the model **Name** as **RotaryAxisShank**.
- Select **AlcamiCollets Size S** ring.
- Set the **Shank Width** as **30mm**, **Border** as **5mm**, **Shank Thickness** as **2mm** and a **Resolution** of **30**.
- Select **Accept** .

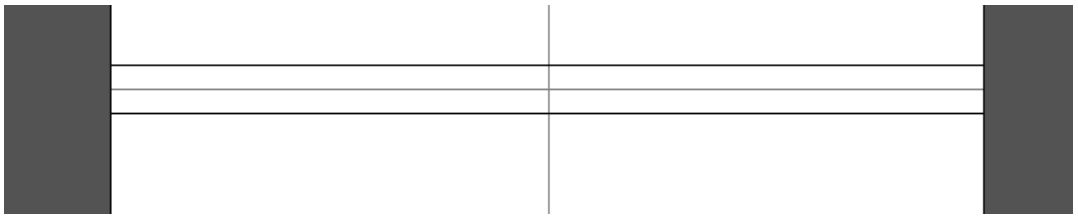


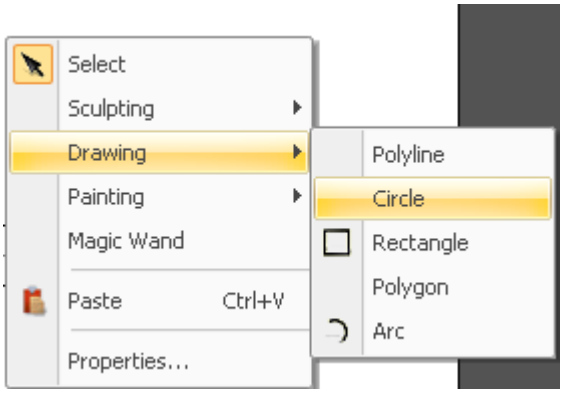
- Select the **horizontal reference vector**.
- Select **Offset Vector(s)** .



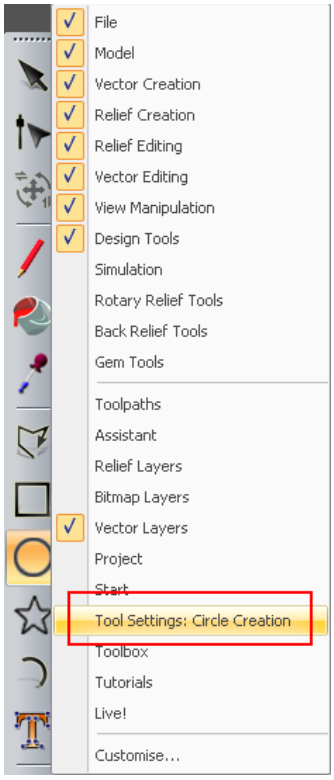


- Enter an **Offset Distance** of **2mm**, select **Inwards/Left** and **Radiused**.
- Select **Offset**.
- Select the **horizontal reference vector**.
- Select **Outwards/Right** and **Radiused**.
- Select **Offset**.
- Close the form.

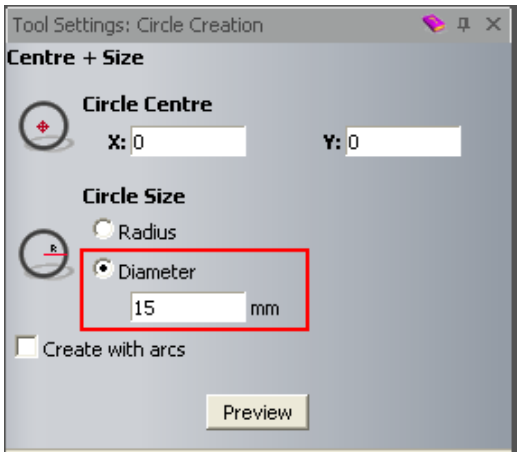




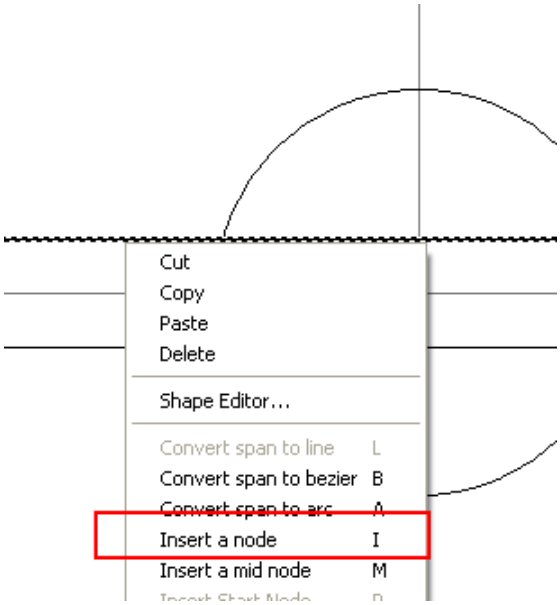
- Right mouse click on the graphics area and select **Drawing** – **Circle**.



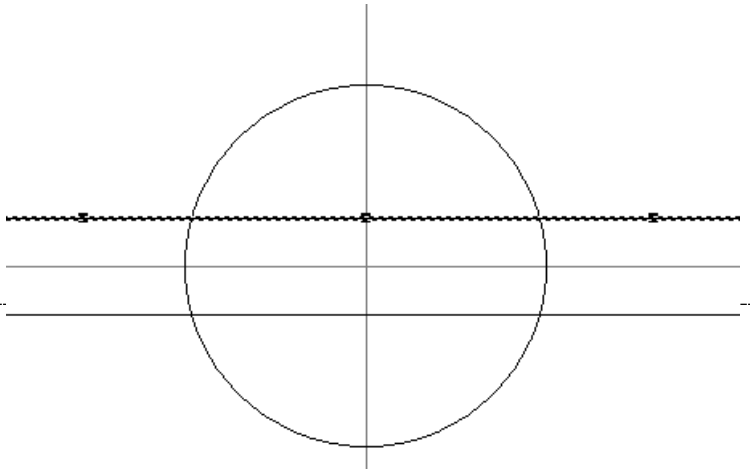
- Right mouse click on the left hand corner of the graphics area and select **Circle Creation**.



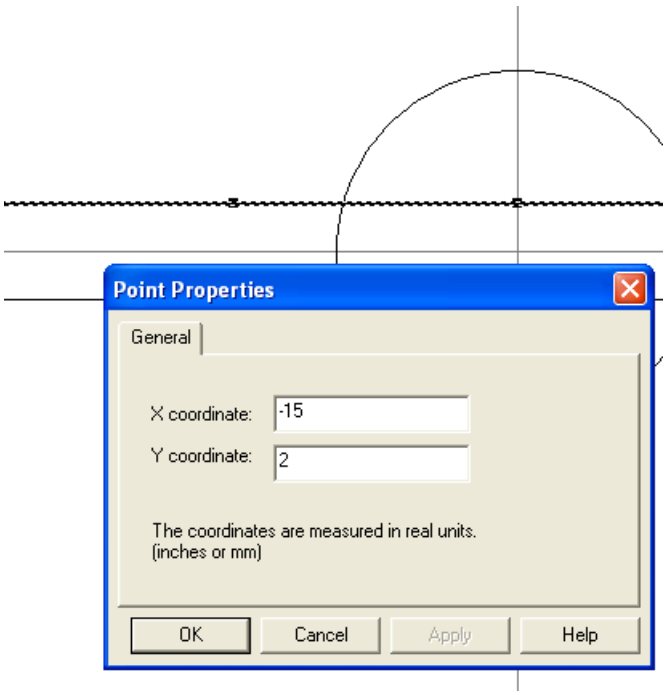
- Enter a **Diameter** of **15mm** at **X0 Y0**.
- Right mouse on the graphics area to close the **Circle Creation** form.
- Select the **top line** vector.
- Press **N** to enter the **Node Editing** mode.



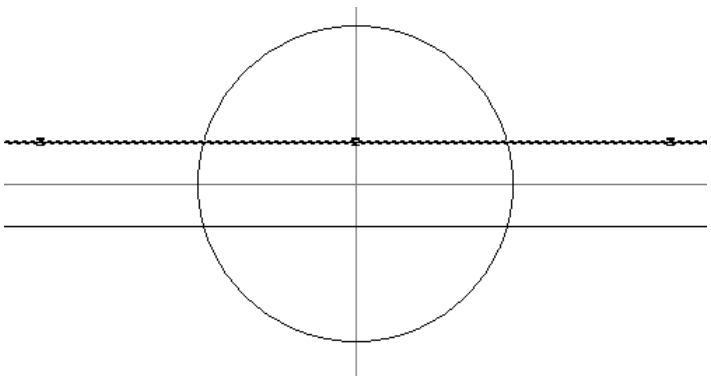
- Right mouse click on the **line** and select **Insert a node** – the shortcut for this operation is pressing **I** on the keyboard.

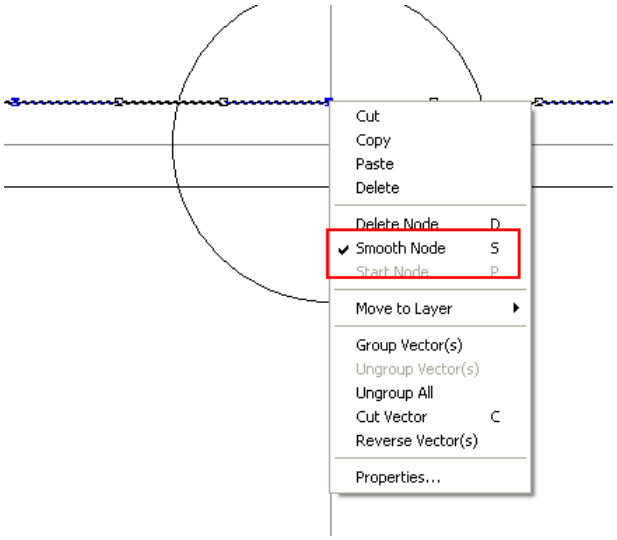


- Insert **three points**.
- Right mouse click on each point and select **Properties**.

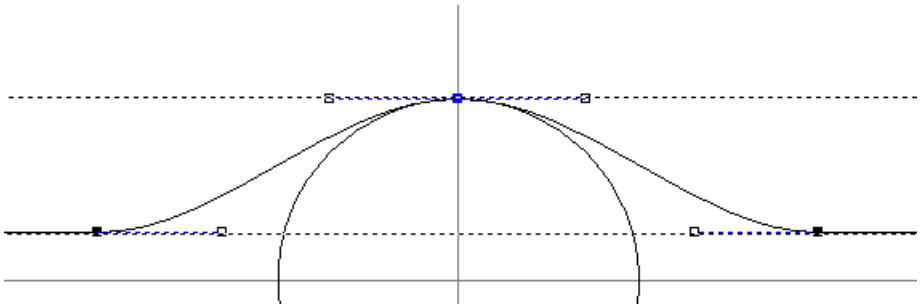


- Change their **Properties** to **X-15 Y2**, **X0 Y2** and **X15 Y2**.

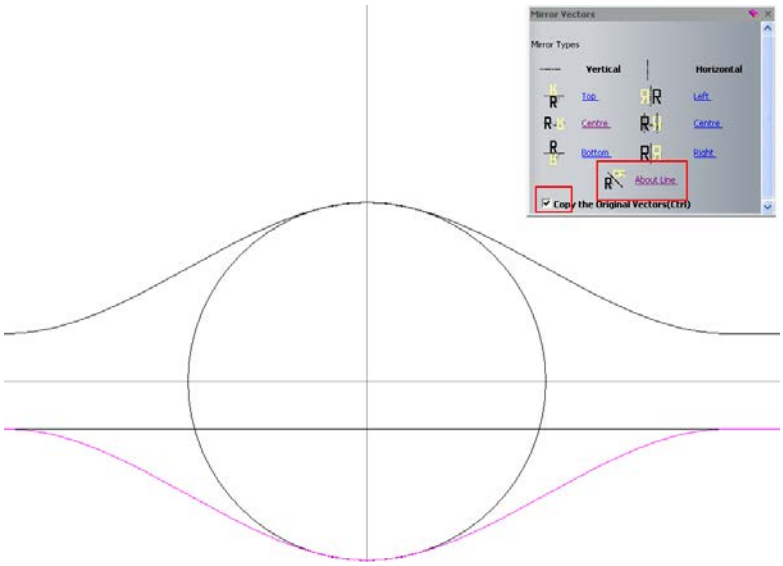




- Select the **Point** at **X0 Y0**, right mouse click on it and select **Smooth Node**.



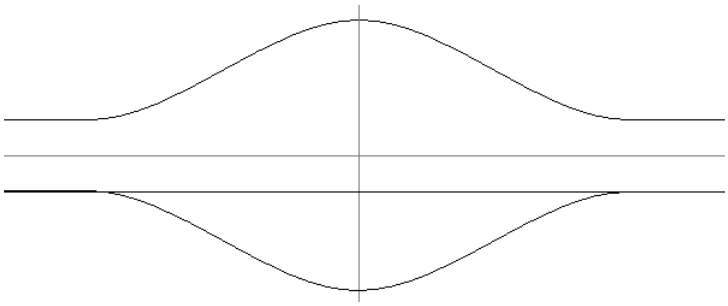
- Dynamically move this point to the **top** of the **Circle vector**.
- Select .
- Shift select the **horizontal reference line**.
- Select **Mirror Vectors** .

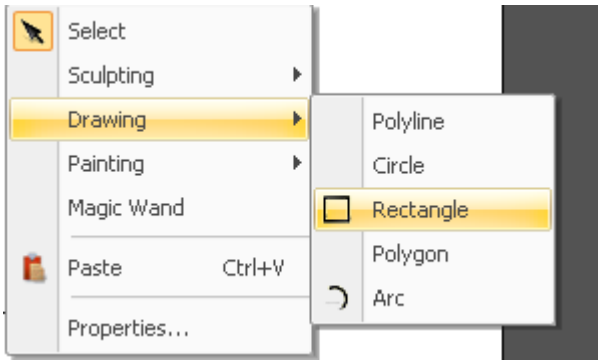


- Mirror the vector **About Line** and **Close** the form.

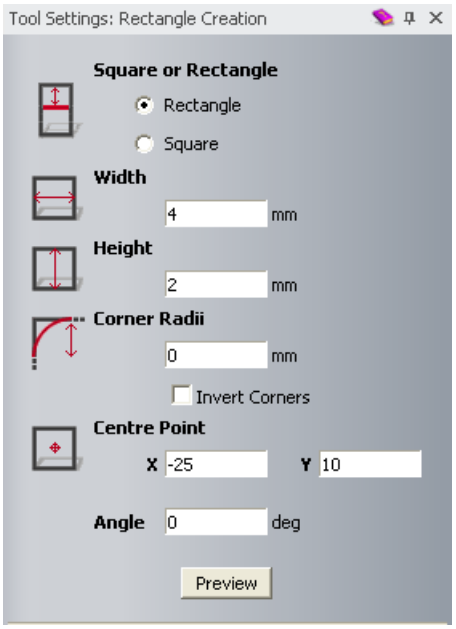
The two **Drive Rails** are complete. You will now create the section for the ring. It will be created with a **Height** of **2mm** and a **Width** of **4mm** to match the **minimum cross sectional dimensions** for the **standard ring**.

- Select the **Circle** vector and press **Delete** on the keyboard.

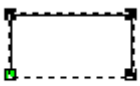




- Right mouse click on the graphics area and select **Drawing** – **Rectangle**.
- Select the **Rectangle Creation** from the left hand corner of the graphics area to display the form on the right hand corner.

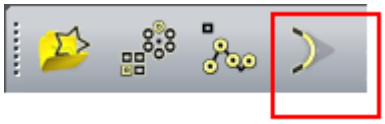


- Select **Rectangle** with **Width** of **4mm**, **Height** of **2mm** at **X-25 Y10**.
- Right mouse click on the graphics area to close the **Rectangle Creation** form.

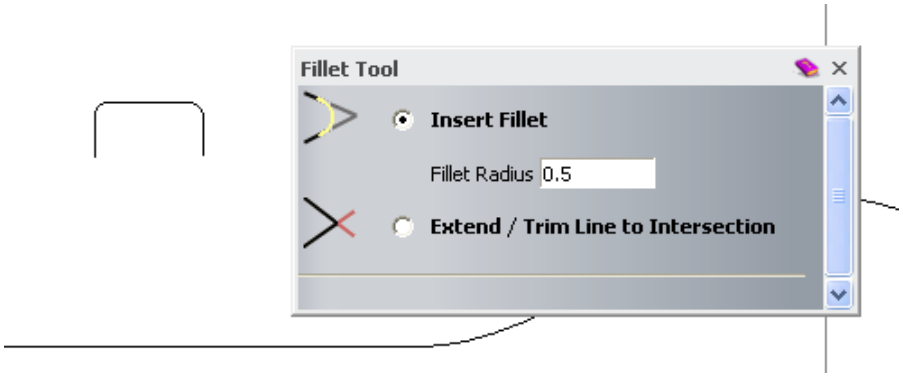


- Select the **Rectangle** vector and press **N** on the keyboard.
- Hover with the mouse on the **bottom span** of the rectangle and press **R** (**Remove span**).

- Select .
- Select **Fillet Vectors** from the top toolbar.

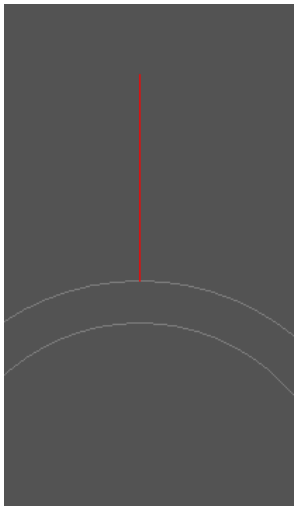


- Remove the **bottom span** and create a **Fillet** on each corner of **Radius 0.5mm**.

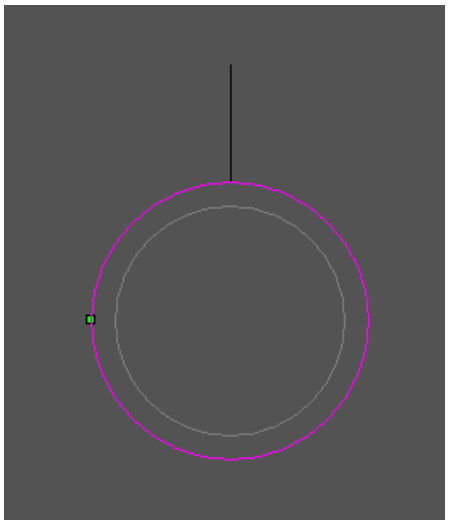


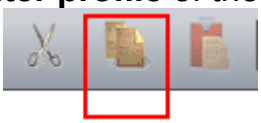
- **Close** the **Fillet Tool** form.

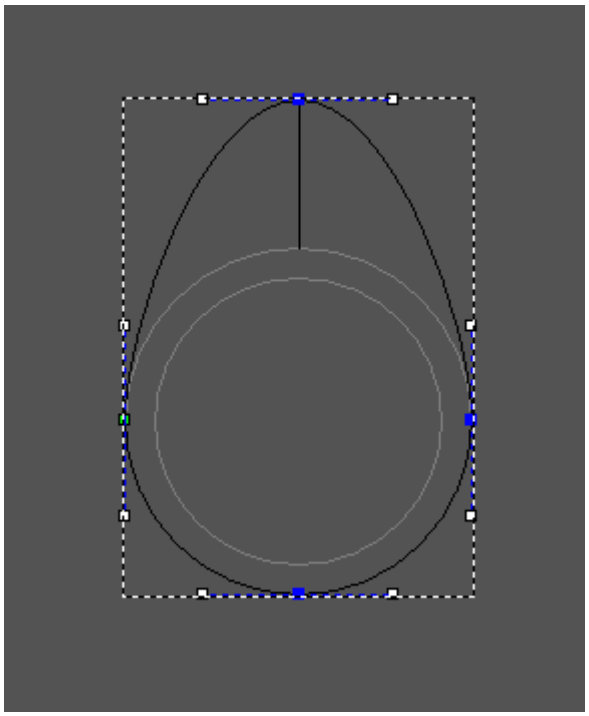
The **ring thickness** needs to be **bulked out** in this wide area to provide the extra volume of material characteristic for this type of **ring**.



- Select **Create Polyline** .
- Create a **Line** from the **top** of the **outer ring profile** up in **Y** by **10mm**.



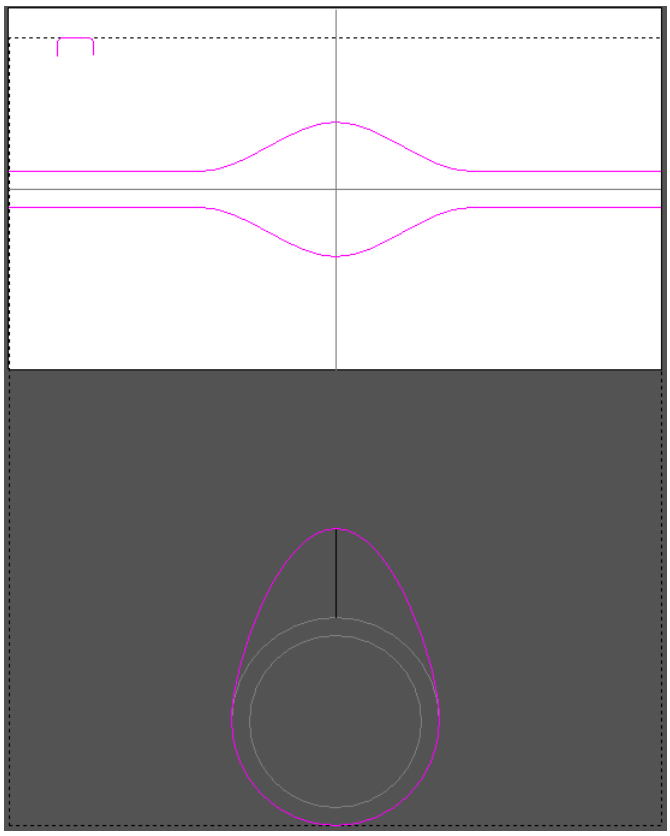
- Select the **outer profile** of the ring.
- Select **Copy**  and then **Paste** .
- Make sure the **new copy** is selected and press **N** on the keyboard.



You've created a very pronounced bulge around the **ring** profile. This is to provide additional material to be sliced off at a suitable height characteristic for this type of ring.
You will now build the **ring** shape.

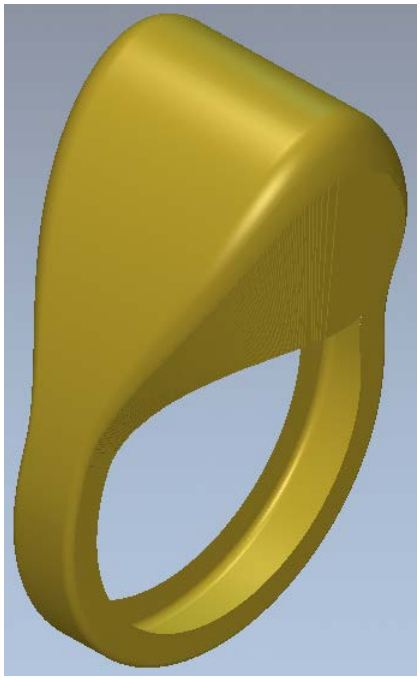
- Select the **top point** of the circle and move it to the end of the line, as shown on the image above.

- Select .



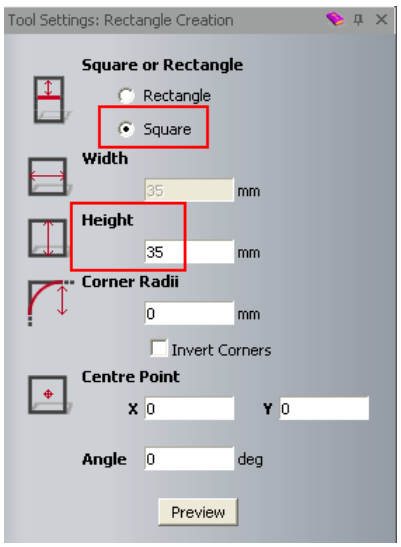
- Select the **Two Rail vectors**, the **Section** and then the **Ring** profile.
- Right mouse click on the left hand corner of the graphics area and select **Rotary Relief Tools**.
- From **Rotary Relief Toolbar**, select **Sweep Profile** .

- Press **F3** on the keyboard.



You've produced a **ring** with an elongated head. This will be 'leveled off' horizontally, to be flush with the standard, **ring** outer diameter **2mm Shank Thickness**.

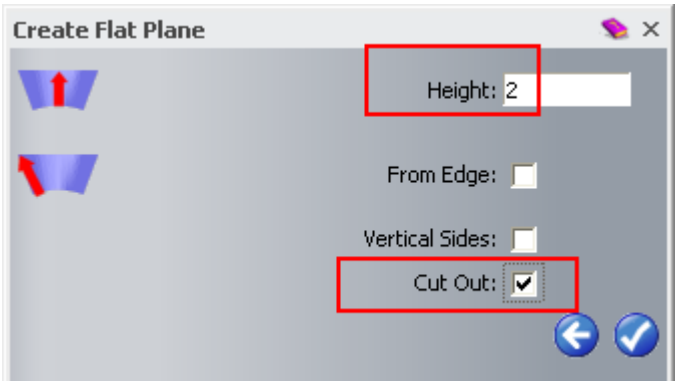
- Press **F2**.
- Select **Create Rectangle** from the left toolbar.
- From the left hand corner of the graphics area select **Rectangle Creation**.



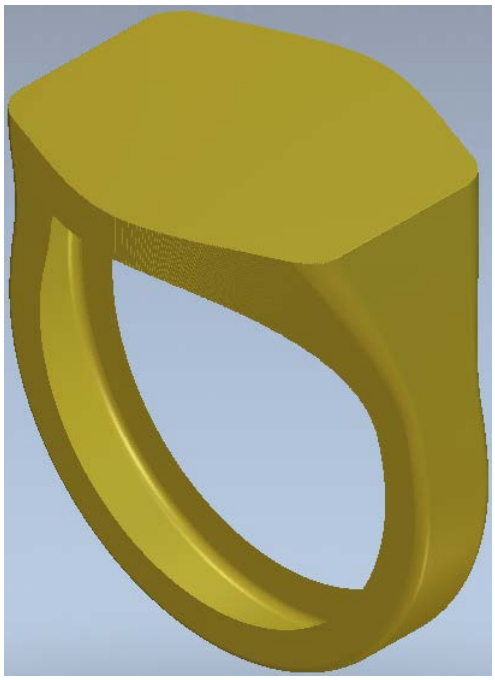
- Select **Square** at **X0 Y0** with a **Height** of **35mm**.
- Select **Preview**.
- Right mouse click on the graphics area to close the form.

- Select the **new square vector**.
- Right mouse click on the left hand corner of the graphics area and select **Rotary Relief Tools**.

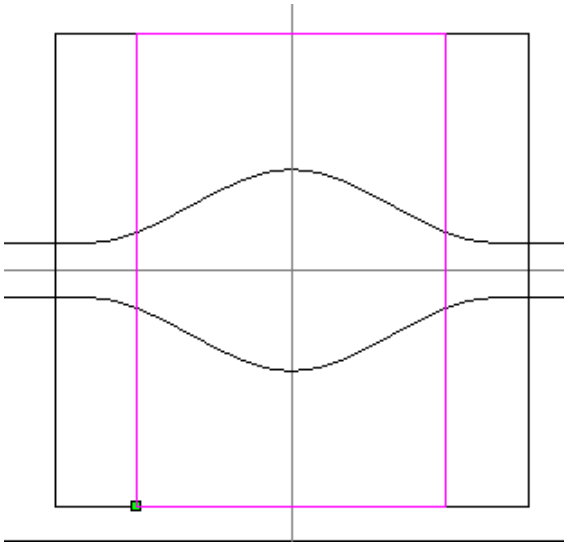
- Select **Create Flat Plane** from the **Rotary Relief Tools** toolbar.

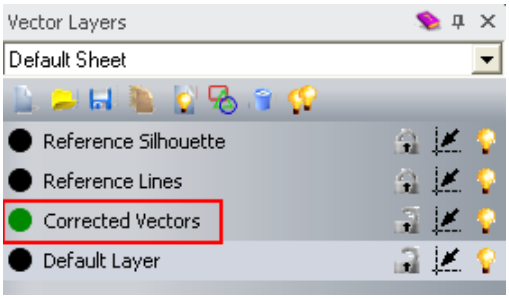


- Enter a **Height** of **2mm**, select **Cut Out** only and select **Accept** .
- Close the **Create Flat Plane** form.
- Press **F3**.



The **top has been limited** by the height specified at the centre of the selected vector.
The next step will be creating the **Back Relief**.

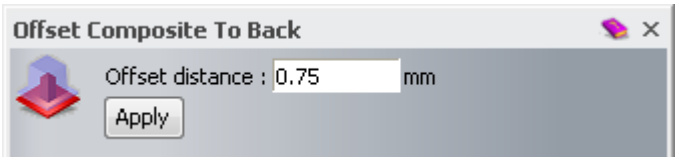




The vector automatically created has been assigned in a new vector layer named as **Corrected Vectors**.

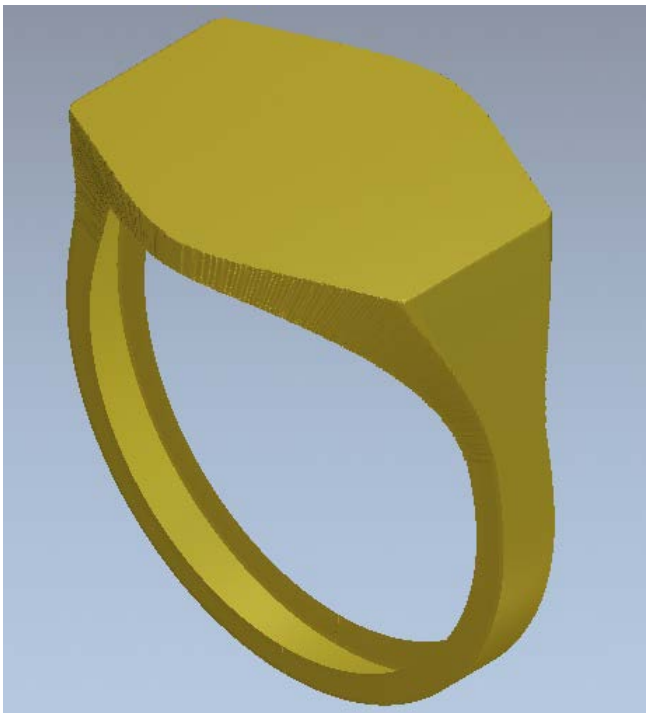
- From the left hand corner of the graphics area, select **Vector Layers**.
- From the left corner of the graphics area, select **Back Relief Tools**.

- Select **Offset Composite To Back** from the **Back Relief Tools** toolbar.



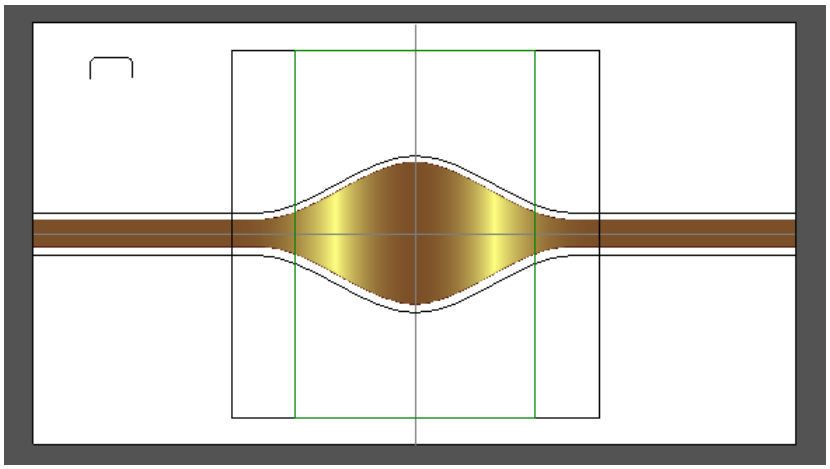
This page enables you to specify a constant wall thickness (**Offset**) with the excess material being hollowed out from the inside of the ring.

- Enter **0.75** and select **Apply**.
- Close the **Offset Composite To Back** form.



The **Back Relief** is automatically made current.

- Press **F3**.
- Press **F2**.

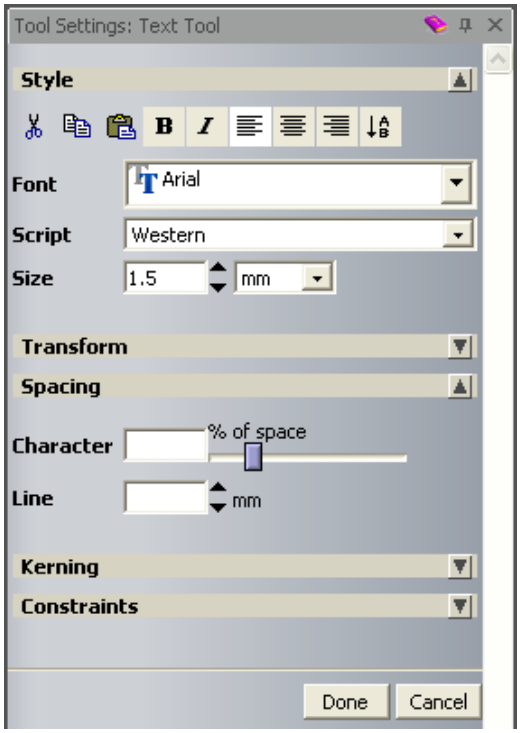


Before the **Project** component is created, you'll add **Text relief** detail to the **inside of the ring**. After creating the **Triangle Mesh**, the **Back Relief** will be **subtracted** from the **Rotary Shank**.

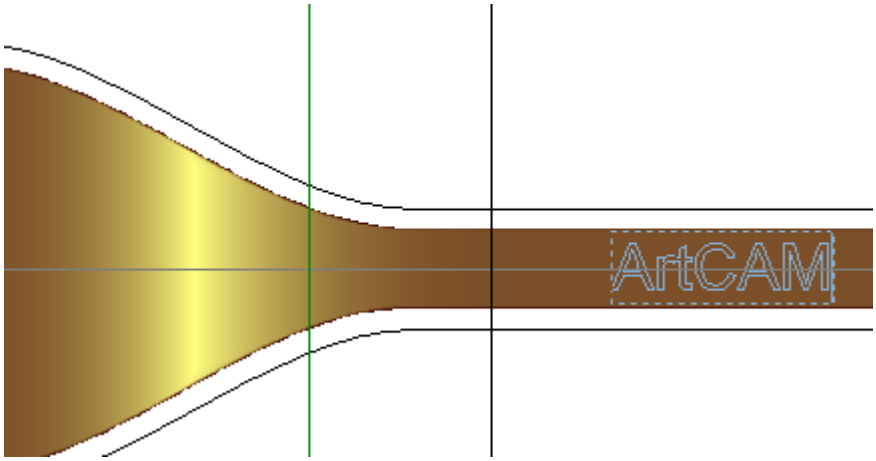
This means **Text** to be engraved on the inside wall must be both **mirrored** and generated as an **up stand** if included as part of the **Back Relief**.

- Select **Preview Relief Layer** from the **2D View** toolbar.

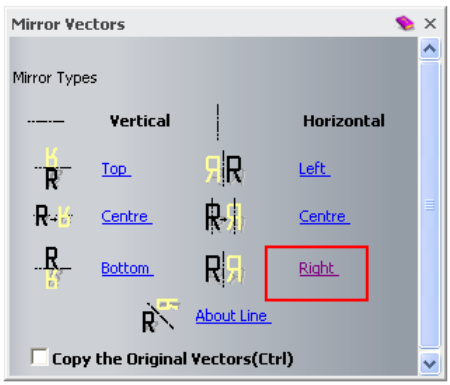
- Select **Create Vector Text** .
- Right mouse click on the left hand corner of the graphics area and select **Text Tool**.



- Select **Arial Font** of **Size 1.5mm**.

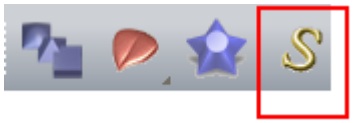


- Position the cursor on the **right side** of the **Back Relief** and type **ArtCAM**.
- Select **Done**.

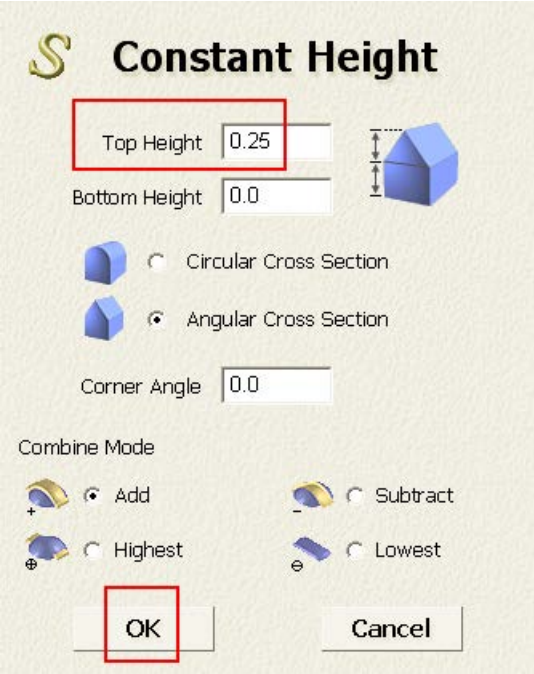


- Select **Mirror Vectors** from the top toolbar.
- Select **Right** .
- Close the **Mirror Vectors** form.

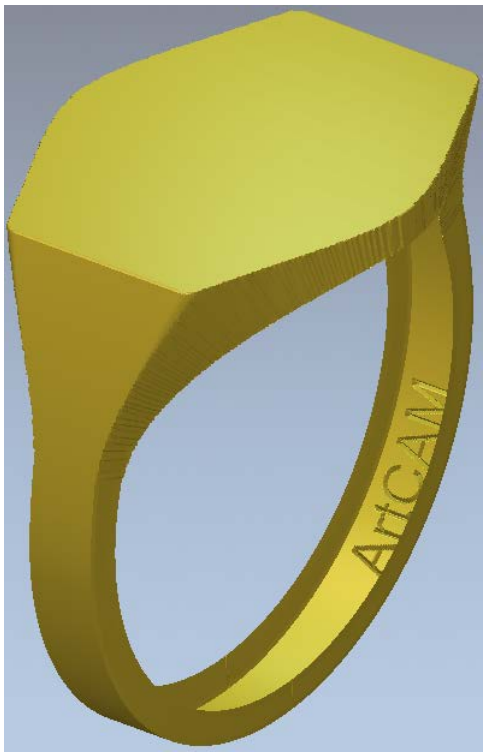
You'll now create a **Relief** using **ISO-FORM Letters** at a constant height.



- Select **Constant Height Letters** from the top toolbar.

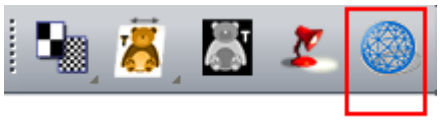


- Enter the values exactly as shown in the image above.
- Select **Add** and then **OK**.
- Press **F3** on the keyboard.

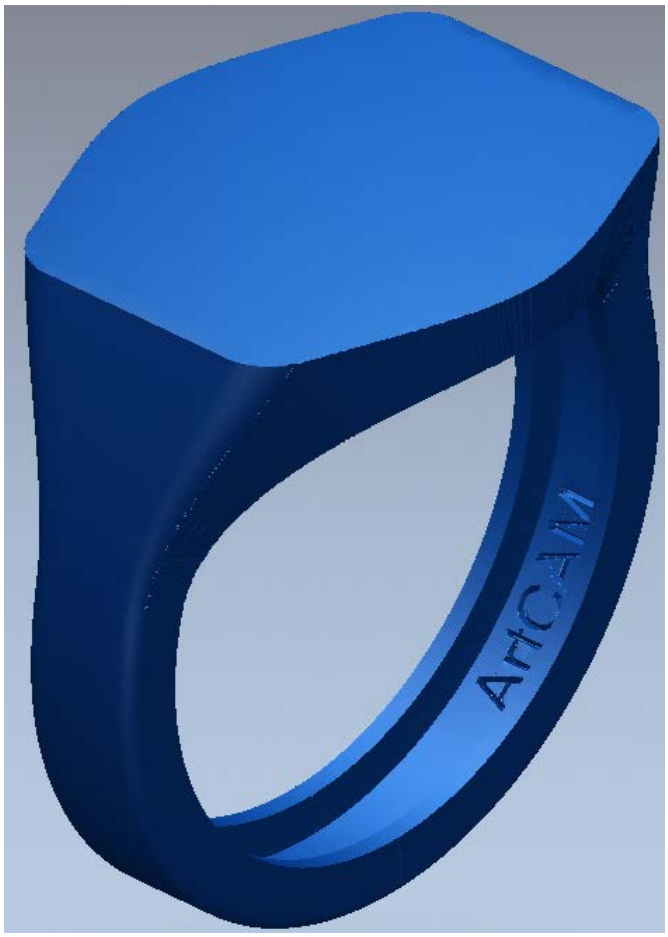


The **Text** relief appears as an up stand on the **outside** of the **Back Relief**.

You'll next create the combined **mesh**.



- Select **Create Triangle Mesh** .
- Select the option **Close with Back Relief** and then select **Create Triangles**.



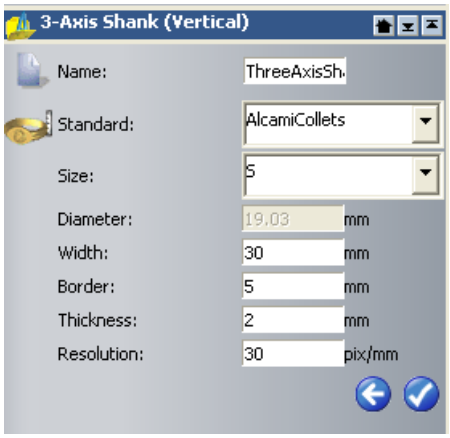
The **Shank** project component is created with the **Back Relief** including the **Text** removed from the inside as a **pocket**.

Once you close the **Mesh Creator** page, the view reverts back to the **Ring relief**.

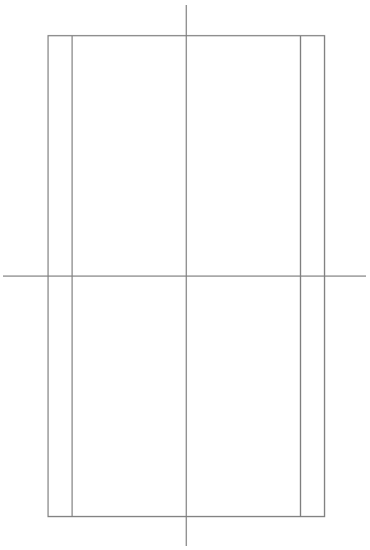
- Select the option **Add To Project**.
- Close the **Mesh Creator** form.
- Select **File** – **Close Model**.
- Select **Yes** to update changes to the **Project**.

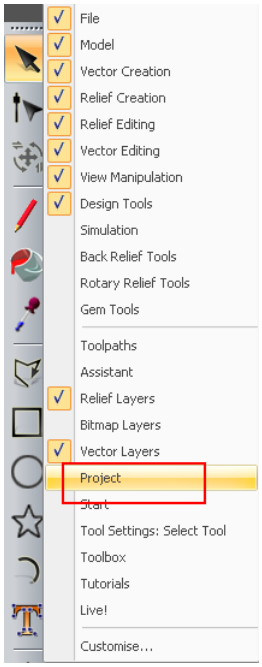
The **Project component** will now be **unwrapped** and displayed in a **3-Axis View** so that the vectors for the **head detail** can be generated based on a **Flat Plane**.

- Select **Models** from the root **Project** folder.

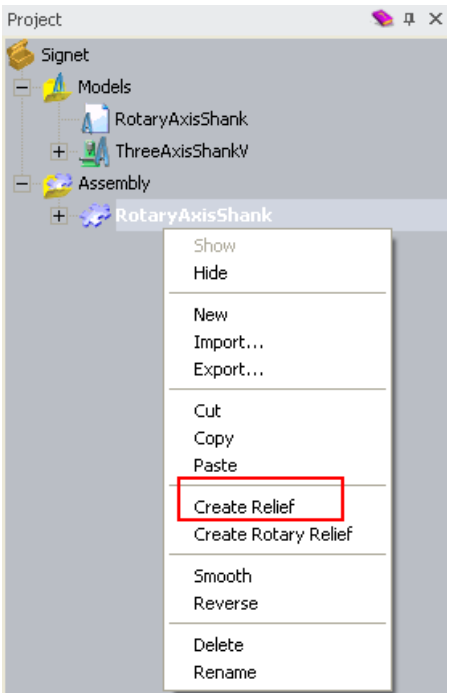


- Select **Create 3-Axis Shank Vertical Blank** .
- Enter the values as shown above.
- Select **Accept** .





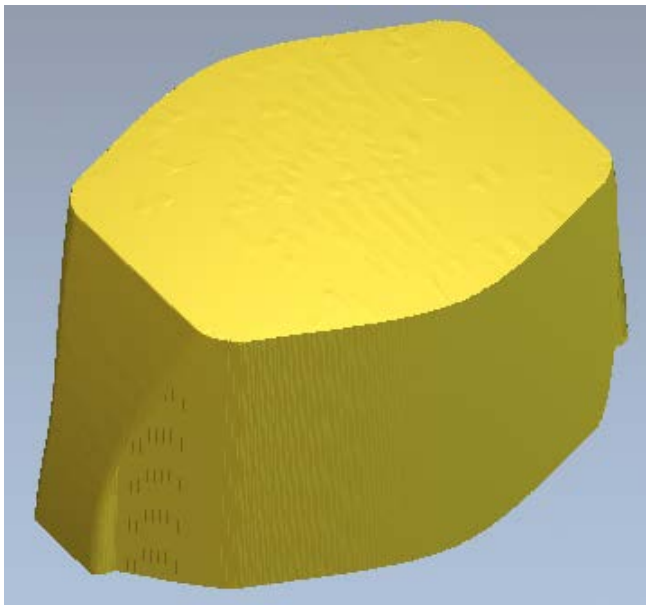
- Right mouse click on the left hand corner of the graphics area and select **Project**.



- Right mouse click on the **RotaryAxisShank**.
- Select **Create Relief**.

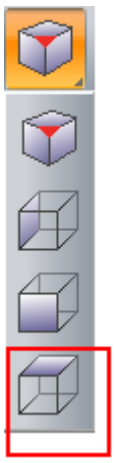
The **Assembly** (rotary) is now combined with a **3-Axis Shank** template

- Press **F3**.
- Select **Toggle Assembly Visibility** .

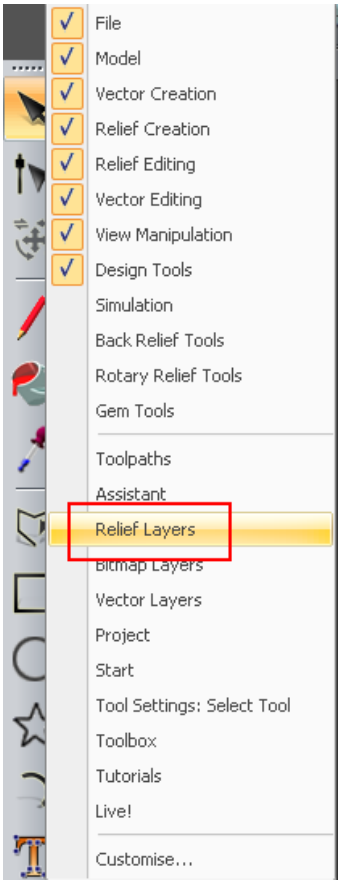


A new **relief** is generated by projecting the area of the **mesh assembly** (as viewed down Z) from Z0 to a height value based on the outer radius of the original ring. This new **relief** will be used as the basis for the head. A **vector** will be created around the upper flat area with the help of the **Bitmap** colours.

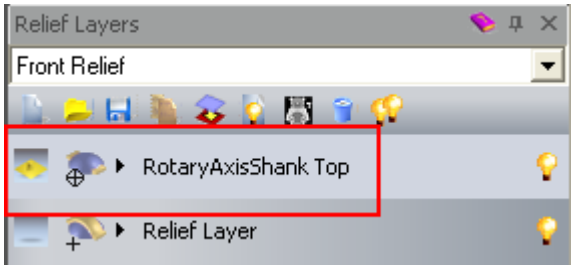
- Select **View Along Z**.



- Press **F2** to select the **2D View**.

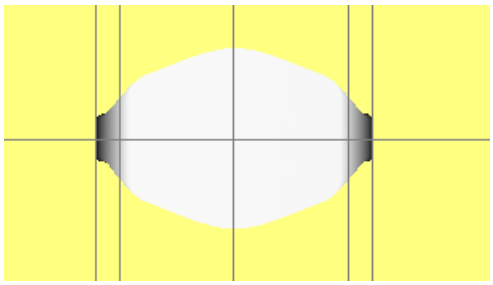


- Right mouse click on the left hand corner of the graphics area and select **Relief Layers**.



- Highlight the **newly** created **relief layer**.

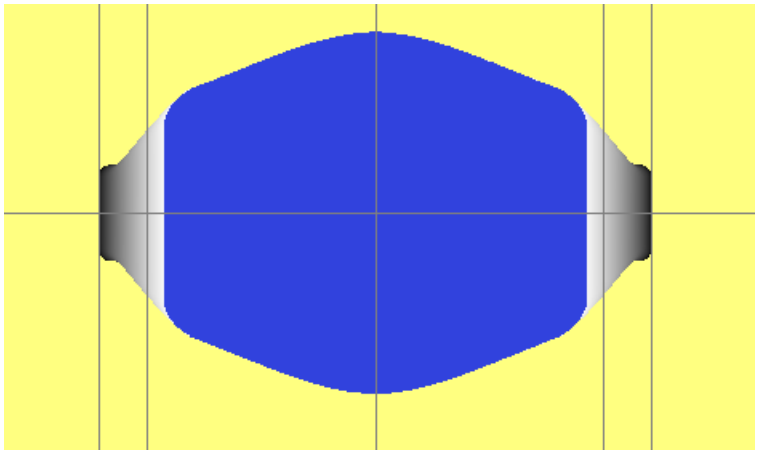
- Select **Greyscale From Composite Relief** from the top toolbar.



Being the **highest point** on the **Relief**, the **Flat** area is displayed with the **lightest colour** (almost white).

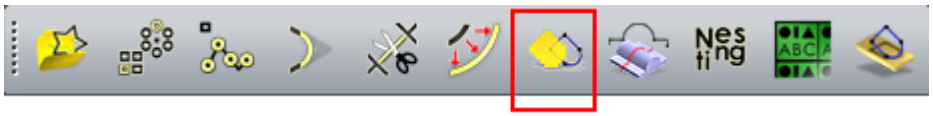
- Select **Blue** from the colour toolbar.

The blue colour will be assigned as primary.

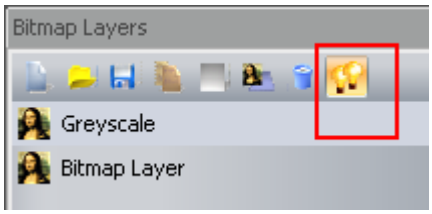


A new **vector** will be created around the blue coloured area.

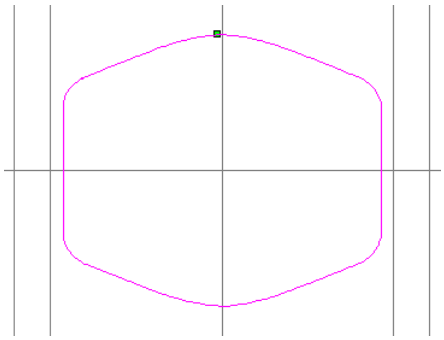
- Select **Flood Fill** and colour the **white** area to make it stand out.
- Select .



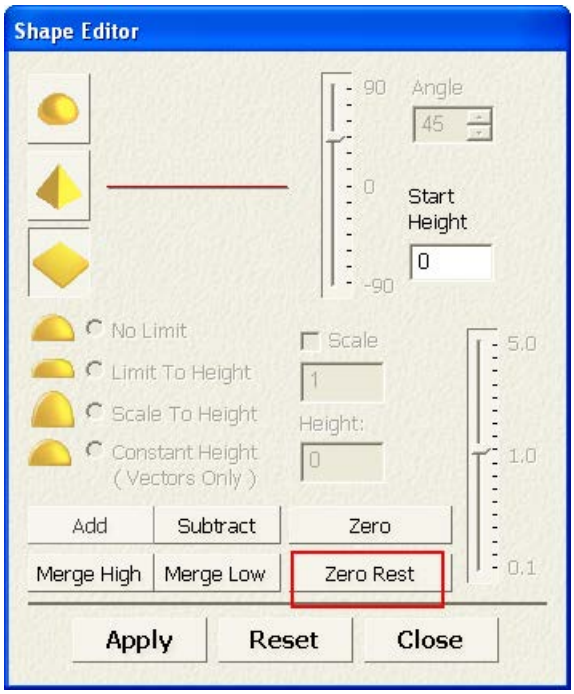
- From the top toolbar, select **Bitmap To Vector**.
- Select **Create Vectors** from the **Vector From Bitmap**.
- Close the form.
- Right mouse click on the left hand corner of the graphics area and select **Bitmap Layers**.



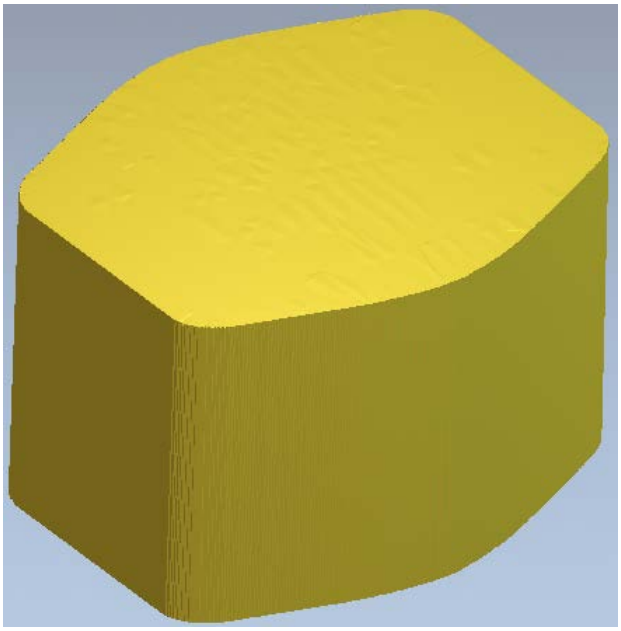
- Select **Toggle Bitmap Layer Visibility**.



- With the **new vector** selected, press **F12** on the keyboard.



- Select **Zero Rest**.
- Select **Close**.
- Press **F3**.

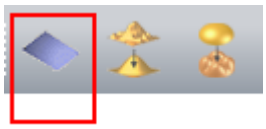


You've neatly trimmed the new **relief** to match the **outer profile** of the **Flat area** of the original **Shank**. The only remaining use for the current **Relief** is for accurately measuring the **Z Height** of the **Flat** area.
You will generate a new **Relief** for the **head detail**. It will be moved the measured distance along **Z** so that its base lies exactly on the **Flat** area of the existing **ring component**.

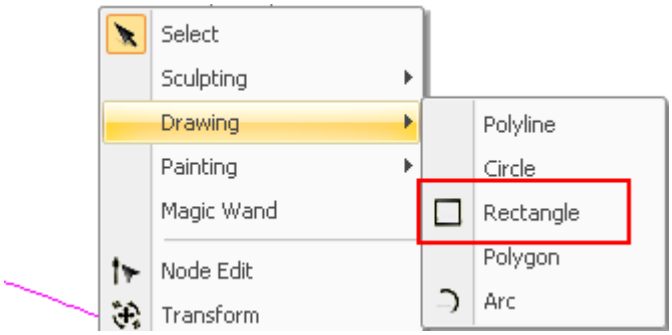
- Right mouse click on the left hand corner of the graphics area and select **Assistant**.

The current Relief will be flattened (**Reset**). Before you do this, the maximum **Z dimension** needs to be recorded. This is the **Max. Z** of the model (**11.564mm**) and you can find it at the top of the **Assistant's** page.

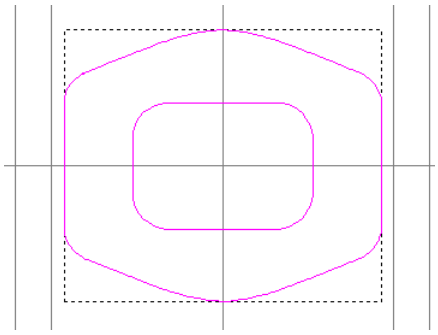
- Close the **Assistant** page.



- Select **Reset Relief**.
- Press **F2**.

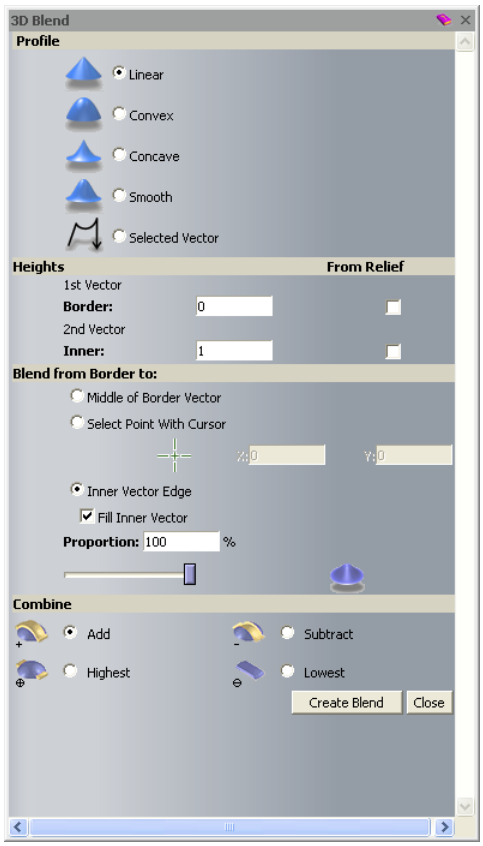


- Right mouse click on the graphics area and select **Drawing** – **Rectangle**.
- Press **F6** to display the **Tool Settings** for the **Rectangle Creation**.
- Enter **Width** of **10mm**, **Height** of **7mm**, **Corner Radii** of **2mm** at **X0 Y0**.
- Select **Preview**.
- Right mouse click on the graphics area to close the **Rectangle Creation** form.



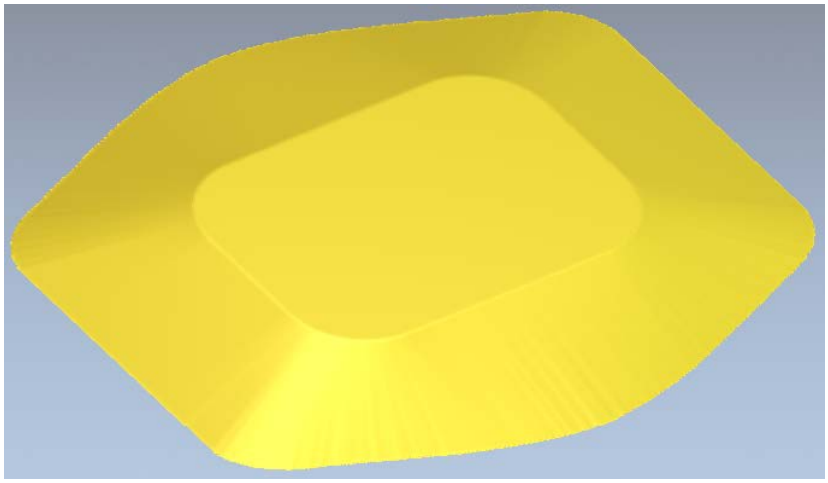
- Select the **outer vector** and then the **inner rectangle**.

- Select **Create 3D Blend** from the top toolbar.



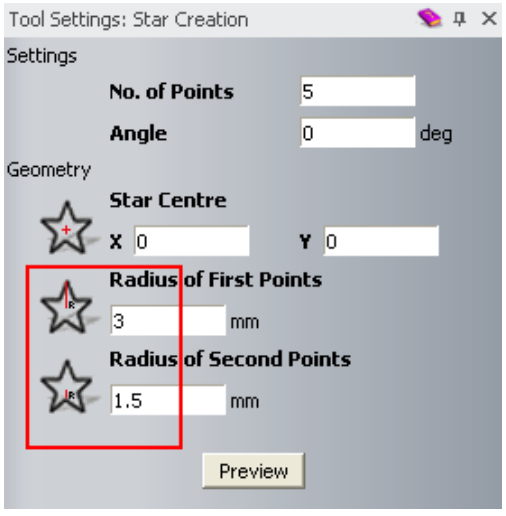
- Select **Linear**, **Border Height** as **0**, **Inner** Height as **1mm**, select **Inner Vector Edge**.
- Select **Add** followed by **Create Blend**.
- Select **Close**.

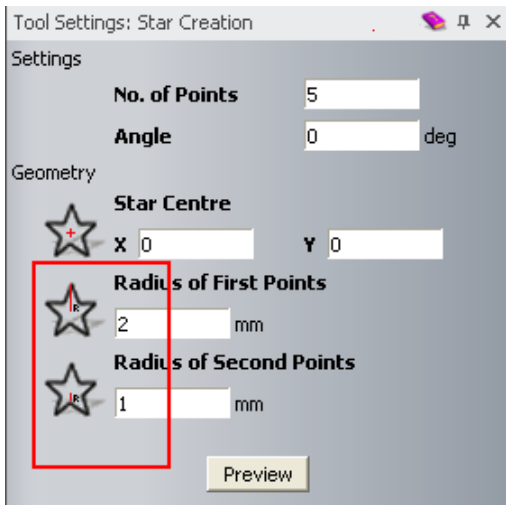
- Press **F3**.



The new **Relief** will start from **Z Zero**. When this is made into a component, you will **Nudged** it upwards in the **Project** view by the value of **11.564mm**. Keeping the **head detail** separate provides the option to create more than one interchangeable design.

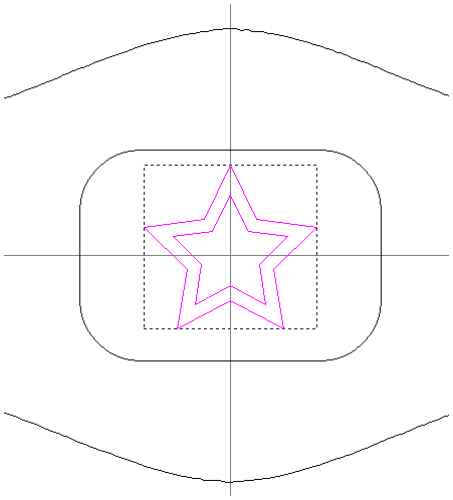
- Press **F2**.
- Select **Create Stars** from the left toolbar.



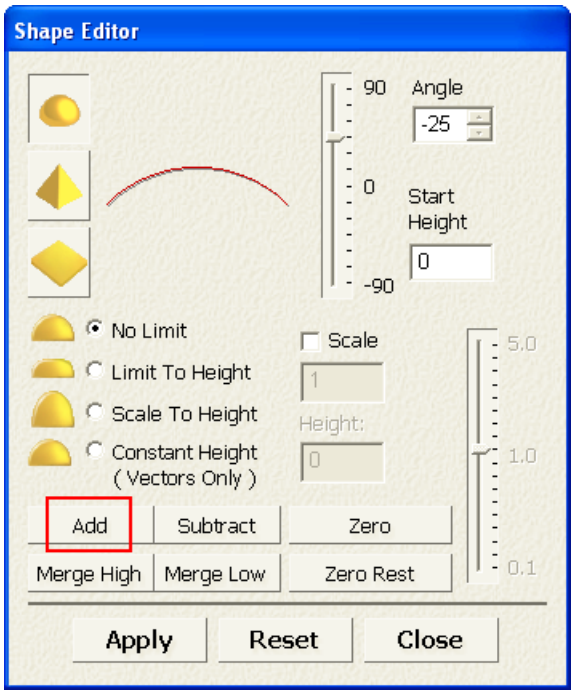


- Enter a **First Radius** of **3mm** and a **Second Radius** of **1.5mm** to create the **first star**.
- Select **Preview**.
- Left mouse click on the graphics area.

- Create a **second star** with a **First Radius** of **2mm** and a **Second Radius** of **1mm**.
- Select **Preview**.
- Right mouse click on the graphics area to close the **Star Creation** form.

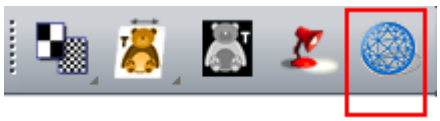


- Select **both Star vectors** and press **F12**.

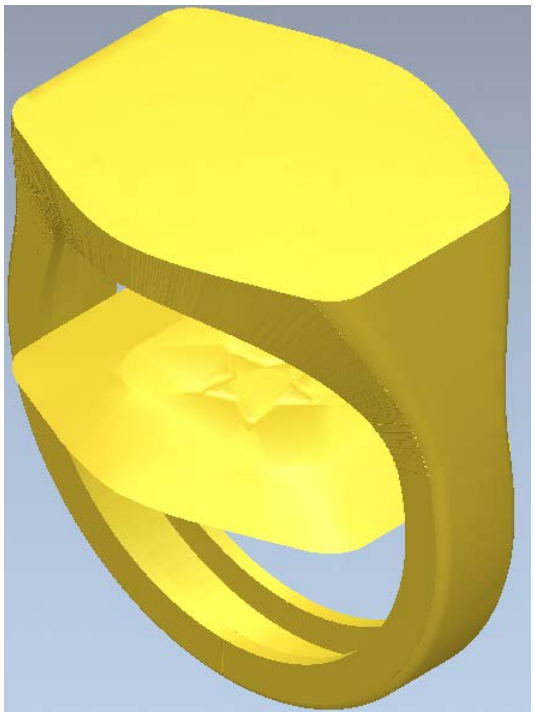


- Select a **Dome shape** with an **Angle** of **–25mm**.
- Select **Add**, followed by **Close**.
- Press **F3**.

You can now add the **Relief** to the **Project**.



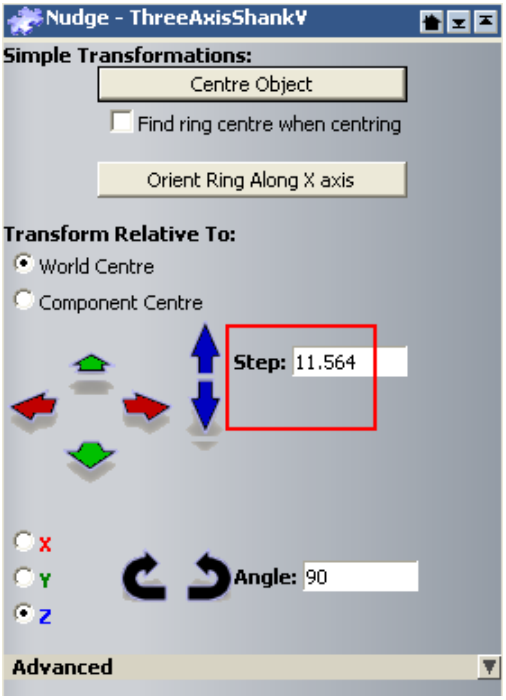
- Select **Create Triangle Mesh** .
- Select the option **Close With a Flat Plane** and then select **Create Triangles**.
- Select the option **Add To Project**.
- Select **Close**.
- Select **File - Close Model** and select **Yes** to update project.



Both components are shown in the **Project** view.
You will select the **head component** and **Nudge it** upwards by **11.564** to align with the **top** of the **Shank**.

- Select the component **ThreeAxisShankV** from the **Assembly** tree.

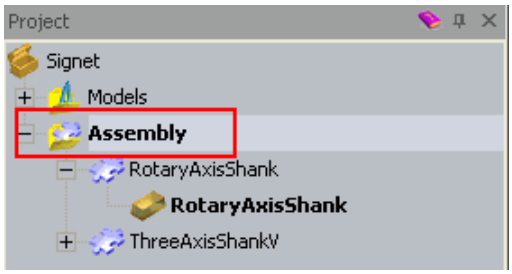
- Select **Nudge** .



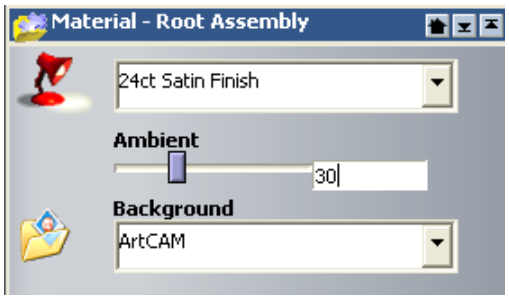
- Enter a **Step** of **11.564mm** and select **Nudge up** .

In this case it does not matter if you choose the component centre or the ring centre, as it is the same place.
The **ring** is completed.

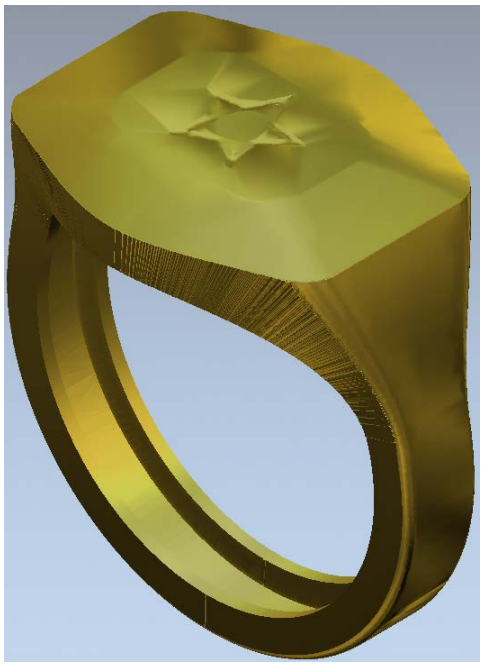
- Close the **Nudge** form.



- Select the **Assembly** folder.
- Select **Edit Object Shading** .



- Select **24ct Satin Finish**.
- Close the **Material** form.
- Select **File** – **Save As**.
- Browse to: **D:\users\training\COURSEWORK\JewelSmith-Jobs**.
- Enter the name **Signet ring** and select **Save**.



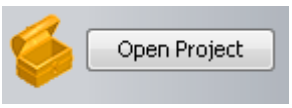
- Select **File** – **Close Project**.

17. Earring

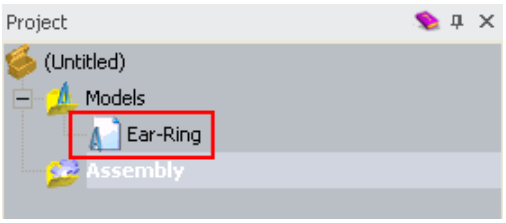
Introduction

This tutorial demonstrates the model creation of an ear ring with **Gem** settings. This exercise includes a range of functionality including **Two Rail Sweep**, **Texturing**, **Back Reliefs**, **Vector** and **Relief Layer** management.
The ear ring will be modelled on vectors that have already been created in an **ArtCAM** model.

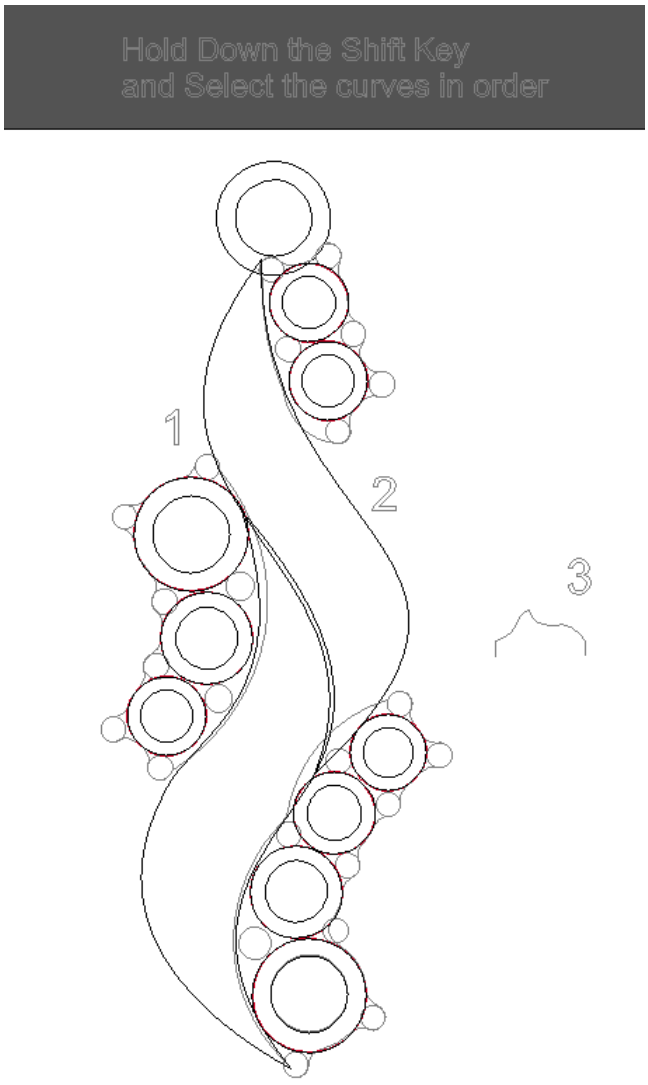
Earring Design Exercise

- Select **Open Project** 

.
- Browse: **D:\users\trainingArtCAM Data**, select **Ear Ring.3dp** and **Open** it.
- Select **No** to the **Save converted project** query.
- Expand the **Models** tree to show the **Ear-Ring** model.

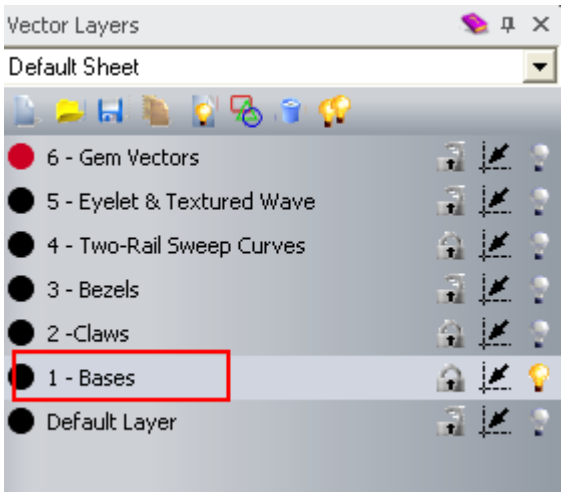


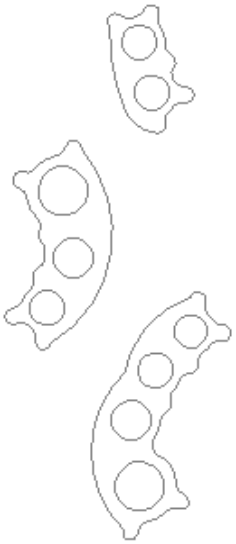
- Double left mouse click on the model to open it *(*or right mouse button and select **Edit**).



The **ArtCAM** model is loaded.
The **vectors** are **grouped** into specific areas and placed on separate **vector layers**.
All **vector layers** are currently **switched on** hence the whole design is visible.
Corresponding **Relief Layers** will be created as the **Relief** is modelled.

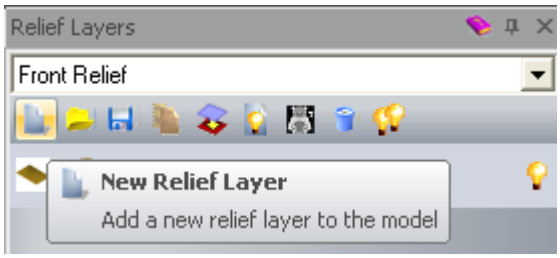
- Right mouse click on the left hand corner and select **Vector Layers**.



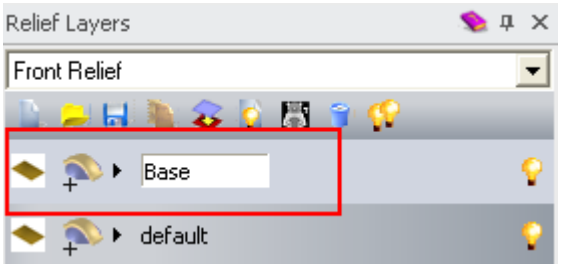


Only the **base vectors** should be visible.

- Switch **off all vector layers** except **1-Bases**.
- Right mouse click on the left hand corner of the graphics area.

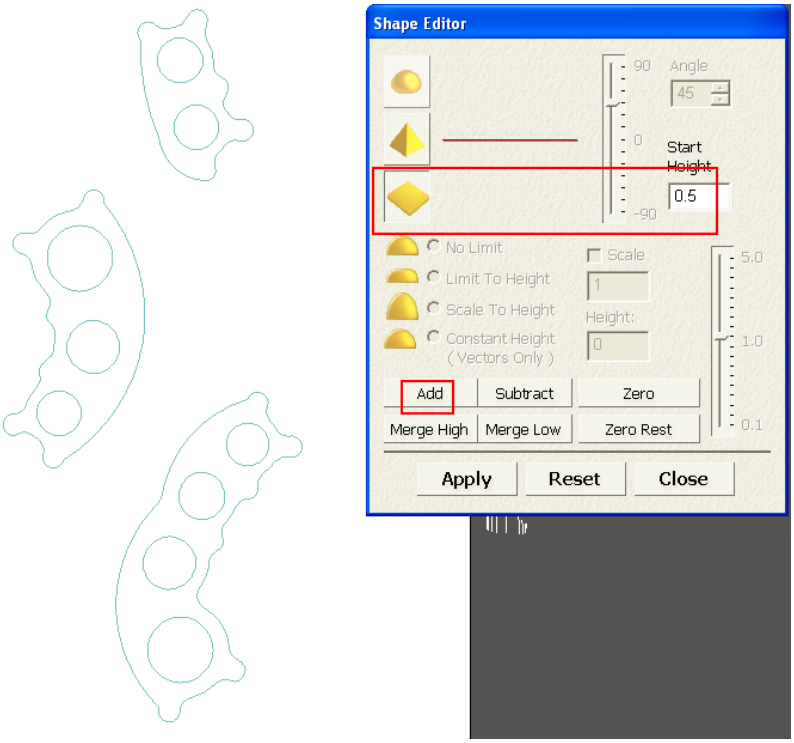


- Select **Relief Layers**.

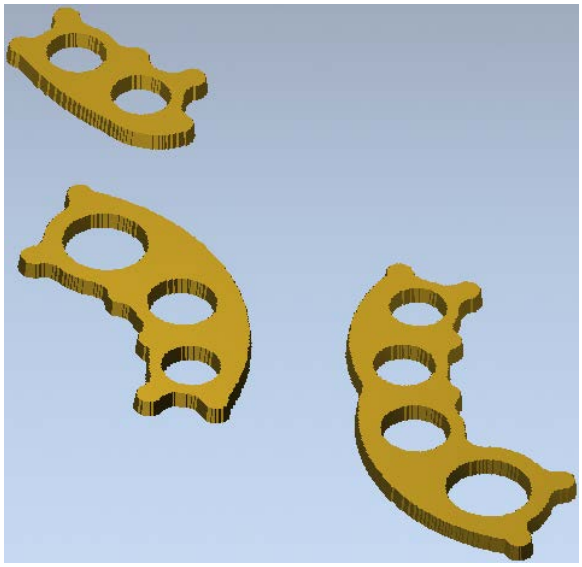


- Select **New Relief Layer** from the **Relief Layers** form and rename it as **Base**.

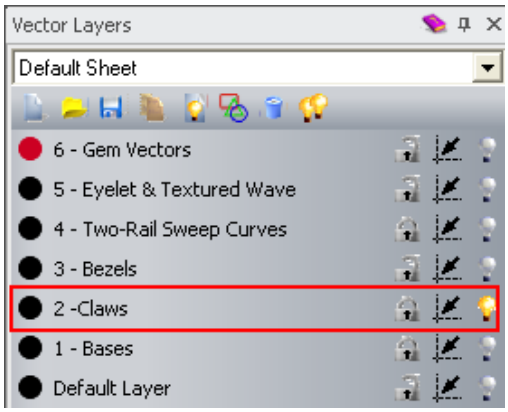
- Select the **base vector group** and press **F12** to open the **Shape Editor**.



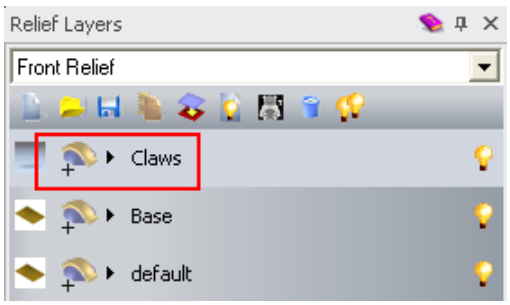
- Add a **Flat shape** with a **Start Height** of **0.5mm**.
- Press **F3** to view the **relief**.



- Press **F2**.

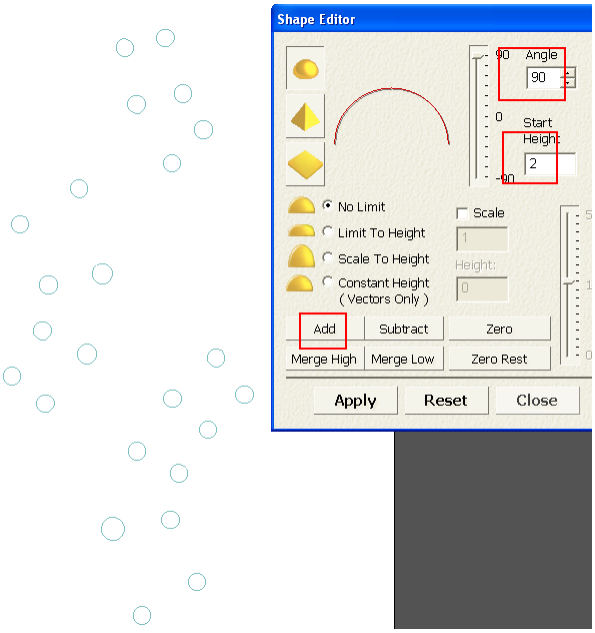


- Switch off the **1-Bases vector layer** and switch on **2-Claws**.

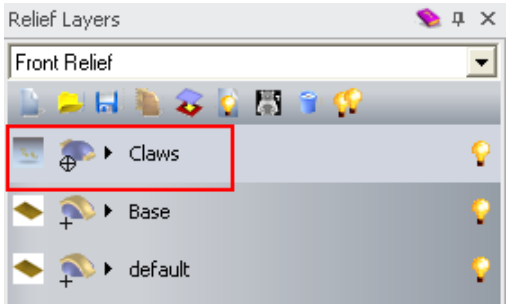


These **claws** (or prongs) are used to hold the gems in place.

- Create a new **Relief Layer** and rename it **Claws**.
- Highlight the **Claws** to make it **active**.



- Select the **claws vector group** and press **F12** to open the **Shape Editor**.
- Add a **Dome** shape of **90 degrees** with a **Start Height** of **2mm**.

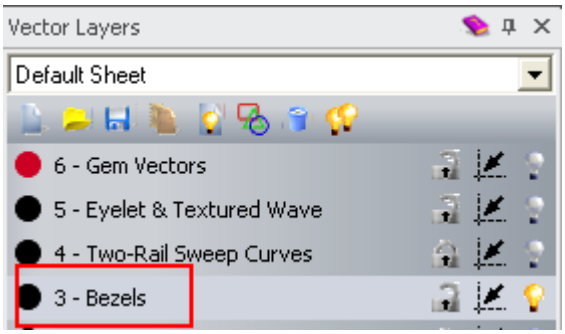


- Change the **combine option** of the **Claws** relief layer from **Add** to **Merge High**.
- Press **F3**.

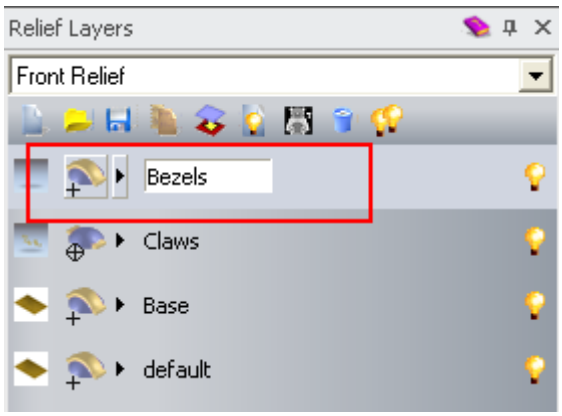
The **claws** now merge (blend) up through the bases – as shown. Setting an **Angle** of **90 degrees** gives a 'true' **Dome shape** at the tops of the claws.

The **next step** is to **create the bezels** (where the girdle of the gem sits).

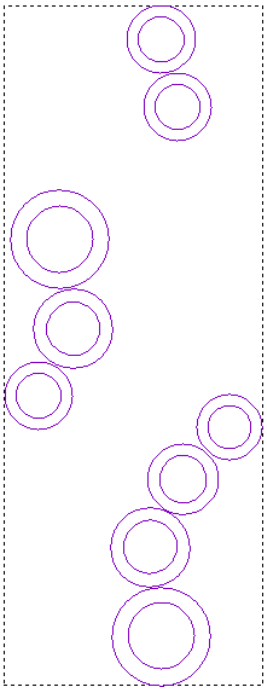
- Press **F2**.

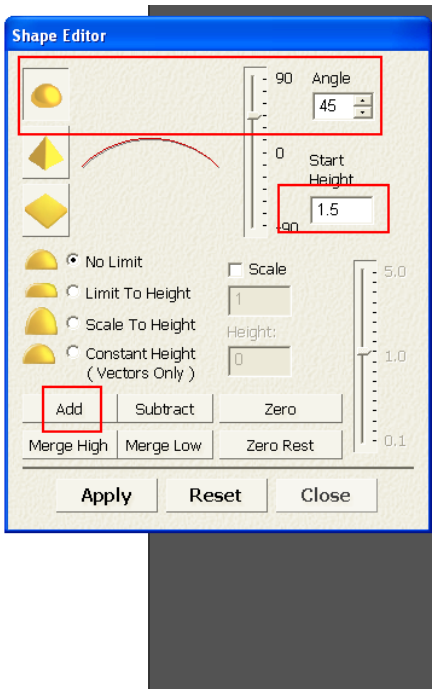


- Switch off the **2-Claws vector Layer** and switch on **3-Bezels**.

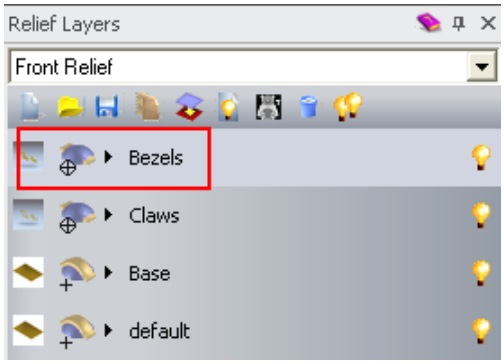


- Create a new **Relief Layer** and rename it **Bezels**.
- Highlight the **Bezels** layer to make it **active**.

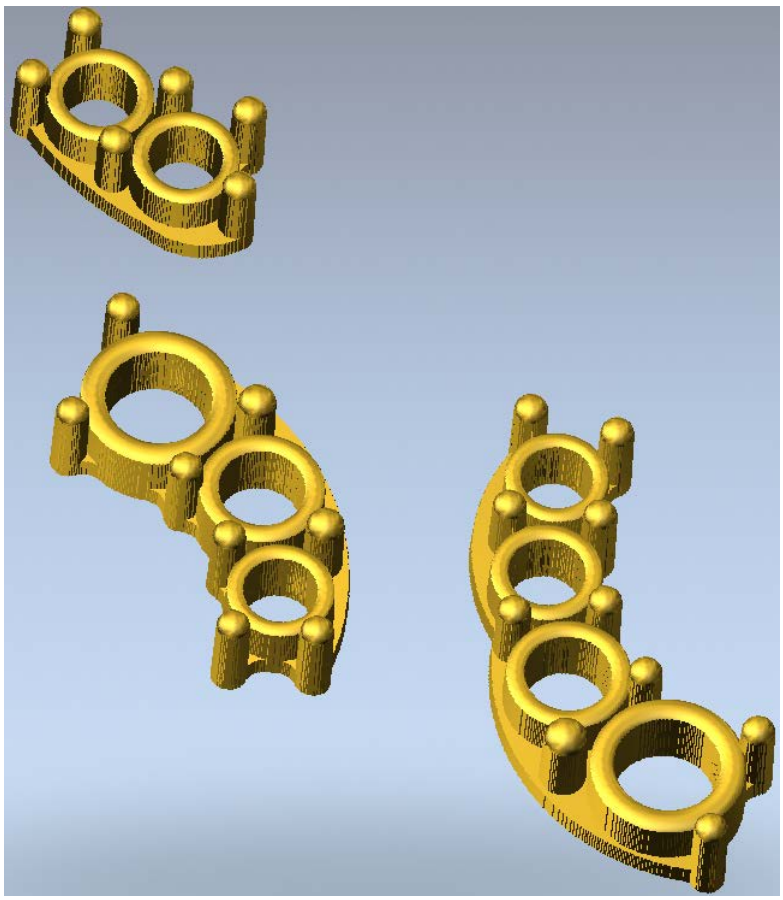




- Select the **outer Ring** group of vectors and then shift select the **inner group**.
- Add a **Dome** shape of **45 degrees** with a **Start Height** of **1.5mm**.



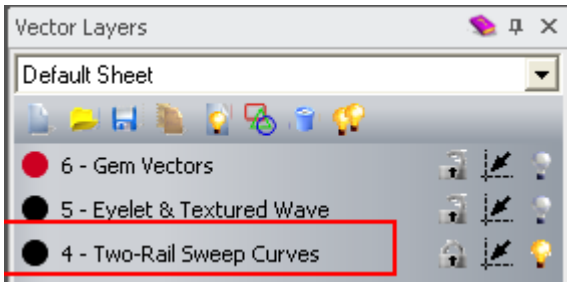
- Change the combine option of the **Bezels** relief Layer from **Add** to **Merge High**.
- Press **F3**.



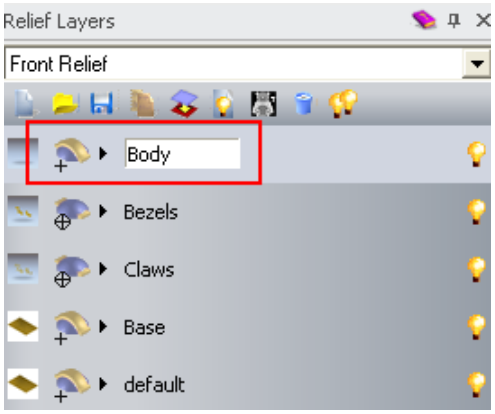
This completes the **Gem** setting part of the design.

You will now create the **main body** of the **ear ring**.

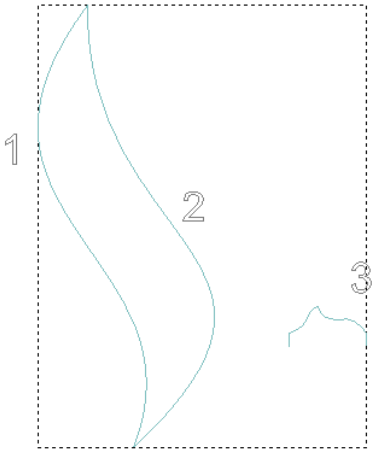
- Press **F2**.



- Switch off the **3-Bezels** vector switch on **4–Two Rail Sweep Curves**.

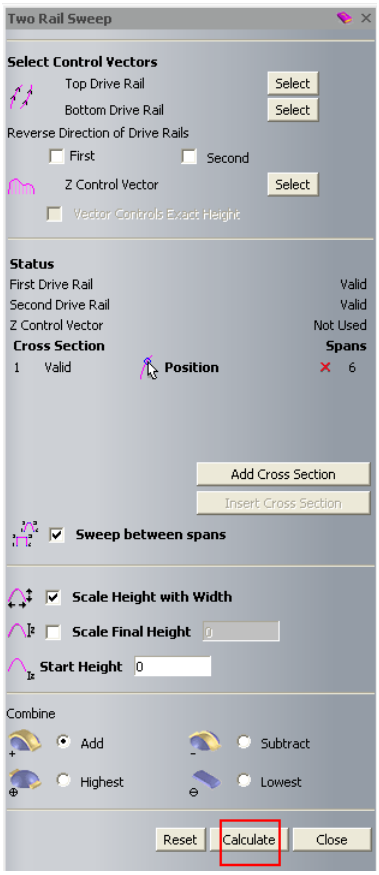


- Create a new **Relief Layer** and rename it as **Body**.
- Highlight this **new layer** to make it **active**.

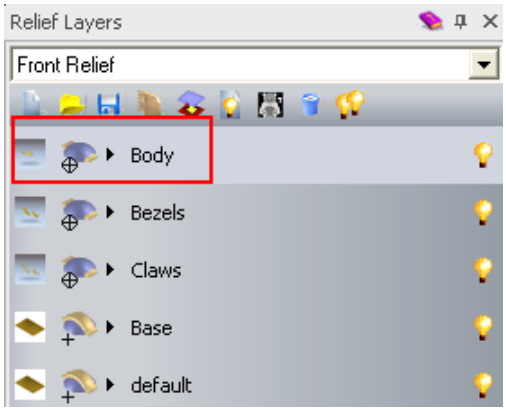


- Shift select the **three** vectors in the order indicated.

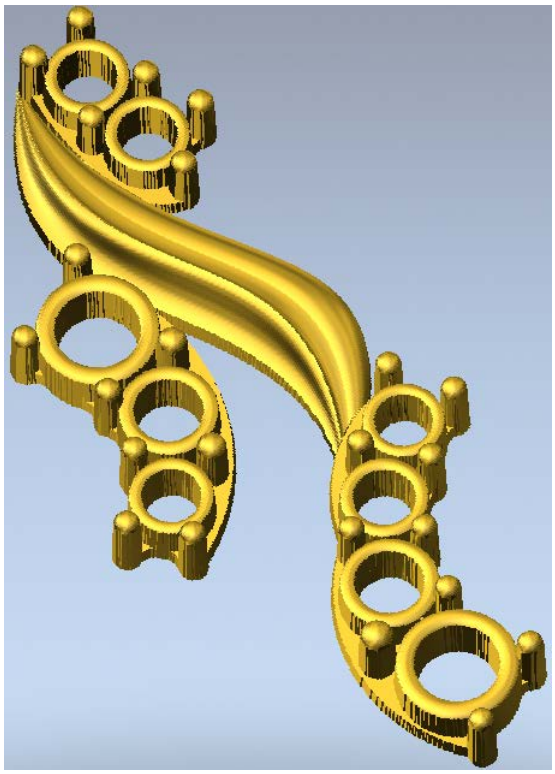
- Select **Two Rail Sweep** from the top toolbar.



- Select **Calculate** and then **Close** the form.

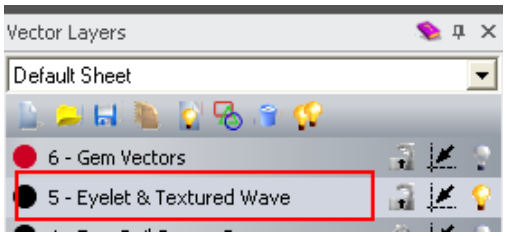


- Change the combine option of the **Body** relief layer from **Add** to **Merge High**.
- Press **F3**.

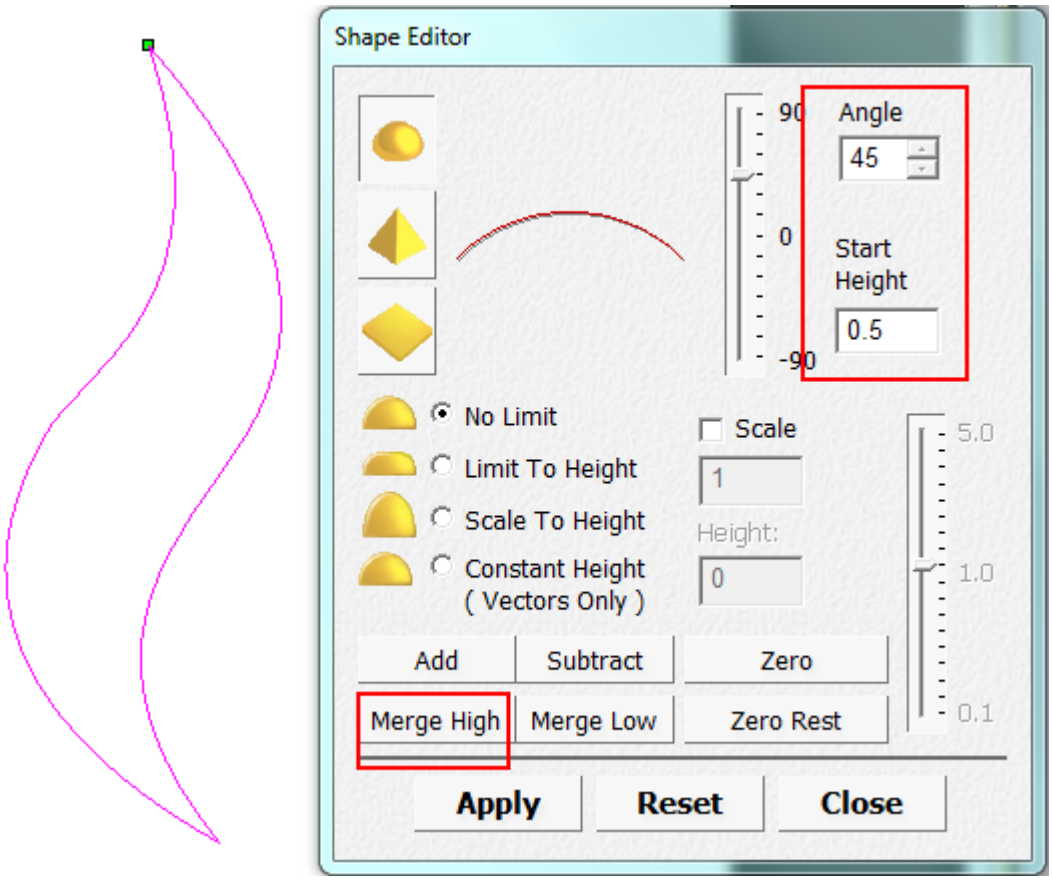


The **Body** is blended into the **Base**.

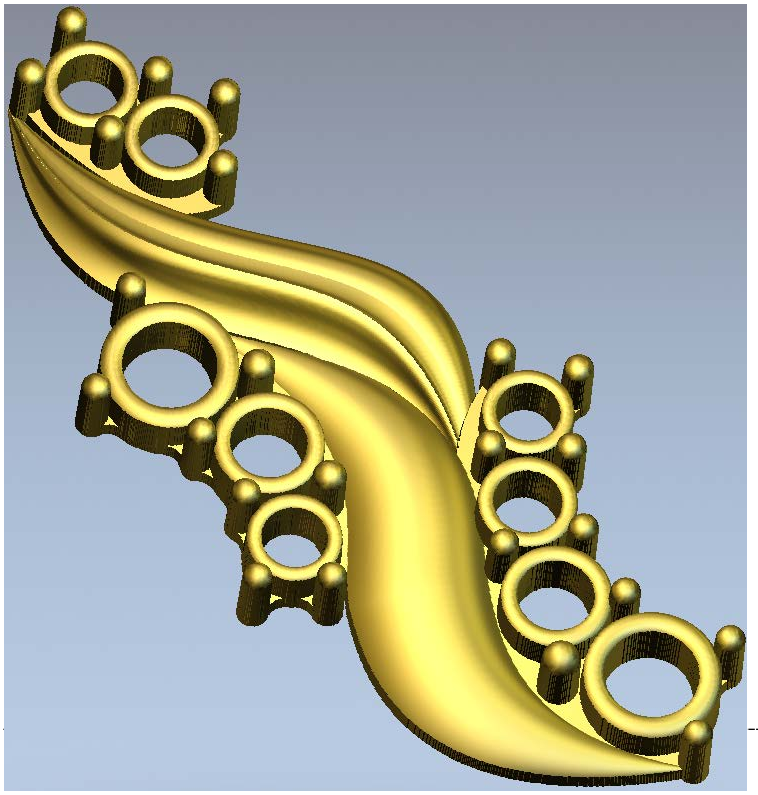
- Press **F2**.



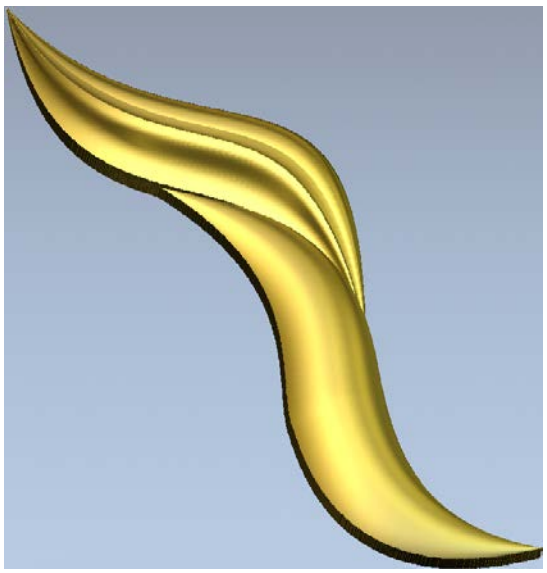
- Switch off the **4–Two Rail Sweep** vector Layer.
- Switch on vector layer **5-Eyelet and Textured Wave**.
- Ensure the **Body** relief Layer is still **active** (highlighted).
- Select the **new body vector**.

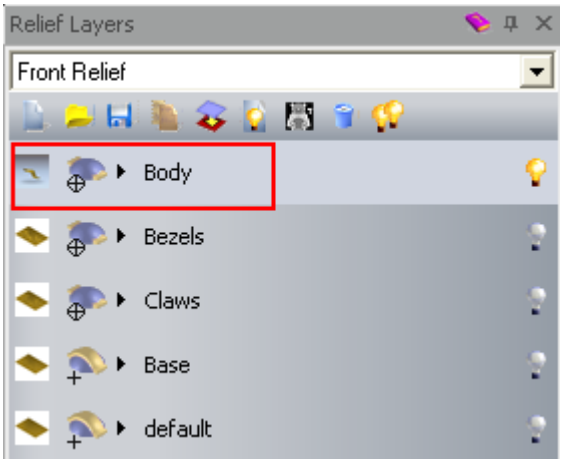


- Select a **Dome** shape of **45 degrees** with a **Start Height** of **0.5mm**.
- Select **Merge High** and **Close** the form.
- Press **F3**.

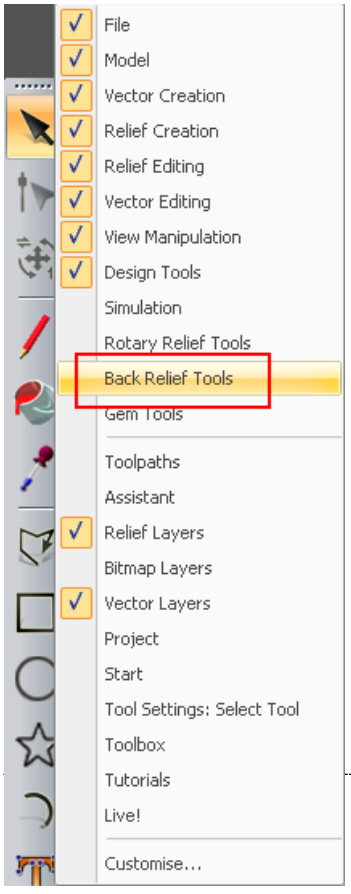


At this stage, you will create an **Offset Back Relief** which will then be used to hollow out the main body. The **Gem** settings do not require hollowing out.



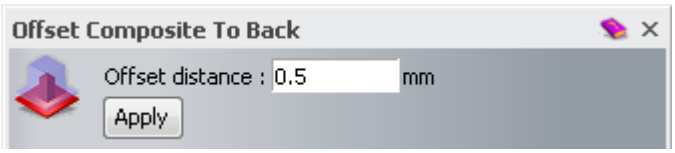


- From the **Relief Layers** tab, switch off the layers **Bezels**, **Claws**, **Base**, **default** to leave only the **Body layer visible**.

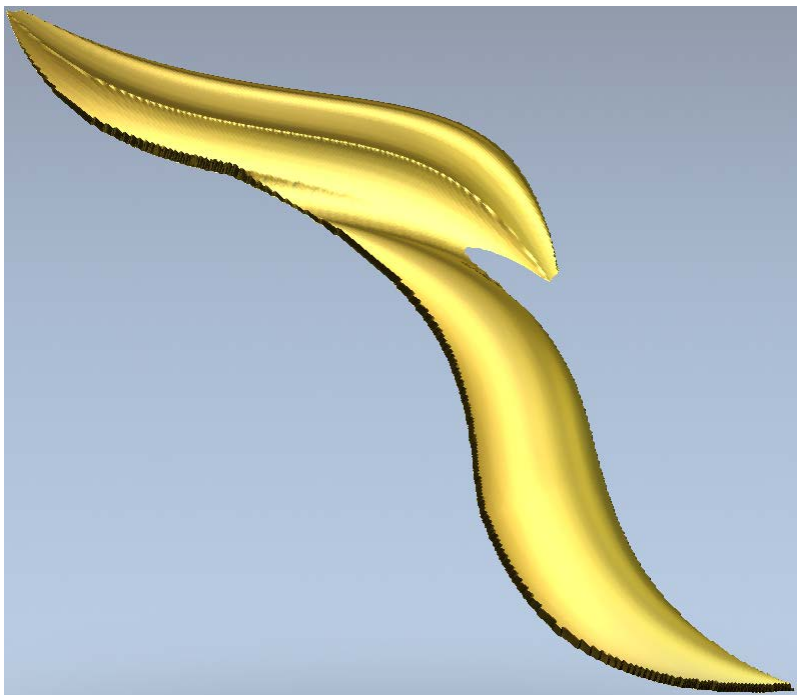


- Right mouse click on the left hand corner of the graphics area and select **Back Relief Tools**.

- Select **Offset Composite To Back** from the **Back Relief Tools** toolbar.

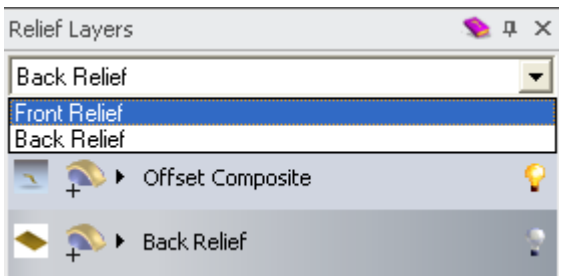


- Enter **0.5mm** in the **Offset Composite To Back** and select **Apply**.

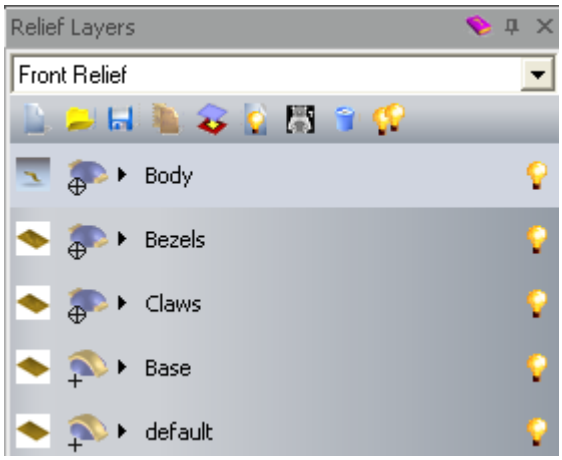


This will provide a **wall thickness** of **0.5mm**.

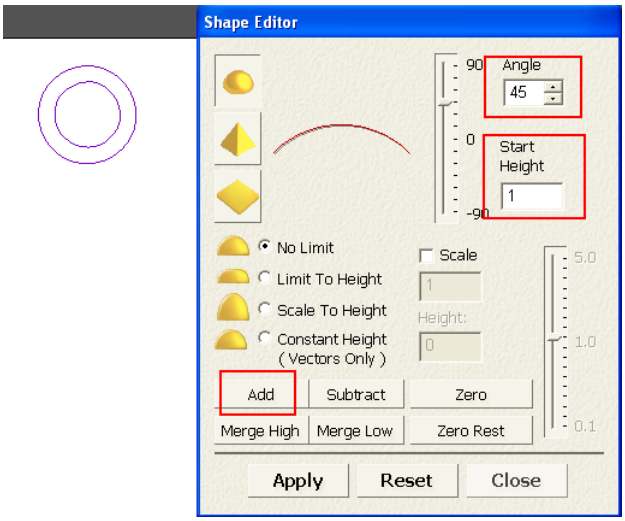
It will be used to **Subtract** from the **Front Relief** to hollow the earring body.



- Select **Front Relief** from the **Relief Layers** pull down menu.
- Press **F2**.

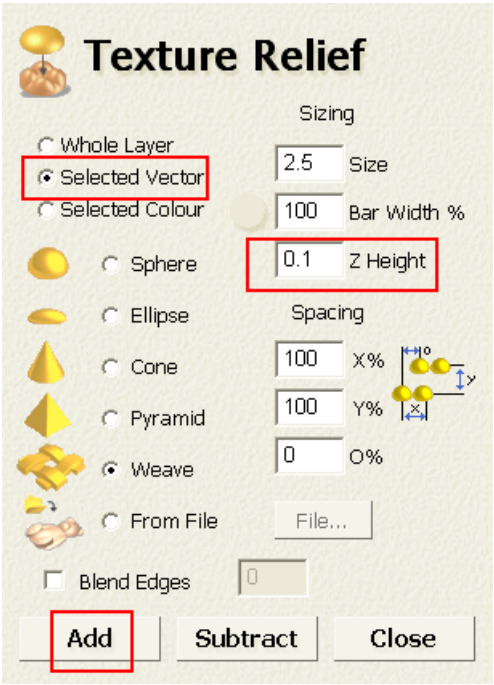


- Switch all the **Relief Layers** back on and ensure the **body Relief Layer** is still **active**.

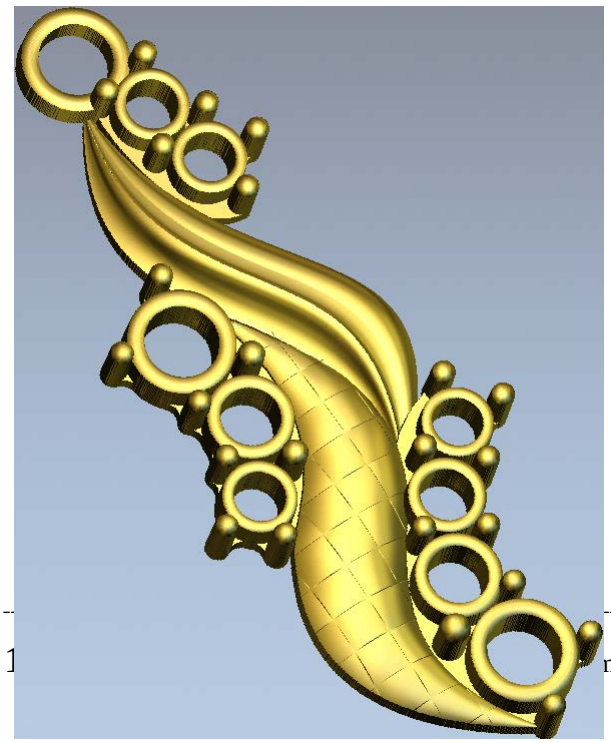


- Select the **Eyelet group vectors** and press **F12**.
- Select a **Dome** shape of **45 degrees** with a **1mm Start Height**.
- Select **Merge High**.

- Select the **lower vector**.
- Select **Texture Relief** .

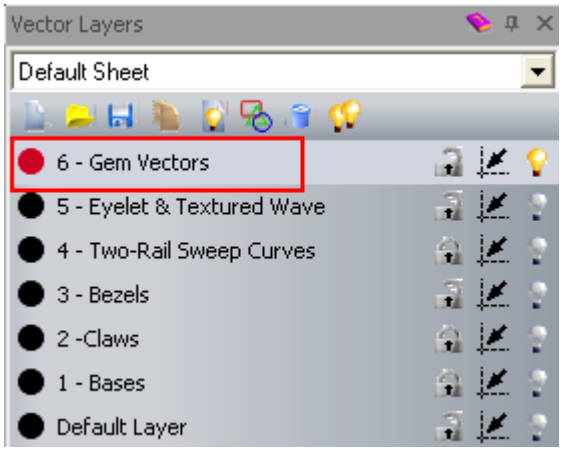


- In the **Texture Relief** form select the **Weave** pattern and change the **Z Height** to **0.1mm**.
- Select **Add** and then **Close**.
- Press **F3**.

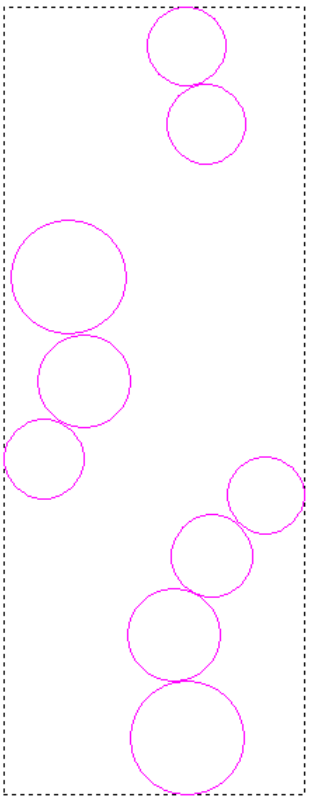


You will now add **Gems** to this completed assembly. The **Gem vectors** have already been created using the **outer circles of the bezels** and placed on **vector layer 6**.

- Press **F2**.

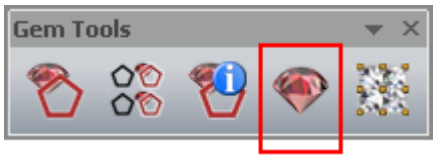


- Switch on vector layer **6 - Gem Vectors** and switch off all other vector layers.

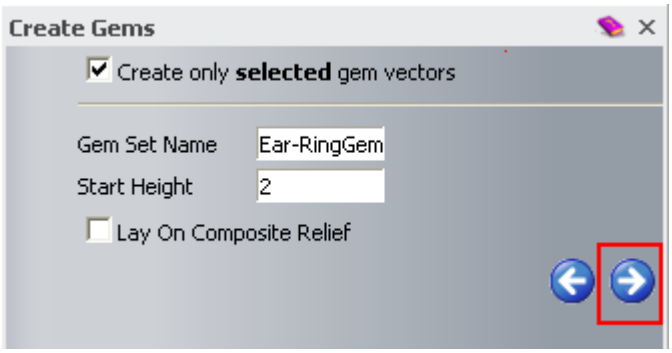


- Select all the **Circle** vectors.

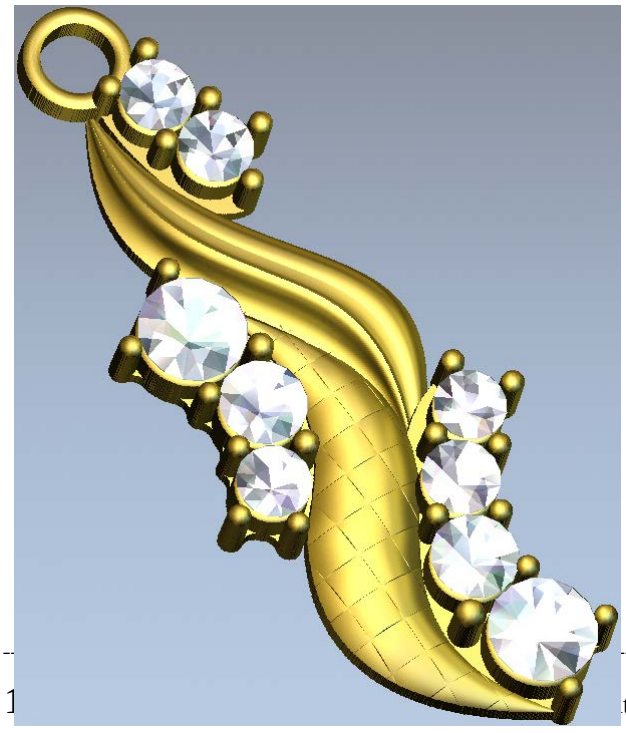
- Right mouse click on the left corner of the graphics area and select **Create Gems** from the **Gem Tools** toolbar.



- Select **Create Gems**.

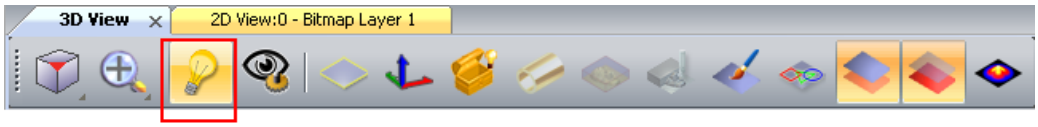


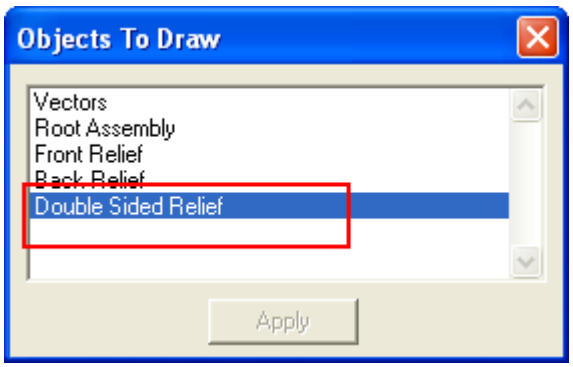
- Enter a **Start Height** of **2mm** and select **Next**.
- Select **Accept** .
- Close the form.
- Press **F3**.



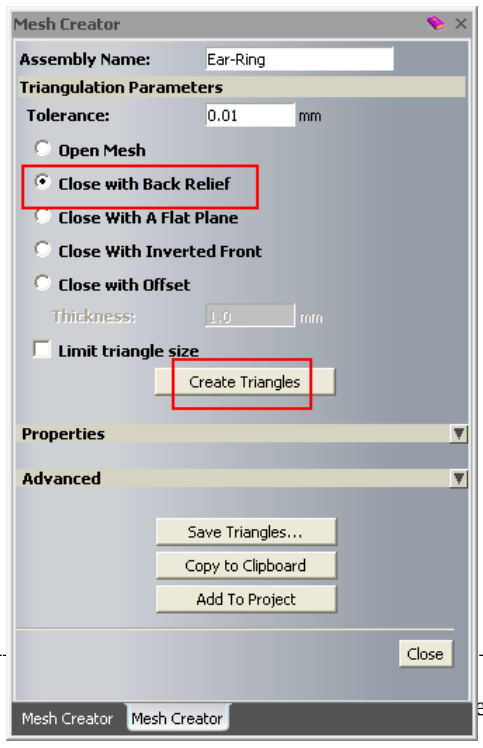
Both **Front** and **Back** reliefs can be showed together before you create the mesh for rapid prototyping.

If you select **Objects to Draw** from the **3D View** toolbar, the **Objects To Draw** form is displayed. If you then select the option **Double Sided Relief**, the Front and Back reliefs are combined.

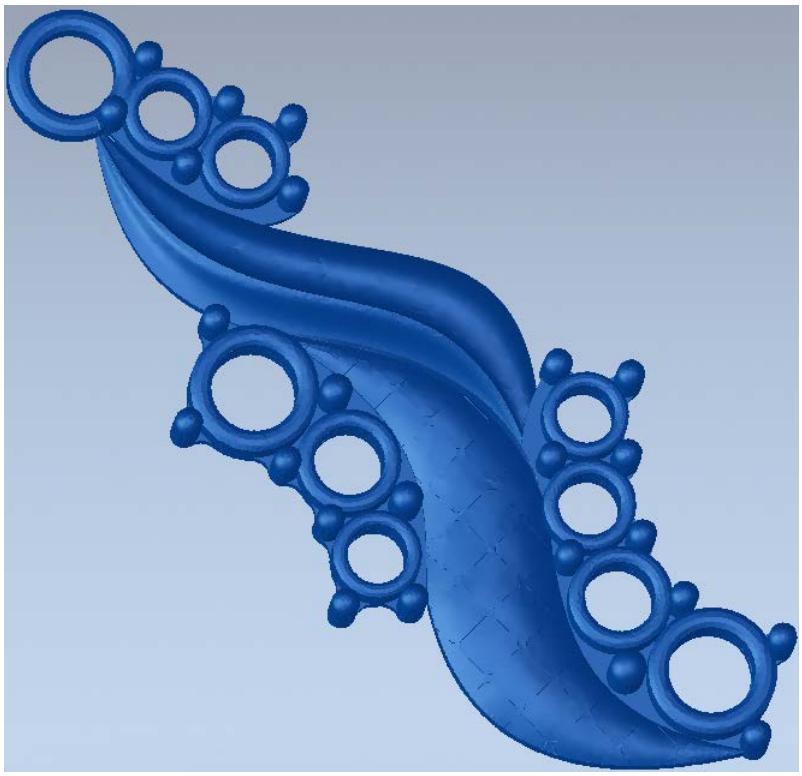




- Select **Create Triangle Mesh** .

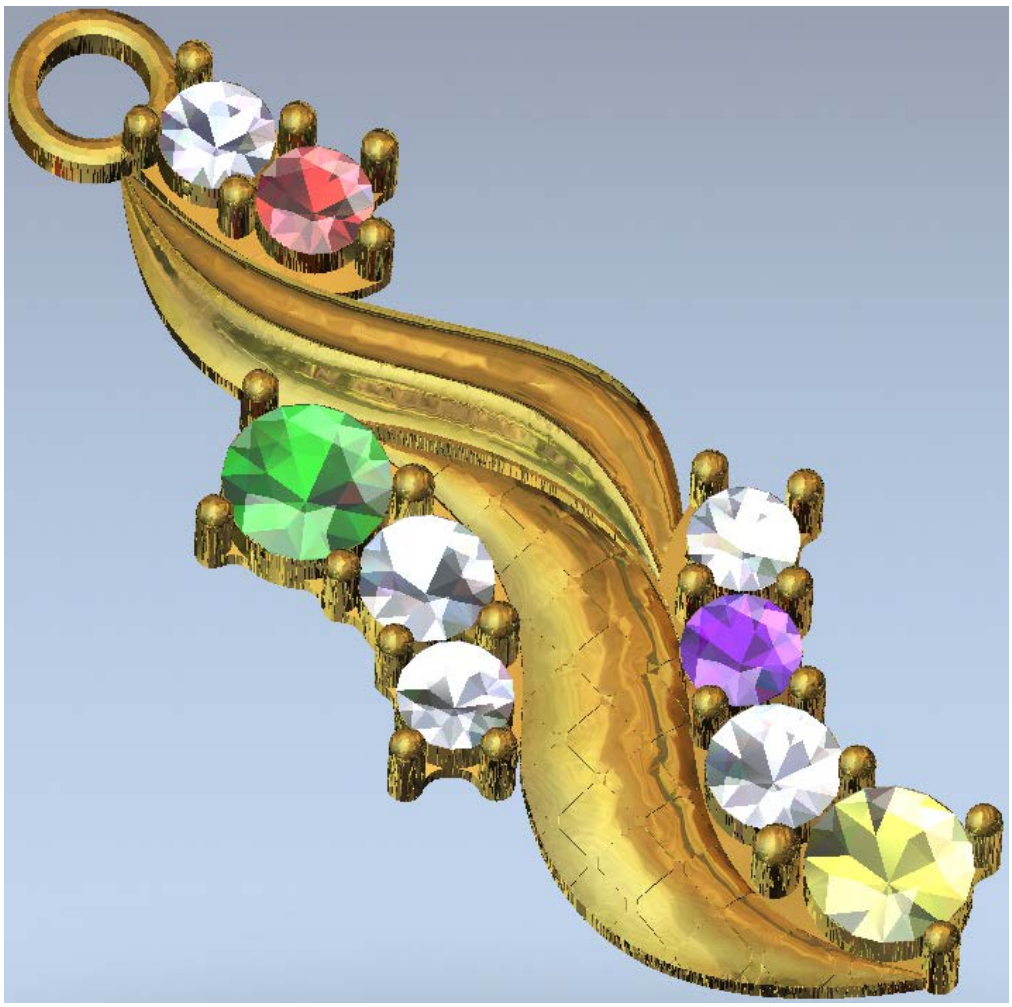


- Select the option **Close with Back Relief** and then select **Create Triangles**.
- Select the option **Add To Project** and then **Close** the **Mesh Creator** form.



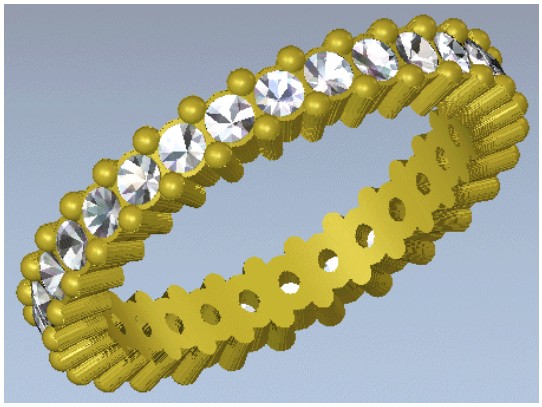
The complete **Earring** assembly is shown with the **hollowed back**.

- Select **File** – **Close Model**.
- Browse: **D:\users\training\COURSEWORK\JewelSmith-Jobs**.
- Enter the name **Earring** and select **Save**.
- In the **Projects** area, experiment with changing the **Colour** of the **individual gems**.



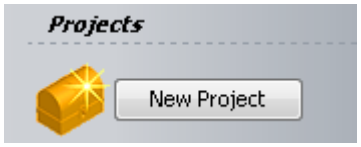
18. Eternity Ring

Introduction

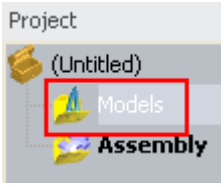


This tutorial demonstrates the model creation of an **Eternity Ring**. Instead of using the **Pave Wizard**, you will create all vector geometry manually with the help of **Paste along curve**.

Eternity Ring Design Exercise

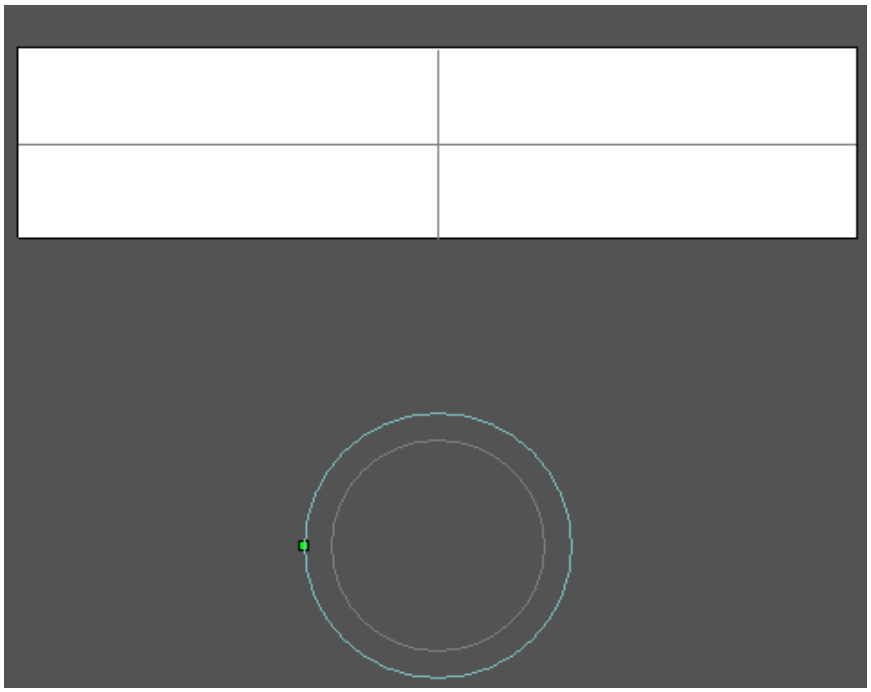


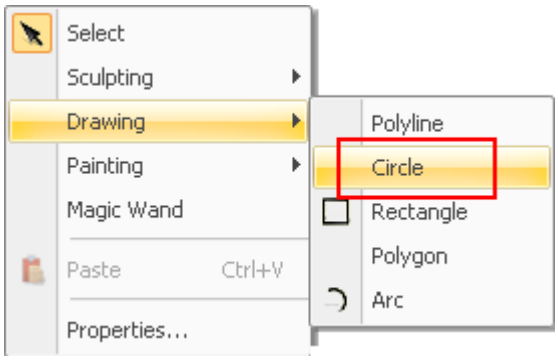
- Select **Create New Project**.



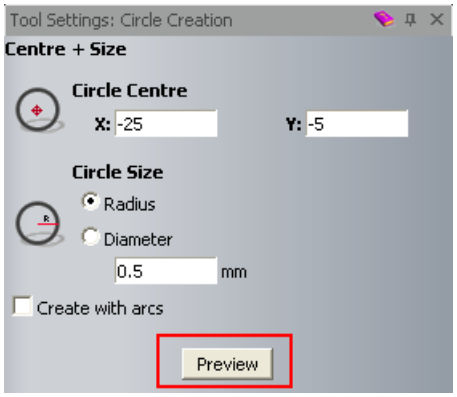
- Select **Models** from the root **Project** folder.
- Select **Create Rotary Axis Blank** .

- Select a **British** standard, **Size J½** ring.
- Set the shank **Width** as **4mm**, **Border** as **5mm**, Shank **Thickness** as **2mm**, with a **Resolution** of **30**.
- Select **Accept** .

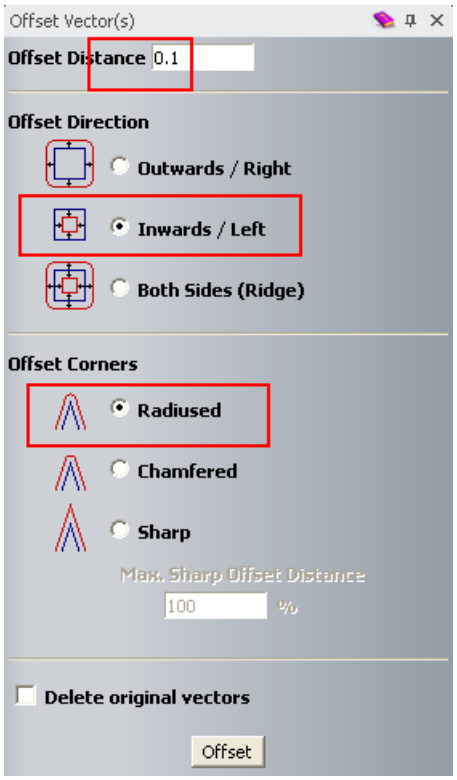


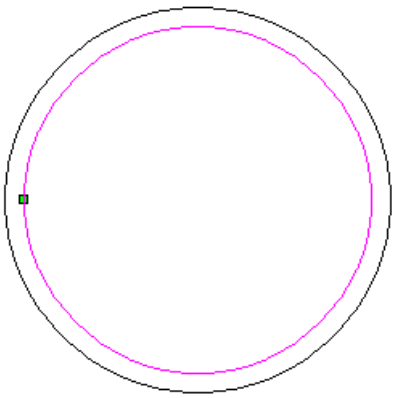


- Right mouse click on the graphics area and select **Drawing** – **Circle**.
- Press **F6** to display the **Tool Settings: Circle Creation**.



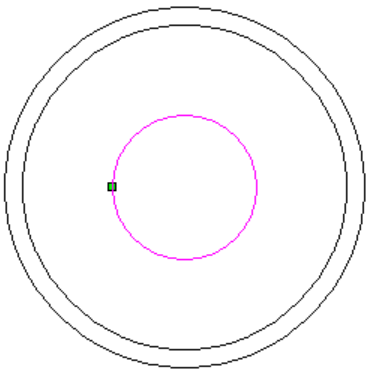
- Select **Create Circles** and create a **Circle** of **Radius 1mm** at **X–25** and **Y–5**.
- Select **Preview**.
- Right mouse click on the graphics area to close the form.
- Select the **Circle**, followed by **Offset Vectors** .



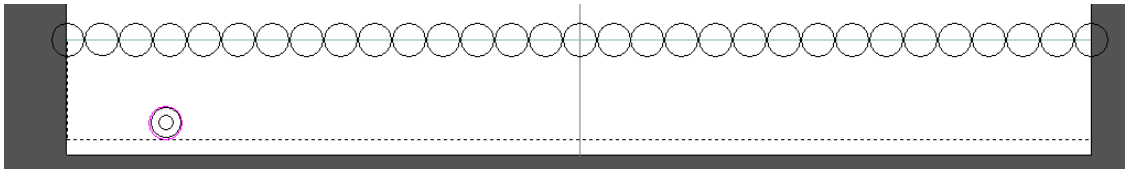


- Enter an **Offset Distance** of **0.1mm** and select the options **Inwards** and **Radiused**.
- Select **Offset**.

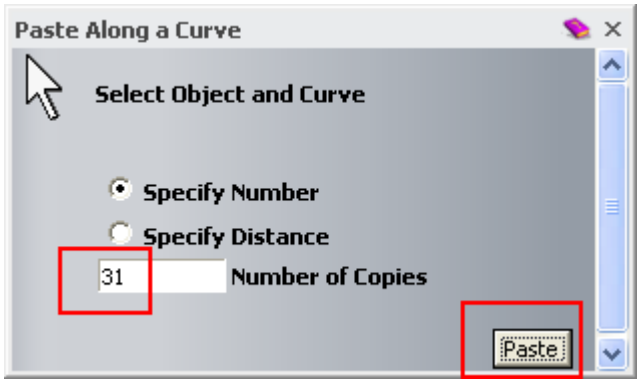
- Select the **circle** that has been offset **0.1mm inwards**.
- Enter an **Offset Distance** of **0.5mm**.
- Select **Offset** and close the form.



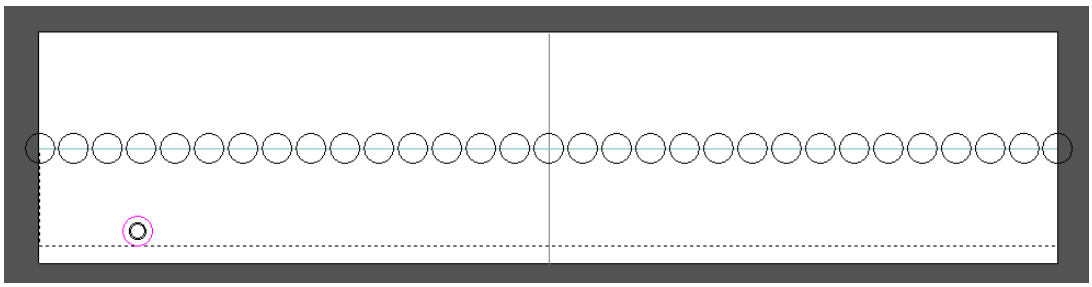
You've created the vectors for a single **stone** setting. Multiple copies will now be required to complete the Eternity ring design. You will use the **Paste along a curve** function to create an equal pattern of stones.



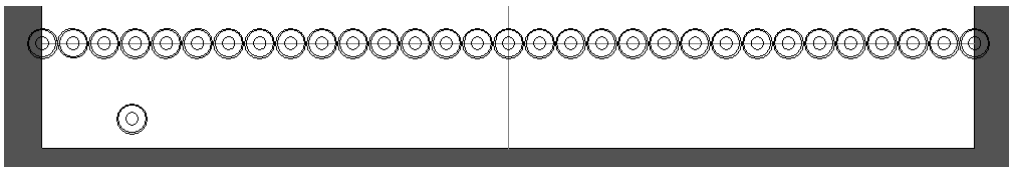
- Select the **outer circle** and then hold **shift** and select the **horizontal reference line**.
- Select **Paste along curve** from the **top toolbar**.



- Select **Specify Number**, enter **31 Number of Copies**.

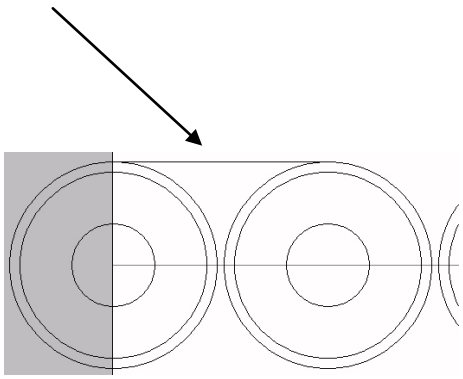


- Select **Paste**.
- Repeat the above procedure for the **inner two circles** (separately).
- Close the **Paste Along a Curve** form.

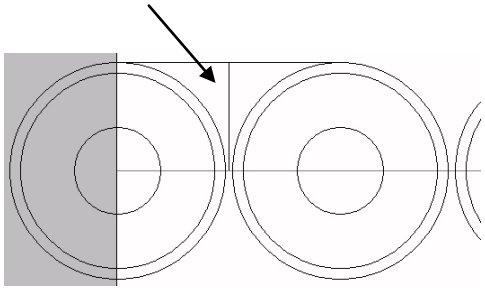


You will now create the geometry for the **beads**. But first you'll have to create **construction geometry** to align them correctly with the stones. You will use the **Object snap cursors** to help you construct quickly and accurately.

- Select **Create Polyline** from the left toolbar.

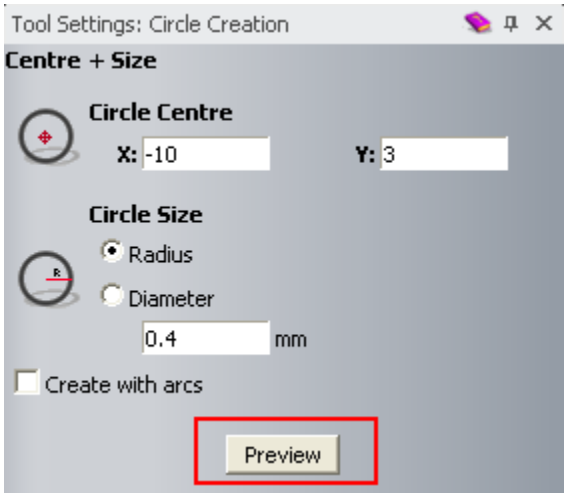


- Create a **single straight line** between the top nodes of the first two circles.

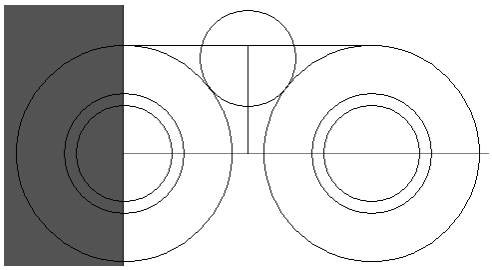


- Create a **second straight line** from the midpoint of this line vertically down to the horizontal vector.

- Select **Create Circles** from the left toolbar.



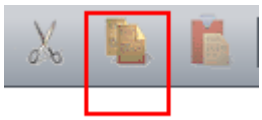
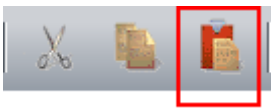
- Create a **Circle** of **Radius 0.4mm** as shown on the image above.
- Select **Preview** and right mouse click to close the form.



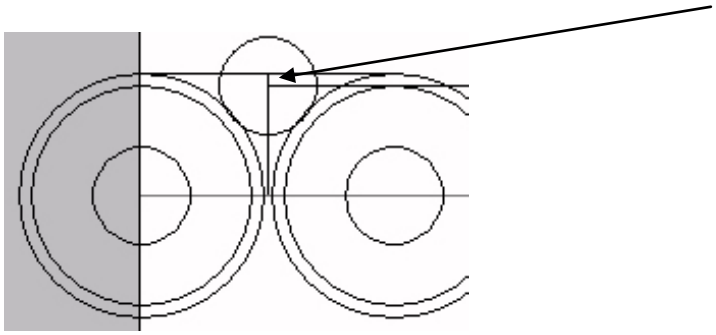
This completes the design and correct position of a single **bead**.

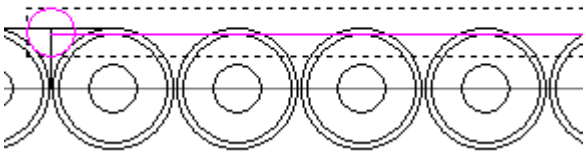
- Drag this **Circle** and place it as shown on the image above.

You will now create multiple copies of this **bead vector** around each of the **Stones**. First you'll have to create a line onto which the **bead vector** will be pasted.

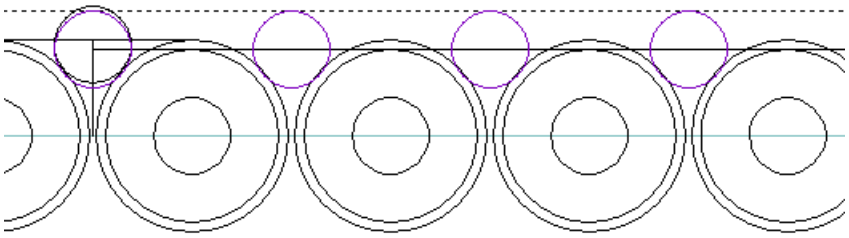
- Select the **horizontal reference line**.
- Select **Copy**  and then **Paste**  .

- Drag the new line from its endpoint and snap onto the centre point of the bead vector circle.

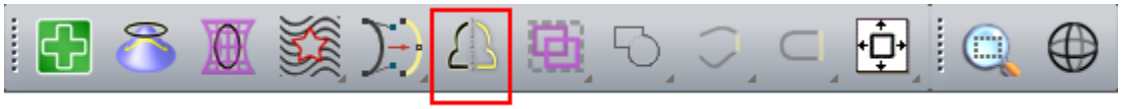




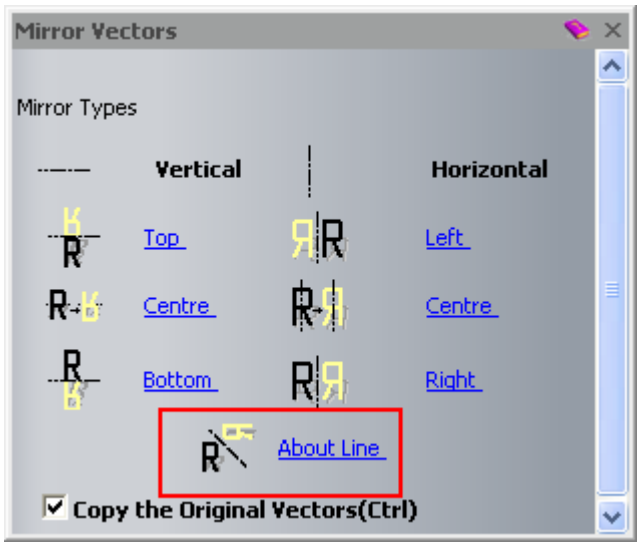
- Select the **bead circle** and then hold **shift** and select the **new horizontal vector**.
- Select **Paste along curve** .
- Select **Specify Number** and enter **31**, select **Paste** and then **Close**.



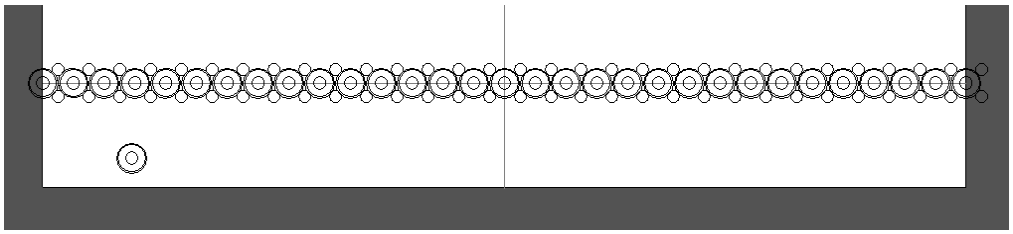
- Select this new **group of circles** and shift select the **original horizontal reference line**.



- Select **Mirror Vectors** from the top toolbar.

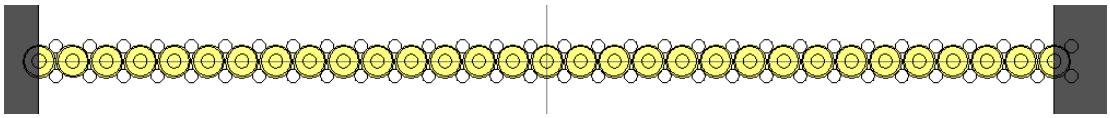


- Select **Copy the Original Vectors** and select **About Line**.
- Close the form.

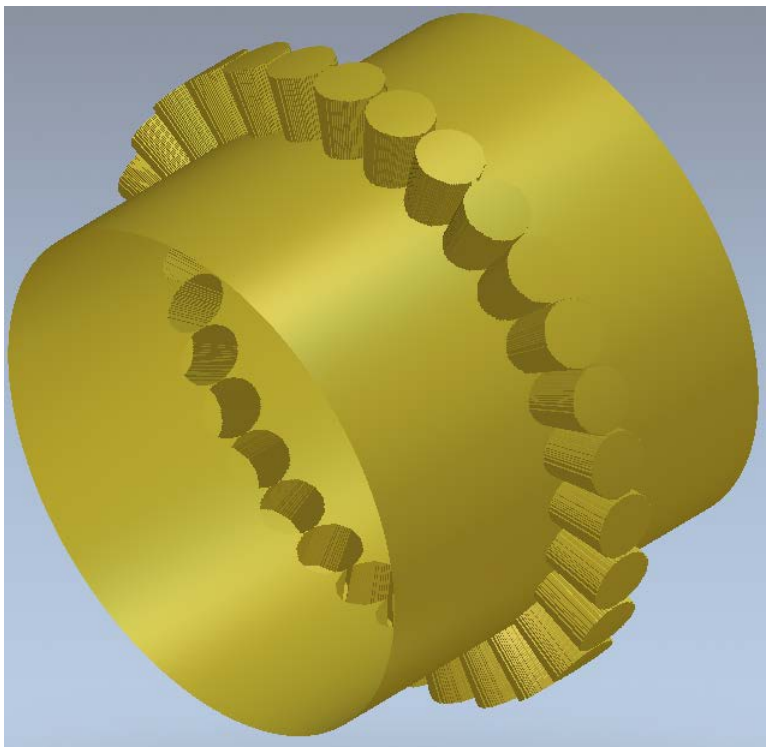


- Delete the **original bead vector** and the **bead vector reference lines**.
- Select the **outer vector group**.
- Press **F12** to display the **Shape Editor** form.
- Select a **Flat Plane** shape with **Start Height** of **2mm**.
- Select **Add**.

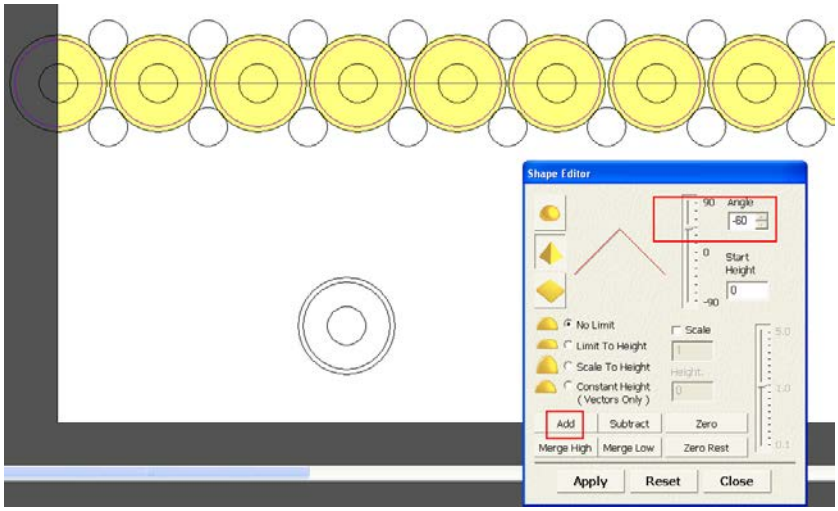
- Select **Preview Relief Layer** from the **2D View** toolbar.



- Press **F3**.

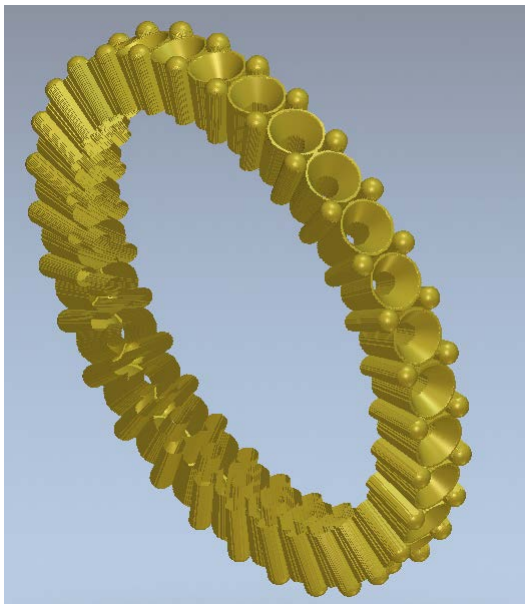


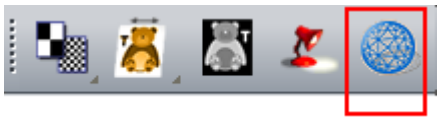
- Press **F2**.



- Select the **stones vector group** and generate a **Pyramid** shape with an **Angle** of **–60 degrees**.
- Select **Add**.
- Select the **small circles group**.
- Select **Zero**.
- Select the beads group and generate a **Dome** shape of **Angle 90 degrees** and a **Start Height** of **2mm**.
- Select **Merge High**.
- Close the **Shape Editor** form.
- Press **F3**.

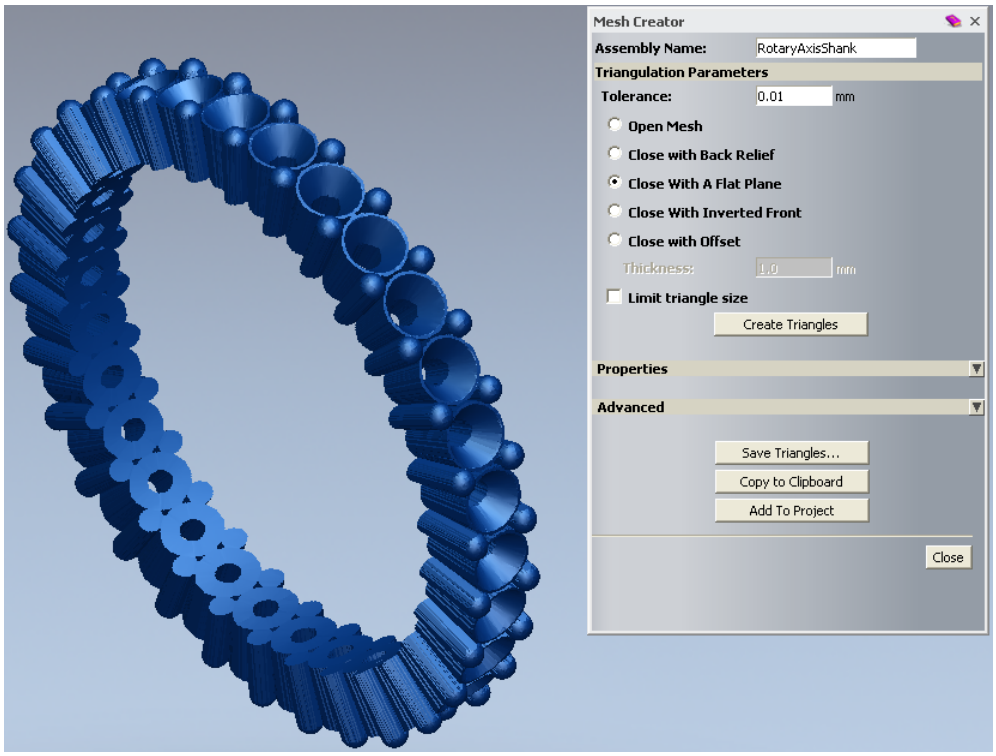
- Select **Draw Zero Plane**.





- Select **Create Triangle Mesh** .

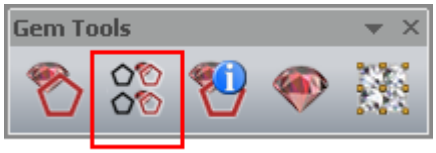
- Select the option **Close With a Flat Plane** and then select **Create Triangles**.



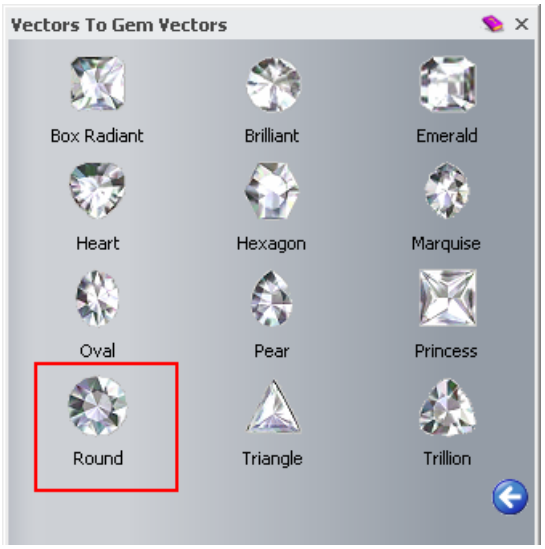
- Select the option **Add To Project** and then **Close** the **Mesh Creator** form.
- Select **Close**.
- Press **F2**.

- Select the **Stone group**.

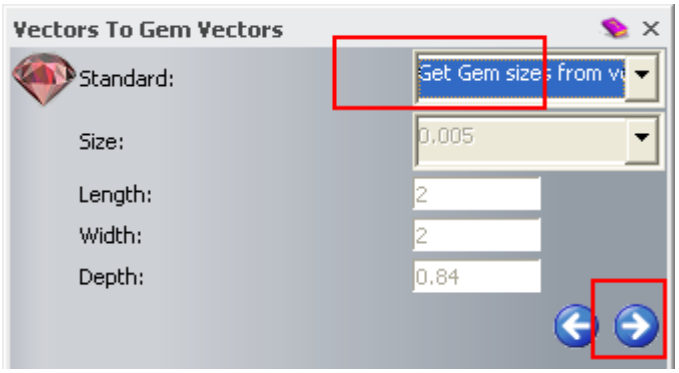
- Right mouse click on the left hand corner of the graphics area and select **Gem Tools**.



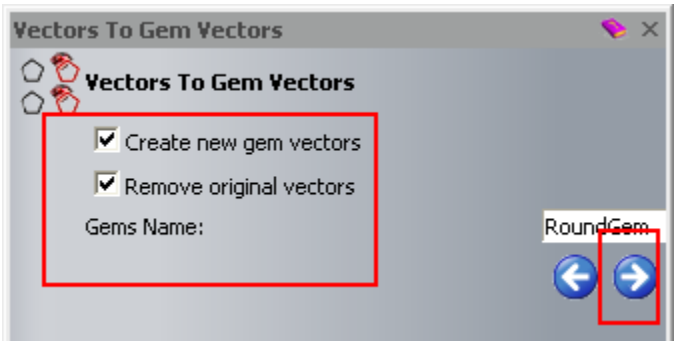
- Select **Create Vectors to Gem Vectors** from the **Gem Tools** form.



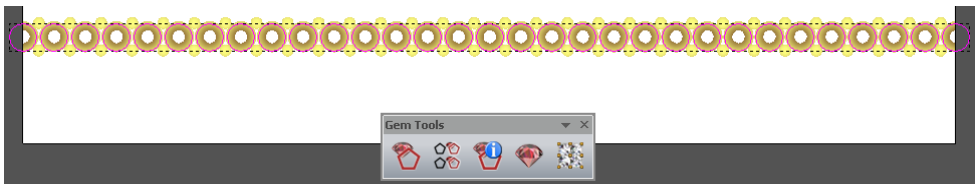
- Select **Round**.



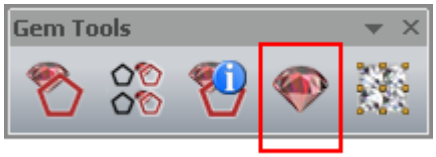
- Select **Get Gem sizes from vectors**.
- Select **Next** .
- Select **Diamond**.



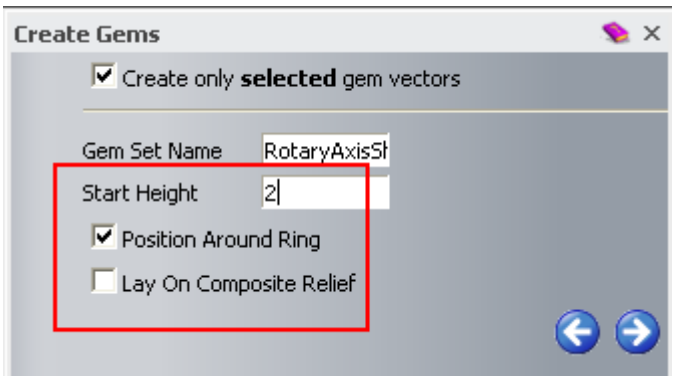
- With **both options ticked**, select **Next** .
- Close the form.



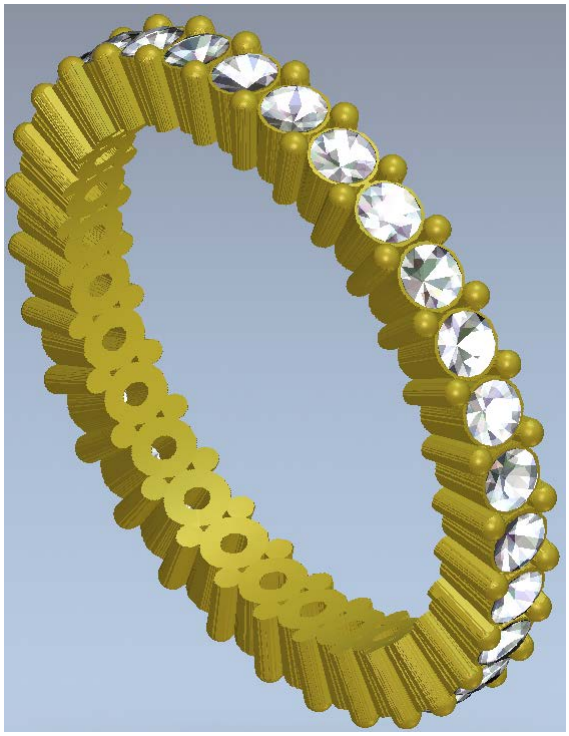
- Select the **Gem vectors**.



- Select **Create Gems** from the **Gem Tools** toolbar.
- Enter a **Start Height** of **2mm** and select **Next** .

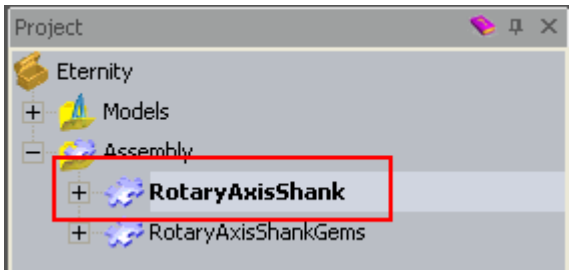


- Select **Accept** and close the form.
- Close the **Gem Tools** toolbar.



The **Stones** are shown.

- Select **File** - **Close Model**.
- Select **Yes** to the query.



- Expand the **Assembly** folder and select **RotaryAxisShank**.
- Double left mouse click **Edit Object Shading** from the **Properties** area.
- Select **24ct Polished Gold**.
- Select at the top right corner of the form.

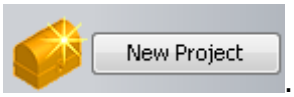
- Select **Save** .
- Browse: **D:\users\training\COURSEWORK\JewelSmith-Jobs**.
- Enter the name **Eternity Ring** and select **Save**.
- Select **File** – **Close Project**.

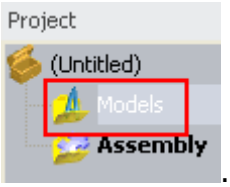
19. Oval Ring

Introduction

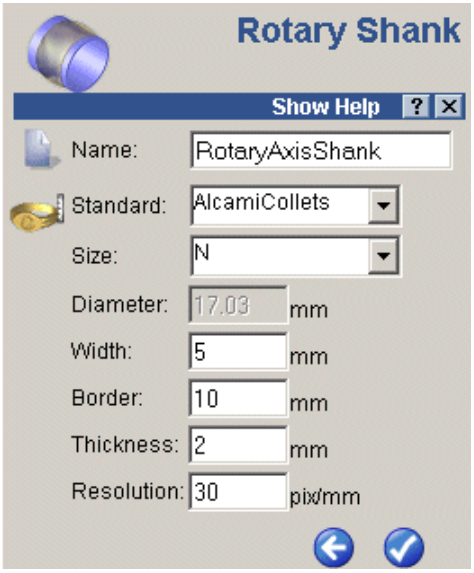
The creation of this oval ring includes functionality to **create a flat plane**, **correct vector for height** and **pave** to create the **gems** and **beads**.

Oval Ring Exercise

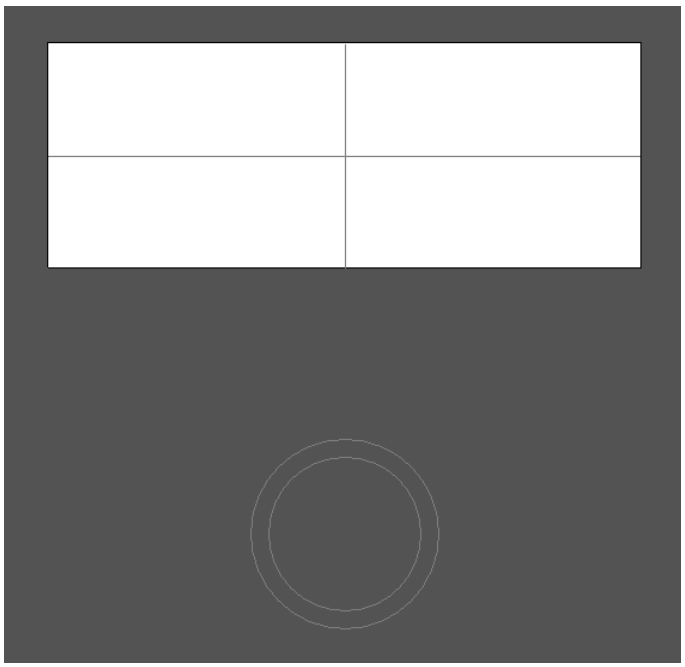
- Select **Create New Project** 

.
- Select **Models** from the root **Project** folder 

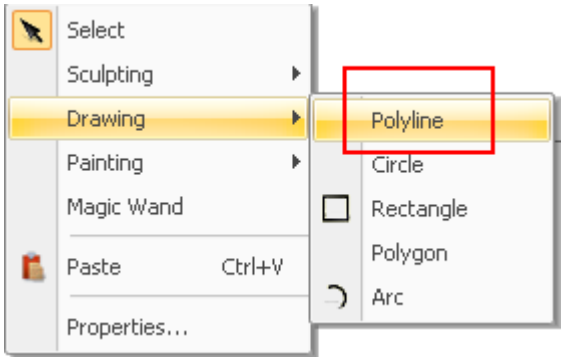
.
- Select **Create a Rotary Axis Blank**
.



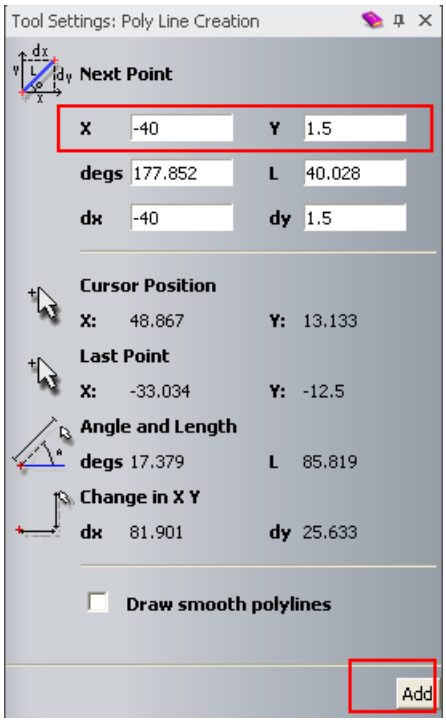
- Leave the model **Name** as **RotaryAxisShank**.
- Select **AlcamiCollets Size N** ring.
- Set the **Shank Width** as **5mm**, **Border** as **10mm**, **Shank Thickness** as **2mm** and a **Resolution** of **30**.
- Select **Accept** .



Note: In this case the ring is one size bigger to allow for shrinkage.
The ring shank will be custom built.



- Right mouse click on the working area and select **Drawing** – **Polyline**.

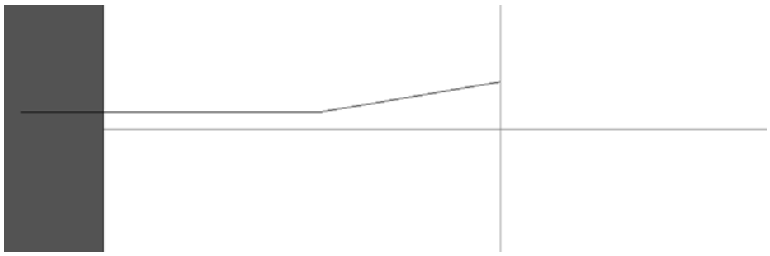


- Press **F6** on the keyboard to display the **Polyline Creation** form.
- Leave Draw smooth polylines unticked.
- Enter **–40** in the **X box** and **1.5** in the **Y box** and press **Add**.

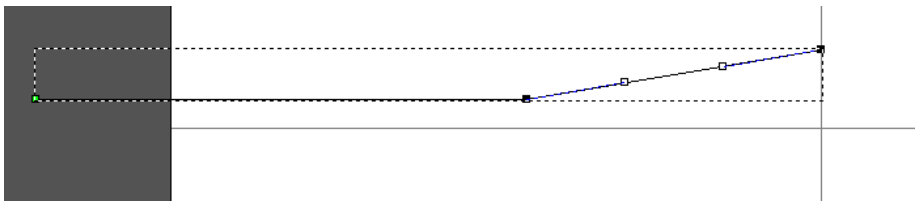
When only one point of a polyline is entered, nothing can be seen unless you move your mouse around the screen.

- Enter **0** in the **X box** and **4** in the **Y box** and press **Add** and then **Close**.
- Enter **–15** in the **X box** and **1.5** in the **Y box** and press **Add**.

- Select from the left hand toolbar.

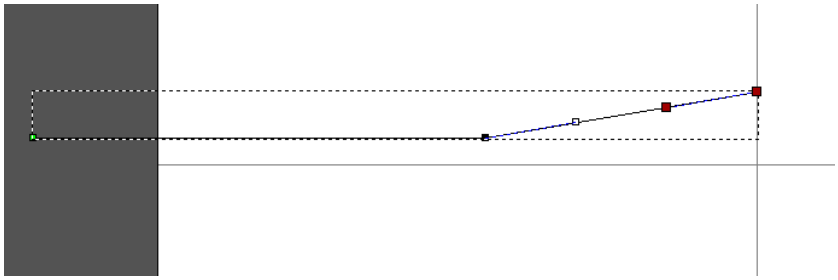


An easy way to smooth the end is to use the shortcut to align the nodes with an axis.

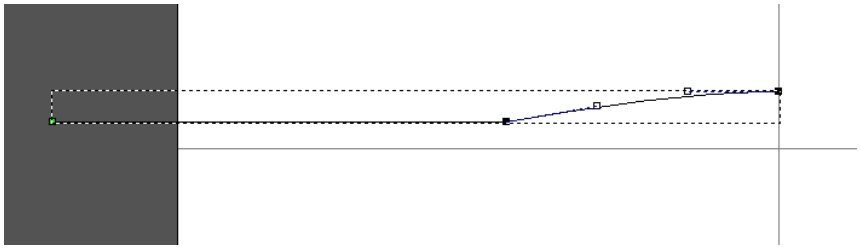


The control points are now shown. To make a smooth curve these need to be aligned with the **Y** position for each point. By using the mouse to grab the point and its control point, they become red and can be moved together by nudging or by using **X** or **Y** on the keyboard.

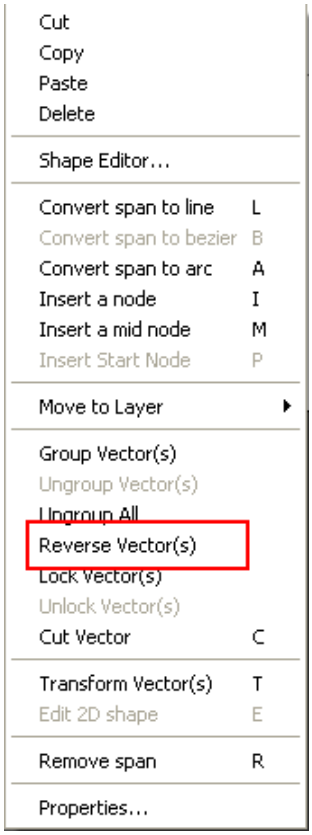
- Select the **vector** and select **N** (**Node mode**).
- Select the angled span and press B (Convert span to bezier).



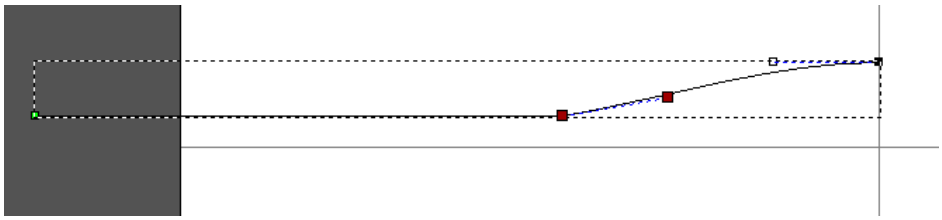
- Select the top point and the control point together with the mouse.



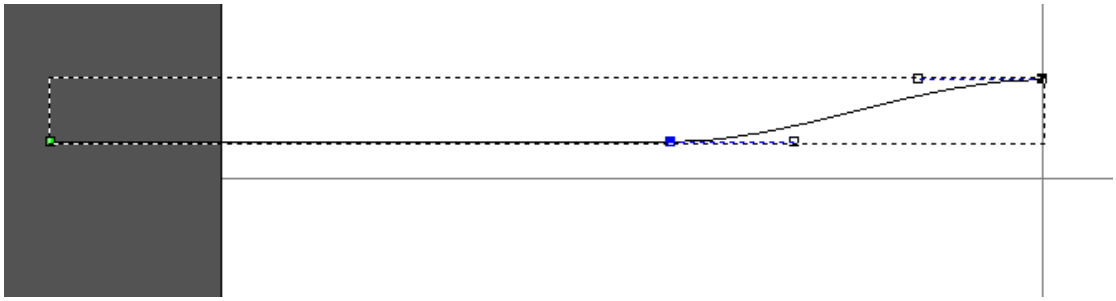
- Select **Y** on the keyboard. (Aligns the y values to be the same as first point).



- Hover over the span and pick **Reverse Vector(s**) from the **right mouse menu**.



- Select the bottom point and the control point together with the mouse.

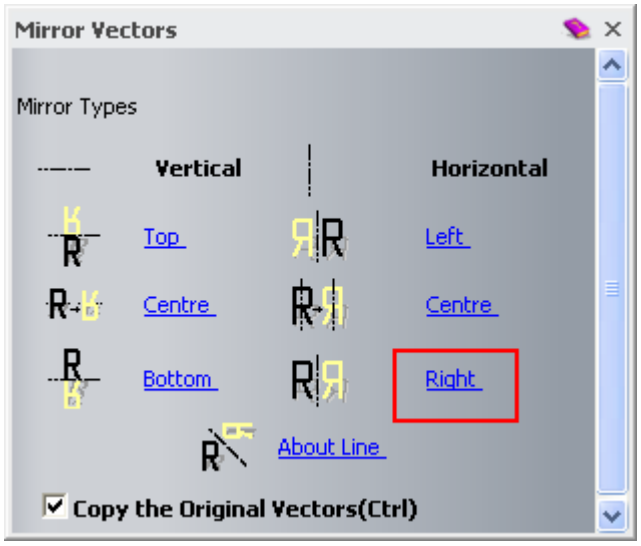


- Select **Y** on the keyboard.

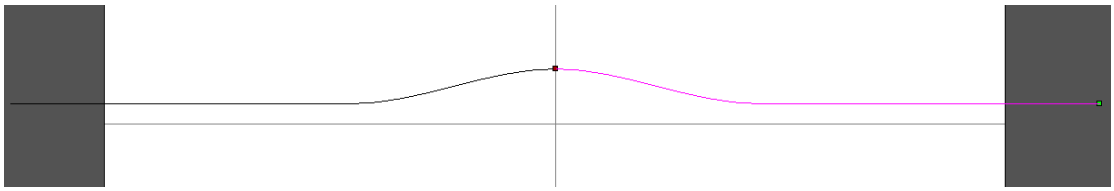
The drive rails can be completed using the mirror option.

- Select .

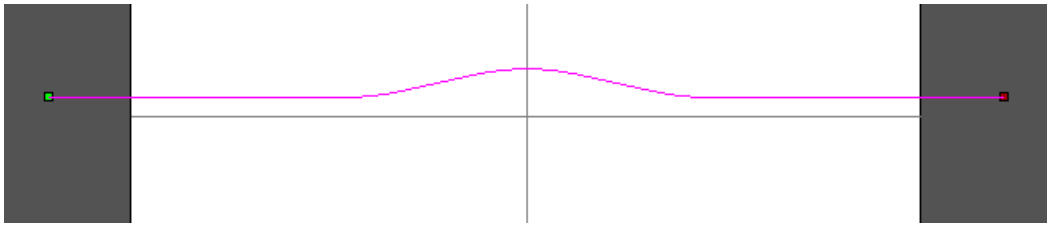
- Select **Mirror Vectors** .



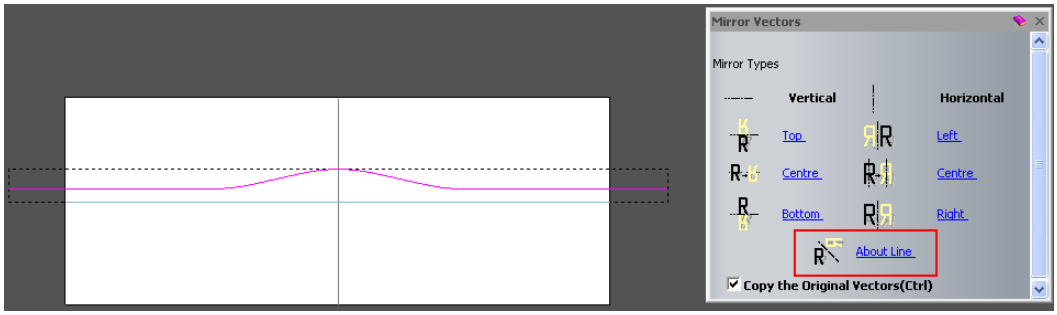
- Select the **vertical centre vector** and the **new vector** and press **Right**.



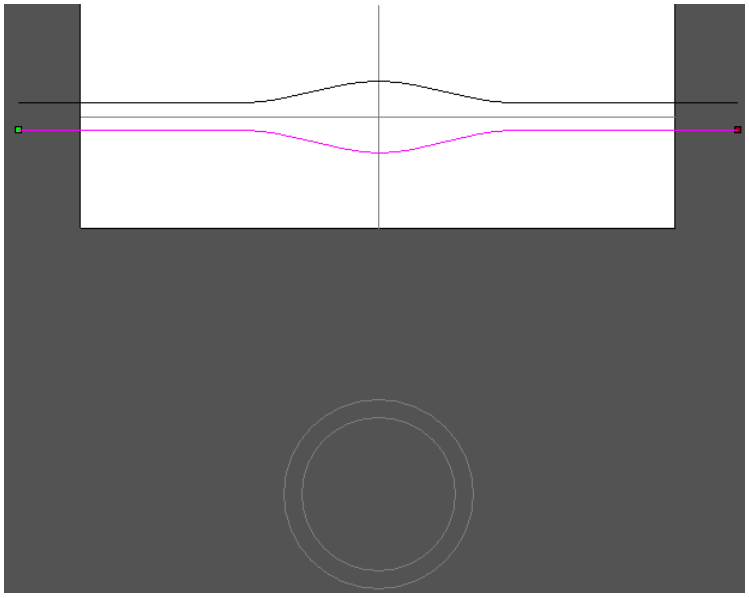
- Close the **Mirror Vectors** form.
- Select the **two rail vectors** and press **Join vectors by moving ends** .

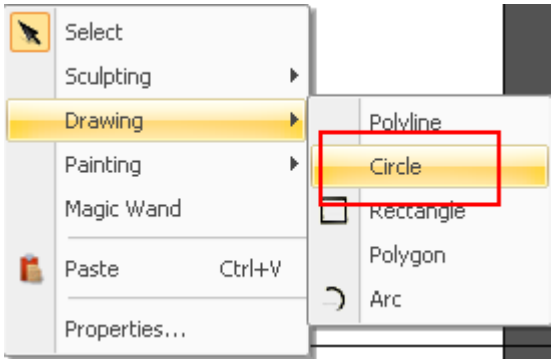


- Select **Mirror Vectors** .

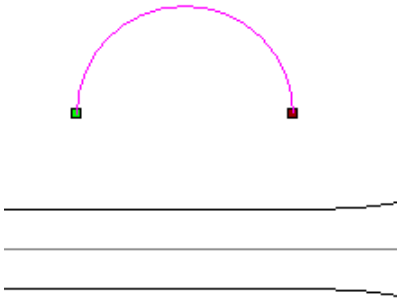


- Select the **horizontal centre** vector and the **new vector**.
- Check the box **Copy the Original Vectors**.
- Select **About Line**.
- Close the form.





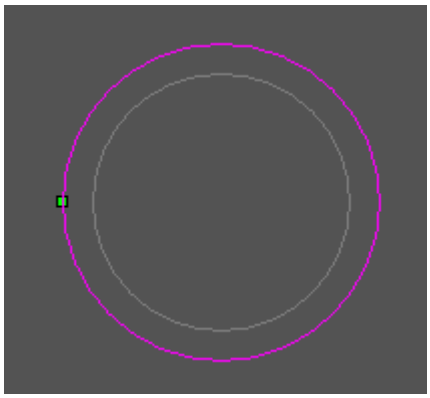
- Right mouse click on the graphics area and select **Drawing** – **Circle**.



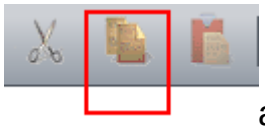
This section gives the overall shape, as the width varies in the two drive rails, the section will become higher.

The ring silhouette will be given a high region.

- Create a **Circle** at **X–20 Y5** with a **Radius** of **4mm**.
- Remove the **lower spans**.



- Select the **outer ring silhouette** and select **Copy**

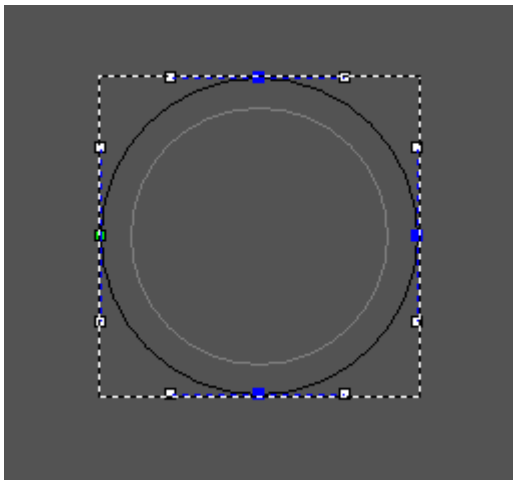


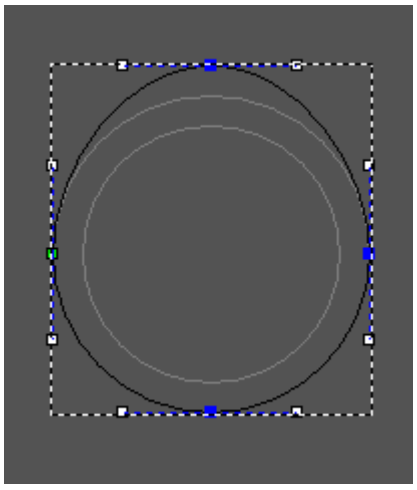
and then **Paste**

.

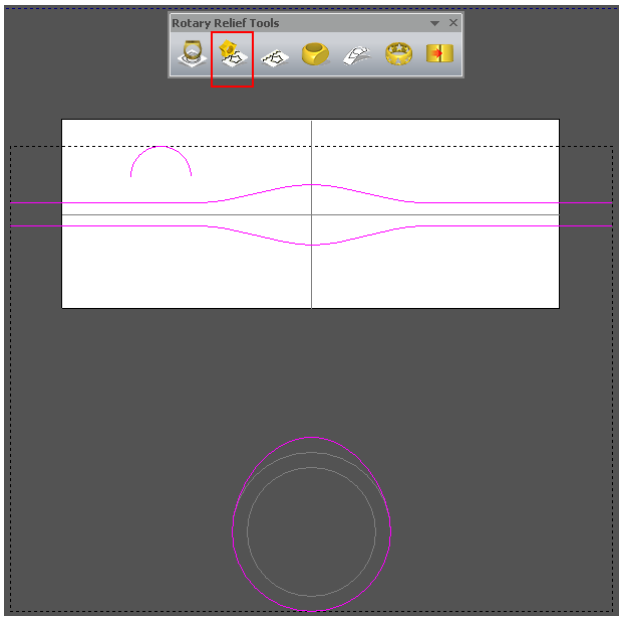
- With the **new vector** selected, select **Node Mode**

.

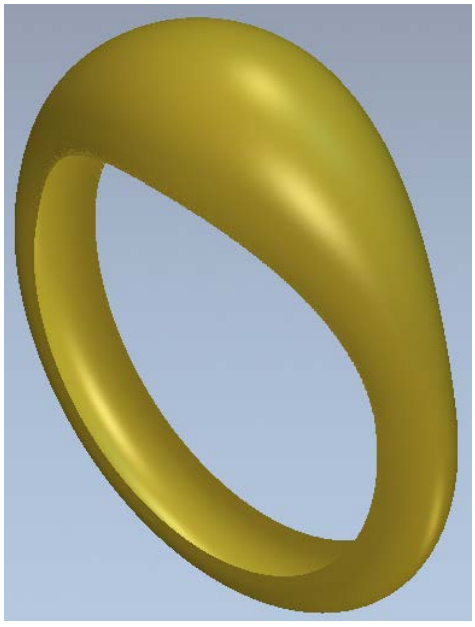




- Change the **Properties** of the **top node point** to be **Y-29.515mm** (a movement of **2mm** upwards).
- Select .
- Right mouse click on the **left hand corner** of the graphics area and select **Rotary Relief Tools**.



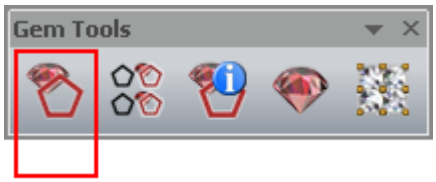
- Select the **two offset vectors**, the **semi-circle** and the **new outer ring silhouette**.
- Select the **Sweep Profile** from the **Rotary Relief Tools** toolbar.



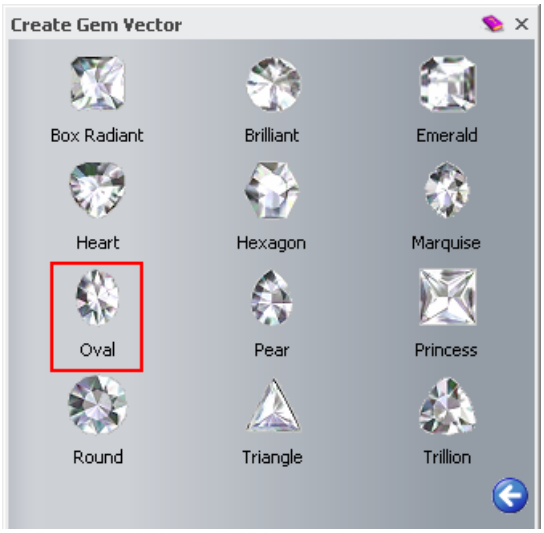
The basic ring shape has been generated, with a maximum **Z height** of **4mm**. More vectors need to be generated to set the flat area for the gem. As the gem size sets the vector sizes, this will be generated first.

A **Flat Plane** will be generated to build up the **Relief** for the oval shape, using the vectors from the **2D View**.

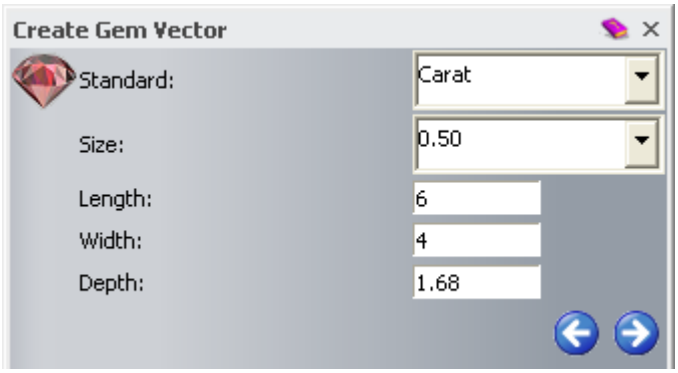
- Press **F3** to go to the **3D View**.
- Press **F2**.
- Right mouse click on the left hand corner of the graphics area and select **Gem Tools**.



- From **Gem Tools**, select **Create Gem Vector** .



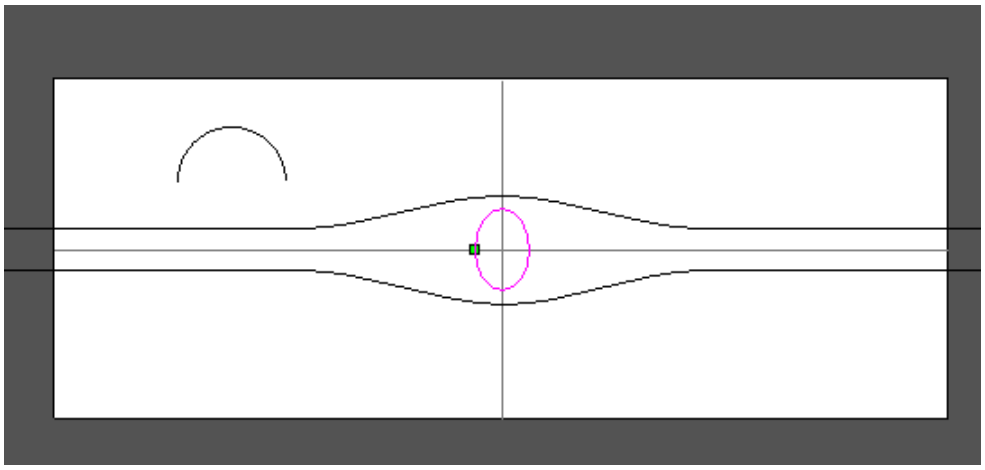
The style of gem vector is selected from the list. A gem vector will contain all of the information about the gem. This allows you to generate several gem vectors of different types in one command.
In this case an **Oval gem** of **0.5 Carat** is required.



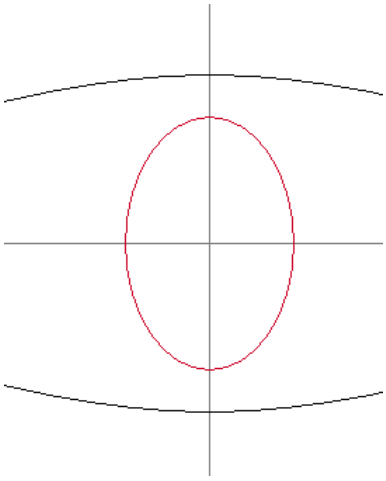
The physical size of the gem vector can be entered or by selecting the option carat and choosing a size, the values are entered into the form.

- Select a **Carat size** of **0.5** and press **Next** .
- Select **Aqua**.

- Leave the **Gem Name** as **OvalGem** and select **Next**.



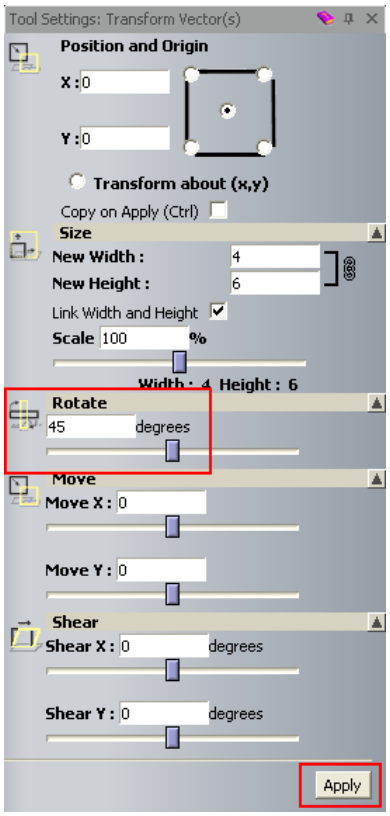
- Close the **Create Gem Vector** and the **Gem Tools** forms.



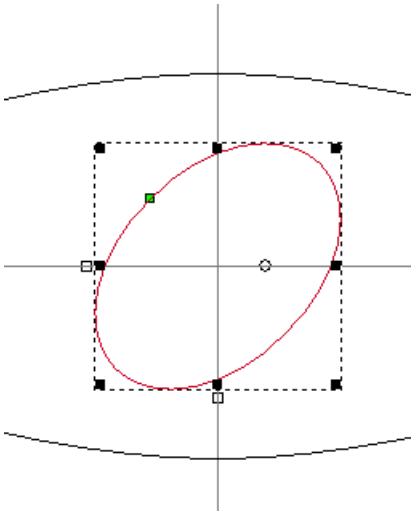
The gem vector (always red) appears and by default it is placed on X0 Y0 in the upright orientation.

The gem needs to be rotated and the platform area made by offsetting the gem vector.

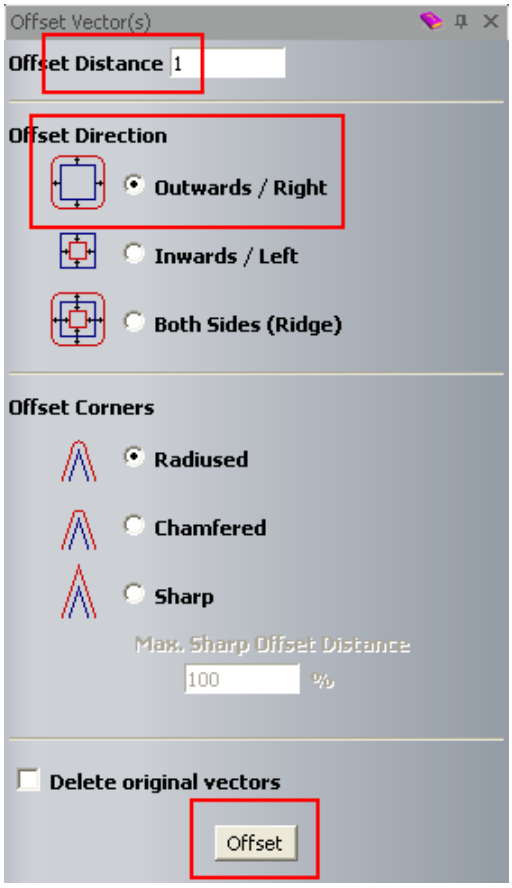
- Select the **gem vector**.
- Select **Transform Vectors** .



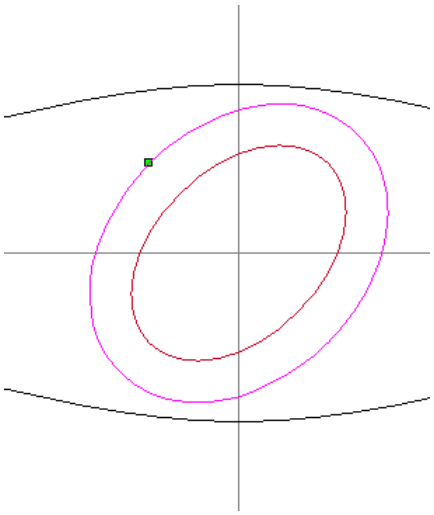
- Enter a **rotation** of **45 degrees**.
- Select **Apply** and then **Close** the form.



- Select .
- Select **Offset Vectors** .



- Offset the **Gem vector Outwards** by **1mm**.
- Close the form.

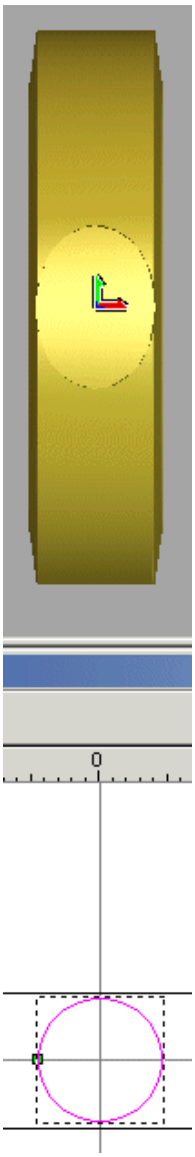


When a gem vector is offset, the offset vector is a normal vector. This is because the vector size has changed. If a gem vector is copied and then pasted within a command, the copy remains a gem vector.

These vectors will be used to generate a flat plane. This will produce corrected vectors, which take into account the stretching effect where the ring is different than the default offset value. By using corrected vectors, you can ensure that the setting will be at the required size.

These corrected vectors are automatically put on a separate layer. The corrected vectors look distorted in the flat view but they are correct in the 3D wrapped view and when machined.

Not corrected **Corrected**

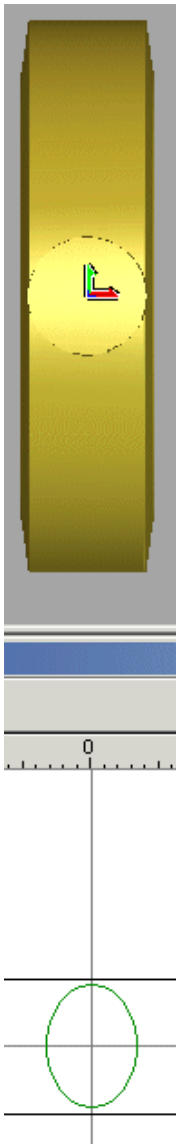


This ring was generated with a thickness of 2mm. The circle, shown in the left hand diagram, was to produce a feature at the Z height of 6mm using **Merge High**.

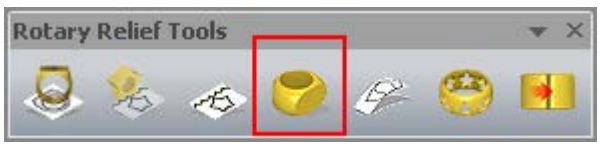
From the **3D View** you can see how the circle shape has become distorted the higher up the Z in the wax, so that it is almost an oval shape.

Correcting a vector for the height will make the vector look incorrect in the 2D view. **ArtCAM** also changes the vector outline to green. However, when the relief is made at the height it has corrected for, the required shape is generated.

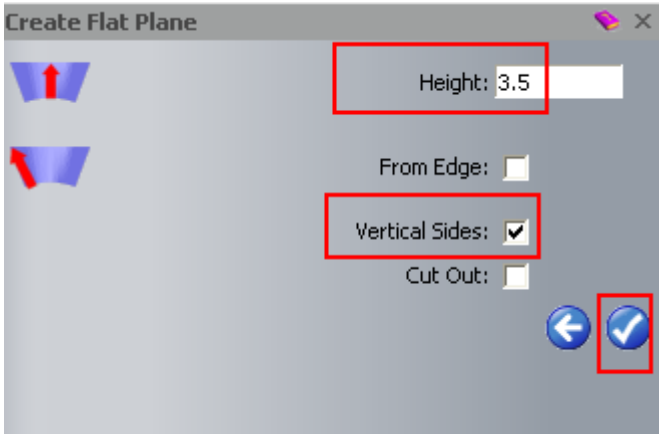
The actual height for the corrected vector can either be at the centre of the vector or at the vector edges.



- Select the **offset vector**.
- Right mouse click on the left hand corner of the graphics area and select **Rotary Relief Tools**.



- From **Rotary Relief Tools**, select **Create Flat Plane**.



The **Height** for the **Flat Plane** is entered in this form.

If **From Edge** is selected the plane will be generated from the edge of the original vector and not from the boxed centre position.

The option **Vertical Sides** will produce true vertical sidewalls instead of being angled radially from the ring centre.

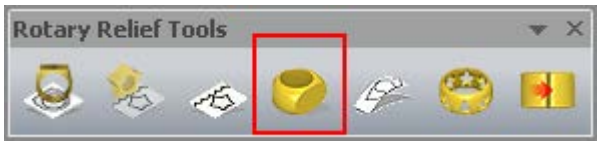
The option **Cut Out** causes the removal of any **relief** higher than the cut-out plane.

- Enter a **Height** of **3.5mm**, tick **Vertical Sides**, followed by **Accept** .
- Close the **Create Flat Plane** form.

A **Flat Plane** with **Vertical Sides** is merged into the **Relief** within the selected **vector** area. A **corrected vector** has also been generated (highlighted in green). This is not required and will be deleted.

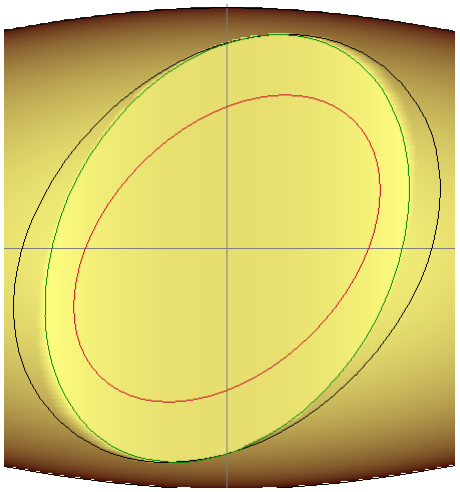
The domed part of the **Relief** will now be removed using **Create Flat Plane** again with the option cut out.

- Delete the **corrected vector** (green).
- Select the **offset vector**.
- Right mouse click on the left hand corner of the graphics area and select **Rotary Relief Tools**.



- Enter a **Height** of **3.5mm**, tick the option **Cut Out** and select **Accept** .
- Close the form.

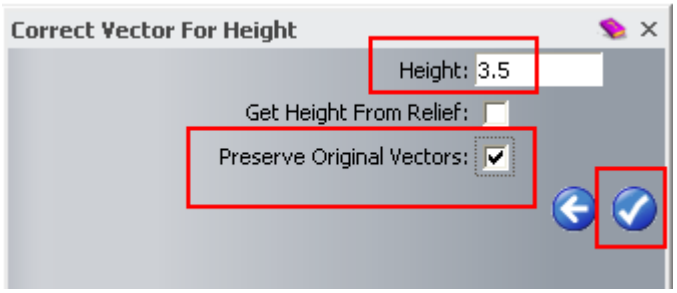
The oval shaped **Flat Plane** has now been calculated with the upper domed material removed.



A **corrected vector** has also been generated. This will be used later.

- Select the **oval gem vector** (highlighted in red).
- Right mouse click on the left hand corner of the graphics area and select **Rotary Relief Tools**.

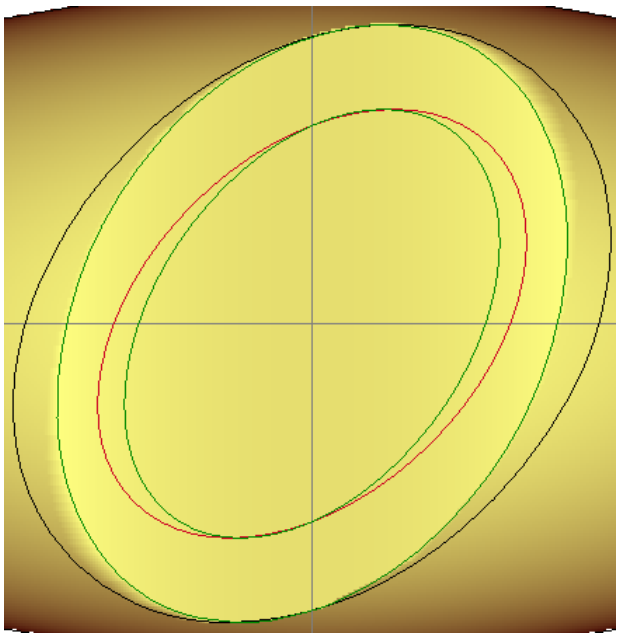
- Select the option **Correct Vectors For Height**.



The height is calculated in the same way as for **Create Flat Plane**.

The option preserve original vectors is crucial as the original gem vector needs to be saved.

- Enter a **Height** of **3.5mm** and tick the option **Preserve Original Vectors**.
- Select **Accept** .
- Close the form.



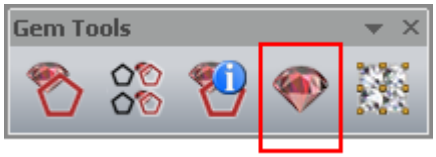
The corrected vectors are shown green and are automatically put on a new layer called Corrected Vectors. This layer is switched on.

A rim around the gem edge can be made using the corrected vectors.

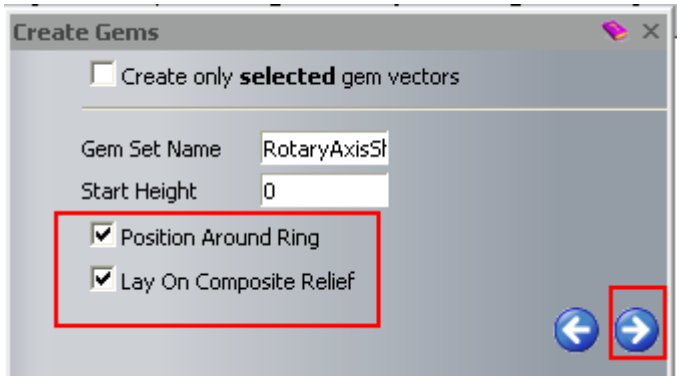
- Select **both corrected vectors** and press **F12** (**Shape Editor**).
- Select a **Dome shape**, **Angle** of **90 degrees**, a **Start Height** of **0**, **No Limit**, press **Add** and then **Close**.
- Press **F3**.

The rim has been produced. The gem can also be produced, using the lay on relief option, before the relief underneath is removed.

- Select the **oval gem vector** (highlighted in red).
- Right mouse click on the left hand corner of the graphics area and select **Gem Tools**.



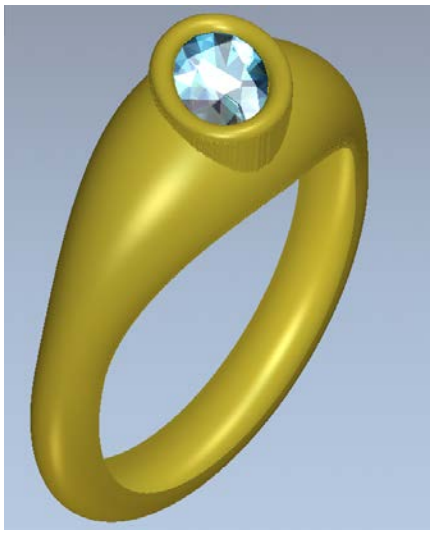
- From **Gem Tools** select **Create Gems**.



The **Create Gems** form appears.

The **Create only selected gem vectors** is useful in applications where it is required to create a different type of **gem** on selected groups of **gem vectors**.

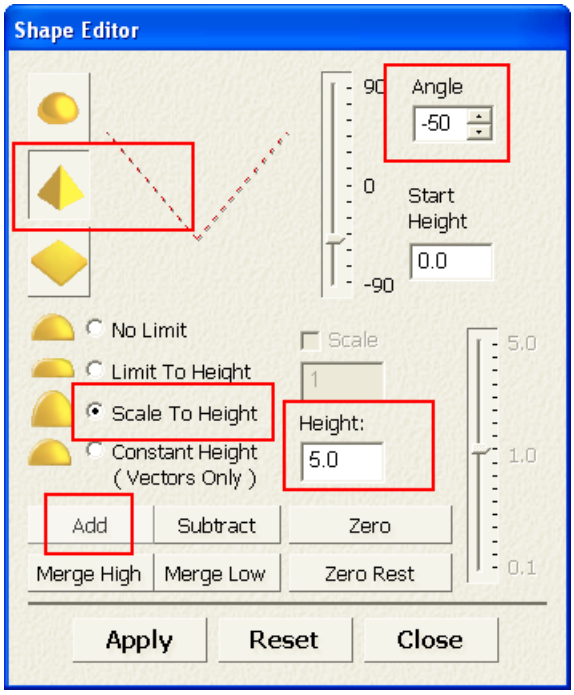
- Untick **Create only selected gem vectors** and leave **Start Height** at **0**.
- Tick both **Position Around Ring** and **Lay on Composite Relief**.
- Select **Next** .
- Select **Accept** .



The gem is shown in place, until accept is pressed. Then it is moved to the project as part of the assembly.

Once the gem is accepted, the relief underneath can be removed.

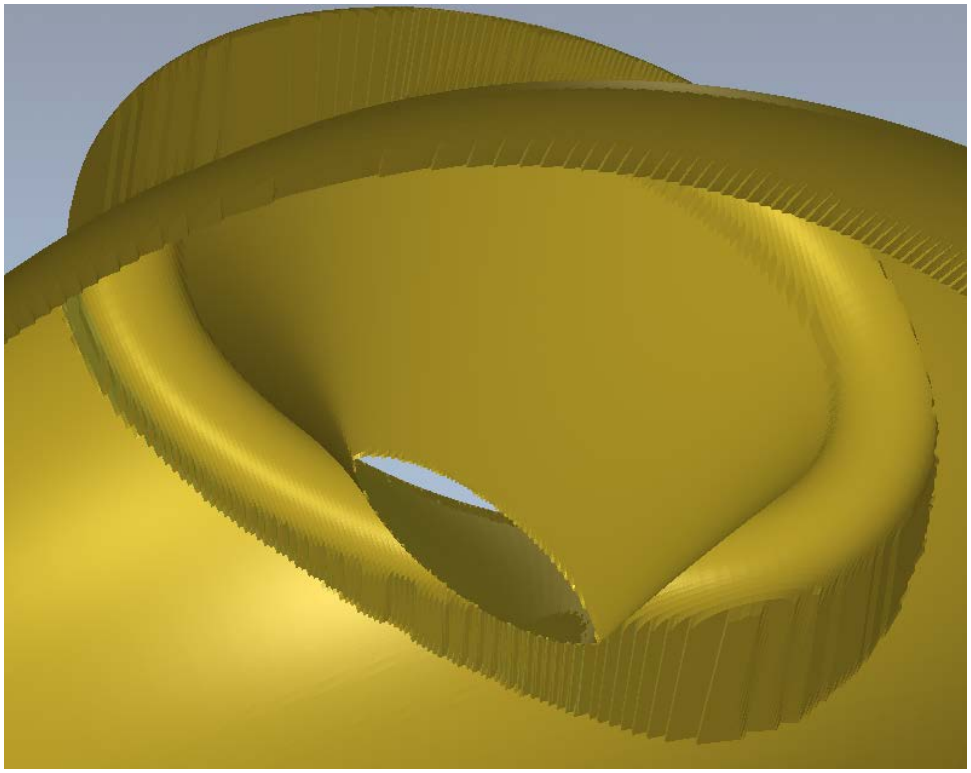
- Close the forms.
- Press **F3**.
- Select the **inner corrected vector** and press **F12** (**Shape Editor**).



- Select a **Pyramid shape**, **Angle** of **–50 degrees**, **Start Height** of **0**, **Scale To Height** of **5mm**.
- Select **Add** and then **Close**.

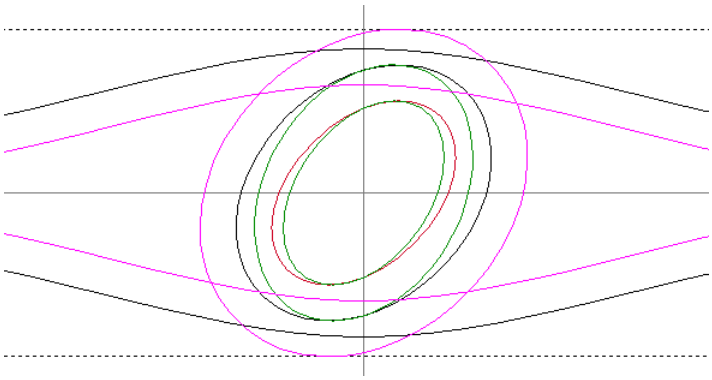
The height of 5mm ensures that the ‘v’ shape goes through the inside of the ring so that it can be removed by limiting the white area (whole model) to be above 0.

- Double click on the **white area**.
- Select a **Flat shape**, **Start Height** of **0** and press **Merge High** and then **Close**.
- Press **F3**.



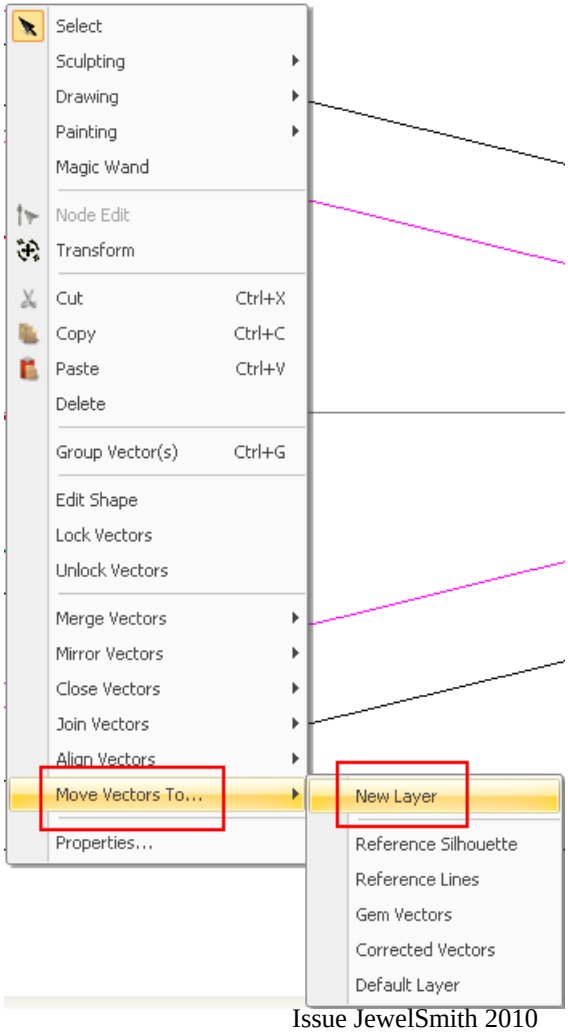
The sides and hole for the gem have been created. At any time you can use the File menu to **Save** the model.
For the side stones, more vectors need to be generated.

- Offset the **bottom drive** rail vector inwards by **1mm**.
- Offset the **top drive** rail vector outwards by **1mm**.
- Offset the **large corrected** vector outwards by **1mm**.

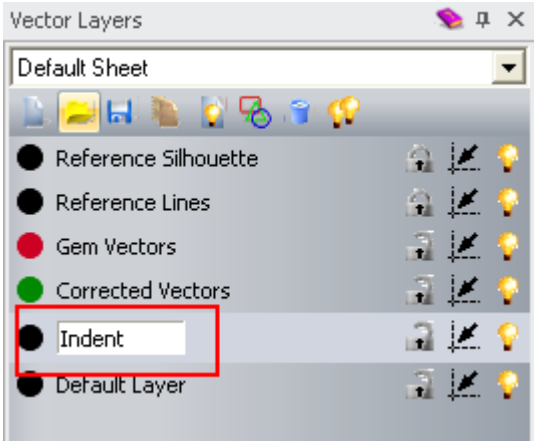


For visualisation these new vectors will be moved to a new layer.

- Select all the **3 new vectors**.

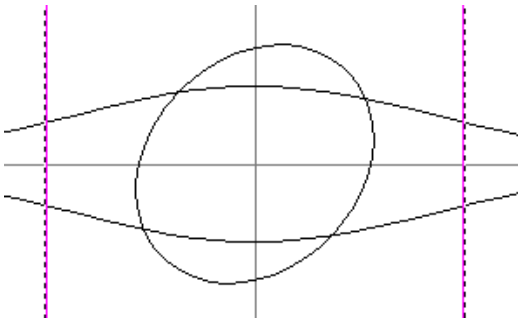


- Right mouse click on the selected vectors and select **Move Vectors To…** - **New Layer**.



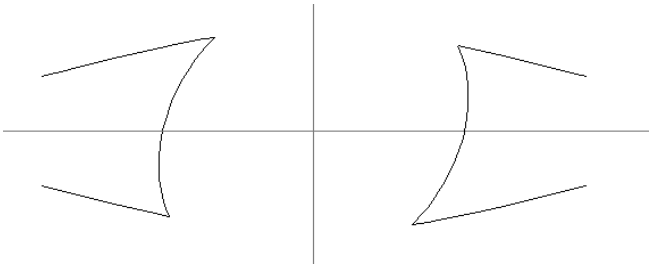
JewelSmith automatically places special vectors on named levels.

- Rename the **Layer** as **Indent** and **switch off** all other layers, apart from the layer **Reference Lines**.
- Offset the **vertical reference line** by **8mm** each side (**Ridge**).



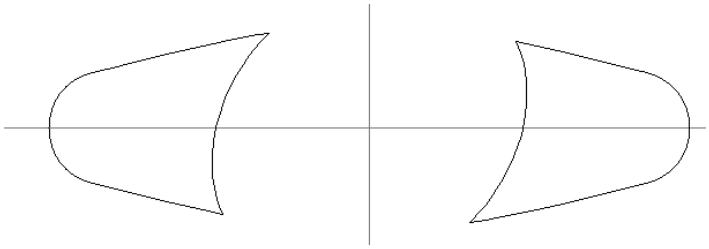
These vectors will be used to trim back the offset vectors.

- Use **Trim vectors** to limit back the curved offset lines as shown.



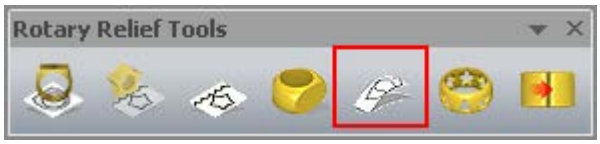
Each side will be joined to make a single vector and then each end closed with a curve.

- Select the **three vectors** for one half and **Join** them together .
- Select the **new vector** and select **Close** with a **curve** .
- Repeat for the **other side**.

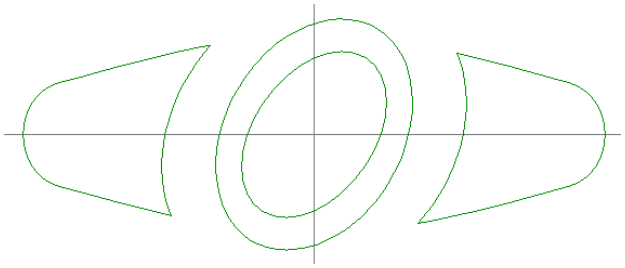


This indent needs to be corrected for the height also, before gems can be fitted inside.

- Select the left **Indent vector**.

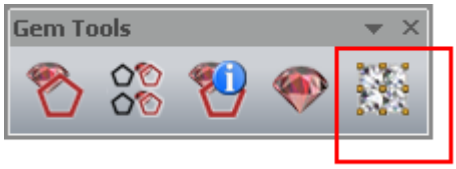


- Right mouse click on the left hand corner of the graphics area and select **Rotary Relief Tools**.
- From **Rotary Relief Tools**, select **Correct Vectors for Height**.
- Leave **Height** as **0**, and tick only **Get Height From Relief**.
- Select **Accept** .
- Repeat for the other side.



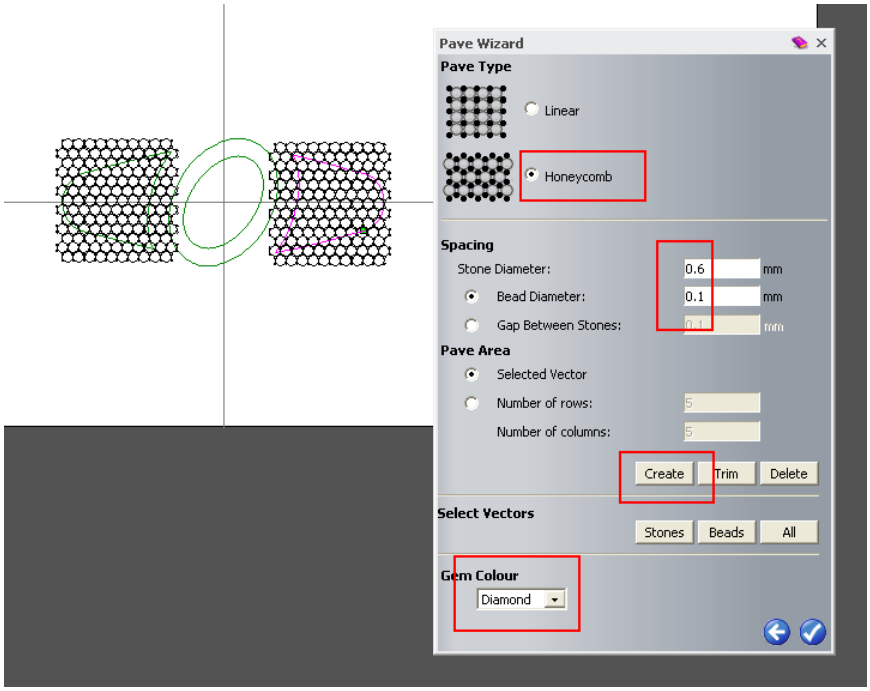
The vectors are corrected and the layer corrected vectors is automatically switched on.
The next stage is to create **vectors** for the settings and claws for the indent using the **Pave Wizard**.

- Select only the **corrected vector on the left**.
- Right mouse click on the left hand corner of the graphics area and select **Gem Tools**.

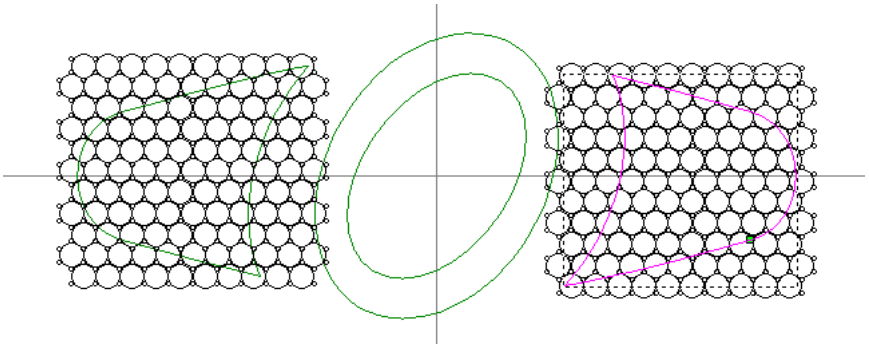


- Select **Pave Wizard** from **Gem Tools**.

This time the pave area will be limited to the selected vector area, whilst maintaining a full honeycomb.

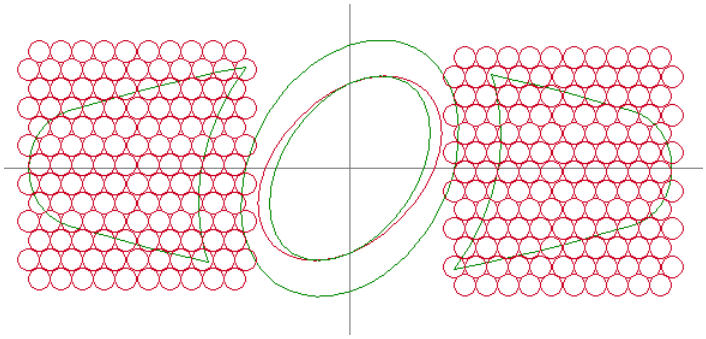


- Select **Honeycomb**, **Stone Diameter** of **0.6**, **Bead diameter** of **0.1** and the option **Selected Vector**.
- Select **Gem Colour** as **Diamond**.
- Select **Create**.
- Select the **right indent vector** and then press **Create**.

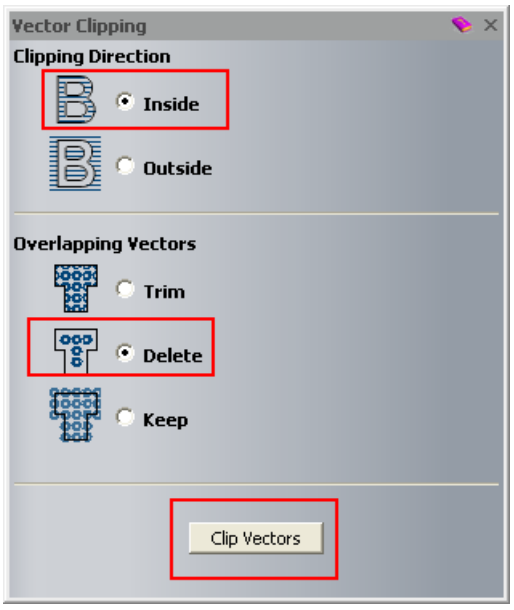


The beads will not be used and can be deleted.

- On the **Pave Wizard** form, under **Selected Vectors**, select **Beads**.
- Press **Delete** on the keyboard.
- Select **Accept** .
- Close the form.



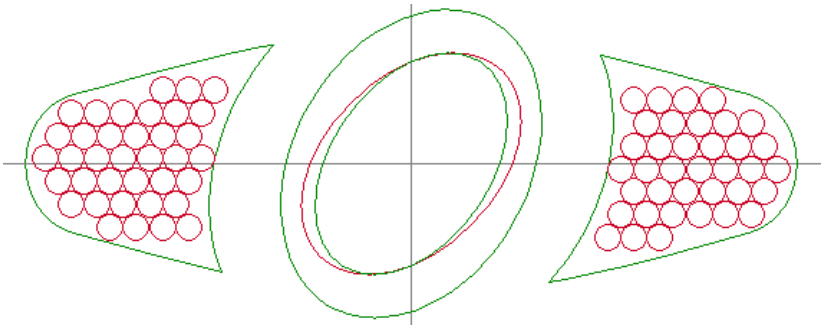
- Select **Vector Clipping** .



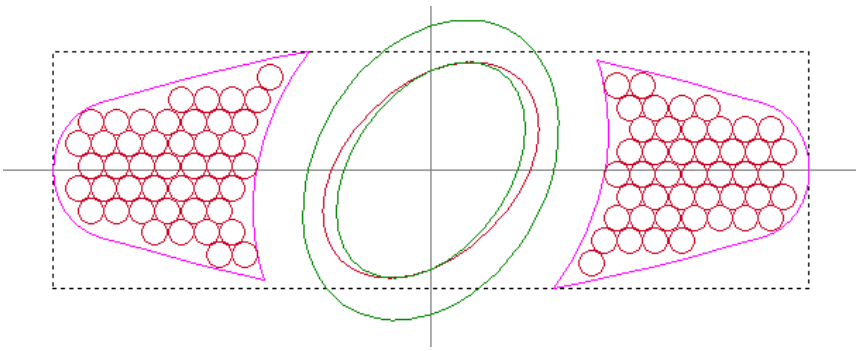
The vector clipping will be used to clip (delete) objects that do not fit completely inside the indent vectors.

This leaves only the whole objects that lie inside the vectors.

- Select the **left indent vector**.
- Shift select the other **left gem vectors**.
- Select **Inside** and **Delete** and press **Clip vectors**.
- Repeat for the other side.
- Close the form.

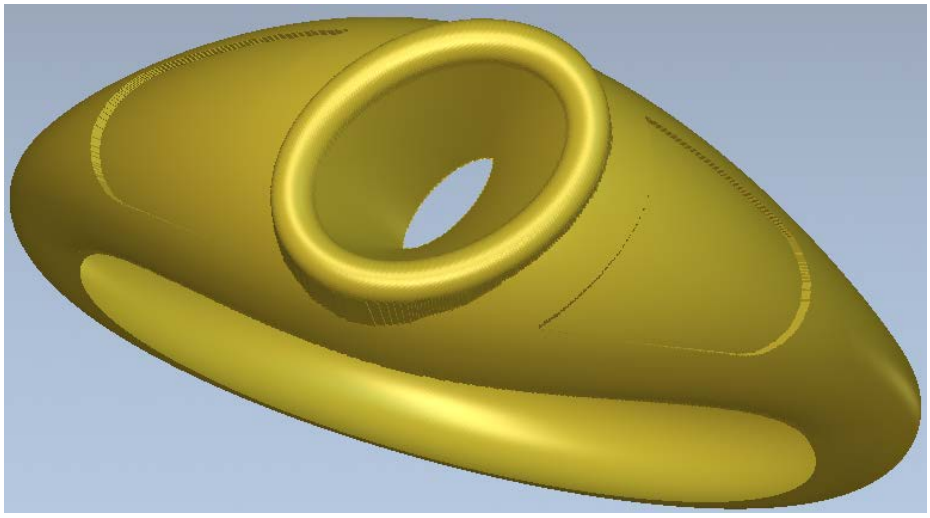


The whole vectors are shown. The gem vector layer is also switched on.



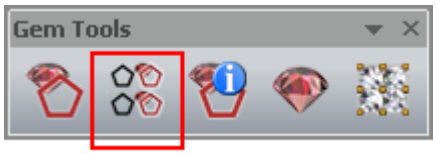
- Select the **two indent** vectors and press **F12**.

- Select a **Flat Plane** with a **Start Height** of **0.25mm**, press **Subtract** and then **Close**.
- Press **F3**.



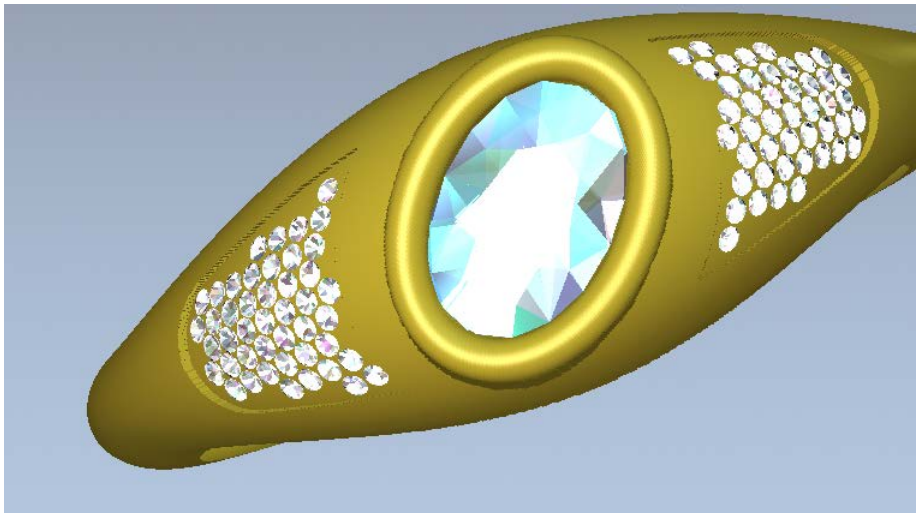
The indents are shown. The vectors for the indents need to be generated as gem vectors, and then gems created.

- Press **F2**.
- Select the **Vector Layers** tab.
- Switch on **ONLY** the layer **Gem Vectors**.
- Select the **Circle** vectors.



- Select **Convert Vectors to Gem Vectors** from **Gem Tools**.
- Select **Round** and then **Next** .
- Select **Get Gem sizes from Vectors** and then press **Next** .
- Select **Diamond**.
- Tick **Create new gem vectors** and **Remove original vectors** then press **Next** .
- Close the form.
- With the **Gem Vectors** selected, select **Create Gems**.
- Untick **Create only selected gem vectors** and leave **Start Height** at **0**.

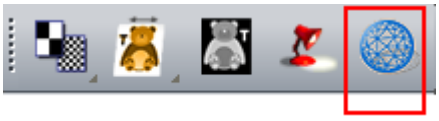
- Tick both **Position Around Ring** and **Lay On Composite Relief**.
- Select **Next** .

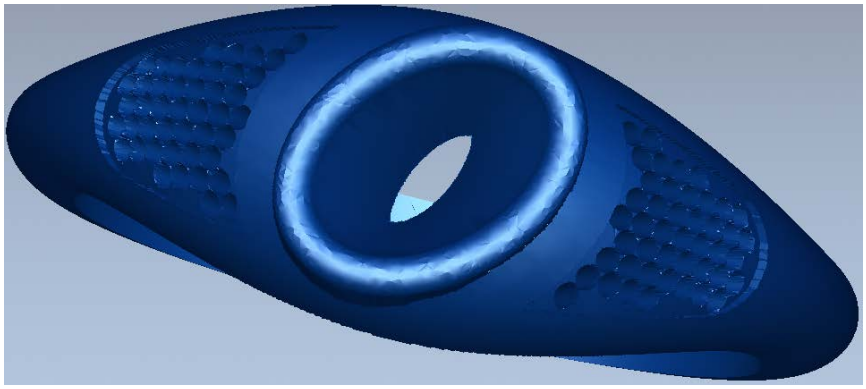


The gems are shown in place, until accept is pressed. Then it is moved to the project as part of the assembly.
Once the gems are accepted, the relief underneath can be removed.

- Select **Accept** .
- Close the form.
- Press **F2**.
- Select the **small gem vectors** and press **F12**.
- Select a **Pyramid shape**, **Start Height** of **0**, **Angle** of **–50degrees**, **Scale to a Height** of **5mm**
- Select **Add** and then **Close**.
- Double click on the **white area**.
- Select a **Flat shape**, **Start Height** of **0** and press **Merge High** and then **Close**.

The top relief has been generated.
To make the bottom relief, the top relief is going to be offset and then modified.

- Select **Create Triangle Mesh**  .



- Select the option **Close with a Flat Plane** and then select **Create Triangles**.

- Select the option **Add To Project** and then **Close** the **Mesh Creator** form.

The **ring** is shown in the finished component and the **gem stones** can now be displayed.

- Select **File – Close Model** from the top menu.
- Select **Yes** to **Update the Project**.
- Select **File – Close Project**.
- Enter the name **OvalRing** and press **Save**.

20. The Toolpath Options

Introduction

ArtCAM can produce a variety of machining strategies on the **Relief**. The machining set up and strategy commands are accessed from the **Toolpaths** tab in the Project tree or by activating the Toolpath's fly out panel. The **toolpaths** that are generated are stored within the **ArtCAM** model and can easily be edited. To drive a specific machine tool one or more **toolpaths** are output as a **post-processed** file translated to the format of the relevant controller.

Toolpaths page

The **Toolpaths** page is segregated into four main categories - **Toolpath Operations**, **2D Toolpaths**, **3D Toolpaths** and **Toolpath Simulation**.

When a **Toolpath** is calculated it will be displayed in this upper area of the **Toolpaths** page. The **Toolpath Names** can be selected for **Toolpath Simulation**, **Toolpath Operations** or to re-opened for editing.

The **Toolpath Operations** area contains operation including Save (to post process), Delete, Tool Database, Material setup and creating machining templates.

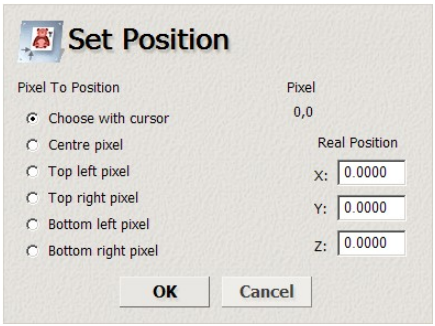
The **2D Toolpaths** section contains commands to generate **2D Toolpaths** directly from **Vectors**.

The **3D Toolpath** section contains commands to generate the toolpaths over the **3D Relief**.

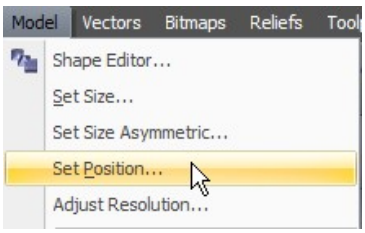
The **Toolpath Simulation** section provides controls for viewing **Toolpath** animation and material removal.

Toolpath Parameters allows changes made to the selected.

It may be required to modify the origin of the model to a position more appropriate as a machining origin. This is achieved by inputting suitable **X Y Z** values in the **Set Model Position** dialog box .



This can be accessed from the top drop down menu **Model > Set position**.



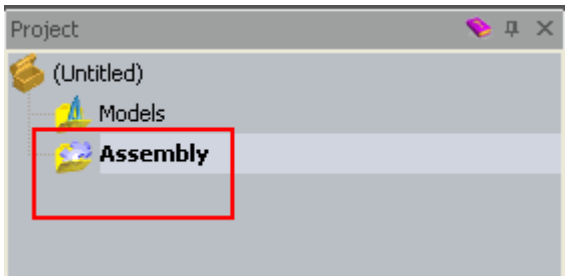
21. 3D Machining Wizard

Introduction

The machining of a **Ring** is almost the same process as machining a **Flat** piece. **JewelSmith** will turn the moves into rotary automatically when it is output in the **CNC** machine format.

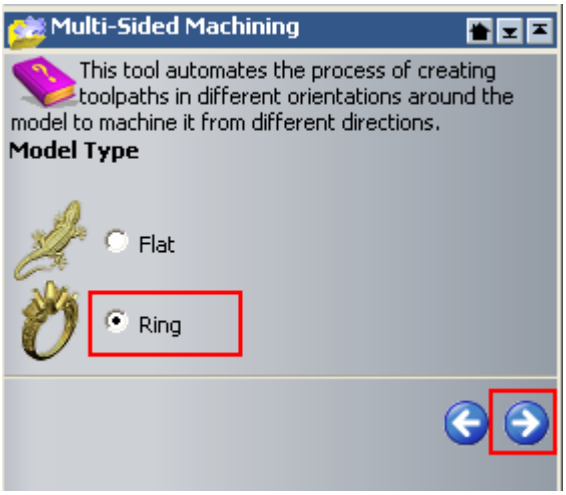
Machining the Star ring

- Open the saved project - **Star-ring.3dp**.



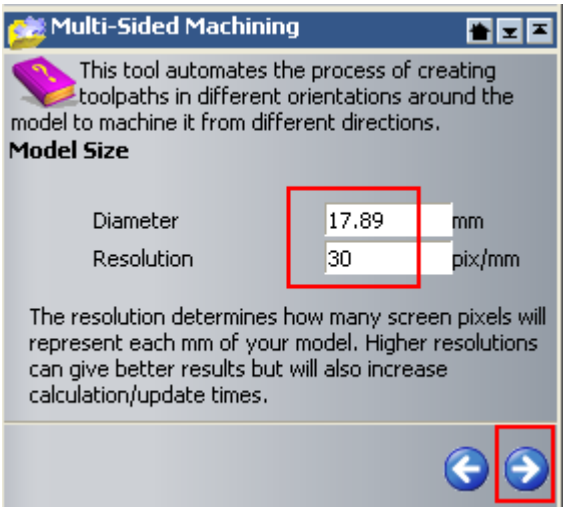
- Select **Assembly** from the **Project** tree.

- Select **3D Machining Wizard** from the **Tools** area.
- Select **Edit Settings**.

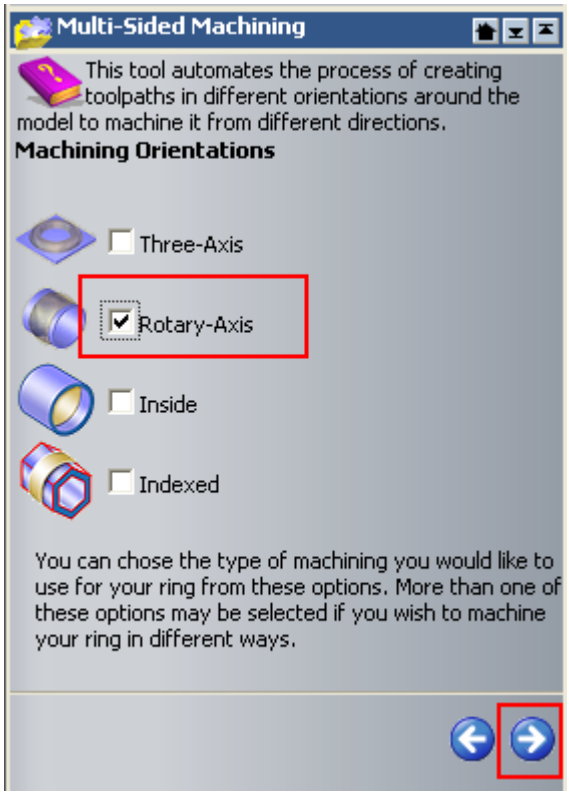


The **Multi-Sided Machining** page allows you to pick the **Model Type**, a **Flat** or a **Ring**.

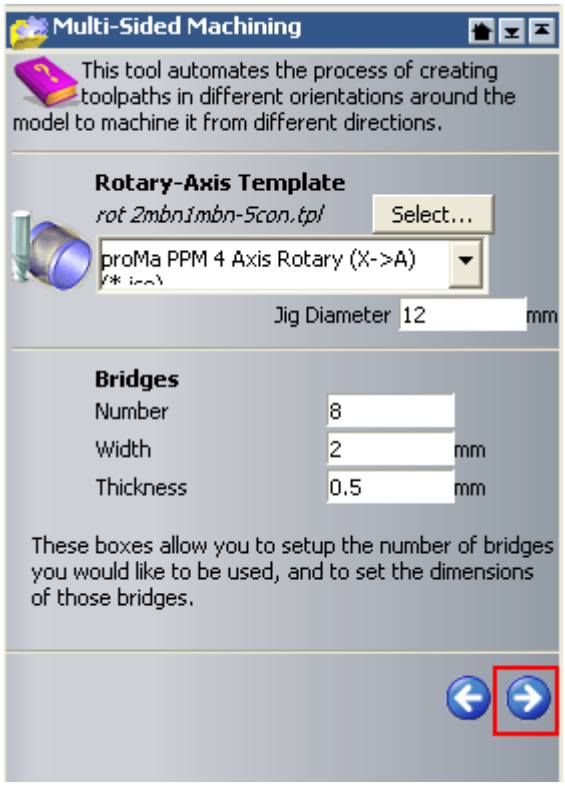
- Select **Ring** and then **Forward** .



- Select **Forward** .

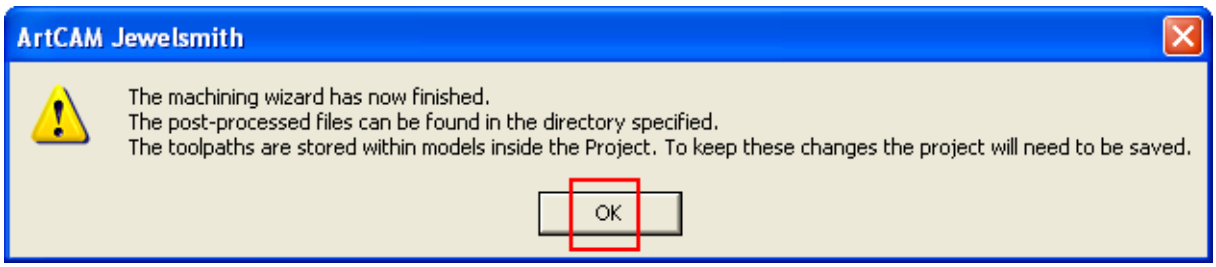


- Select **Rotary-Axis** and then **Forward** .

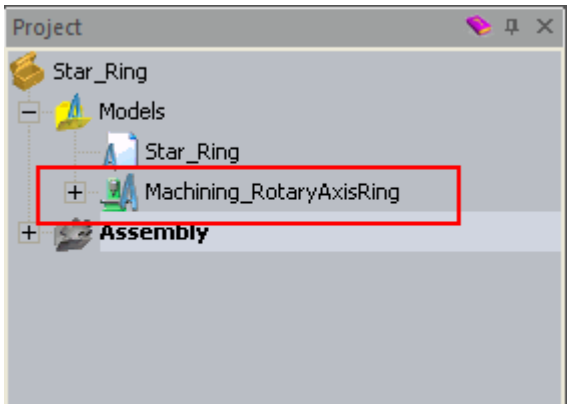


The last **Rotary** defaults are shown.

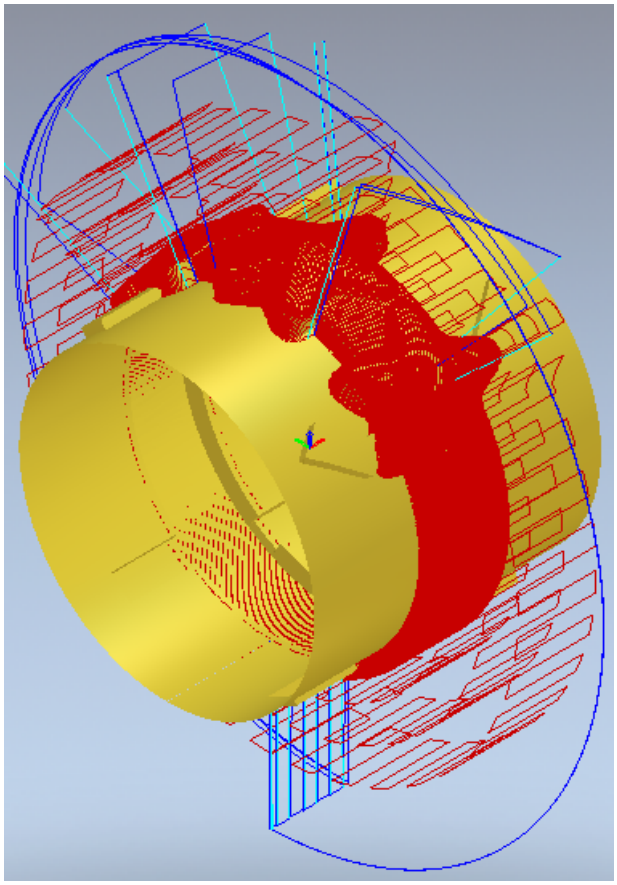
- On **Rotary-Axis Template**, press **Select**.
- From **ArtCAM Files**, select **Toolpath Templates/Alcami/Proma PPM/ PPM rotary**, select **rot 2mbn1mbn-5con.tpl** and then **Open**.
- For the Output, select **Proma PPM 4 Axis Rotary (X->A) (*.iso)**.
- Leave **Jig Diameter** as **12mm**.
- Enter **8 Bridges**, select **Forward** .
- For the **Machining Output Folder**, browse: **D:\users\training\COURSEWORK\JewelSmith-Jobs**.
- Enter **Star-ring** in the **Output prefix**.
- Select **Accept** to calculate.



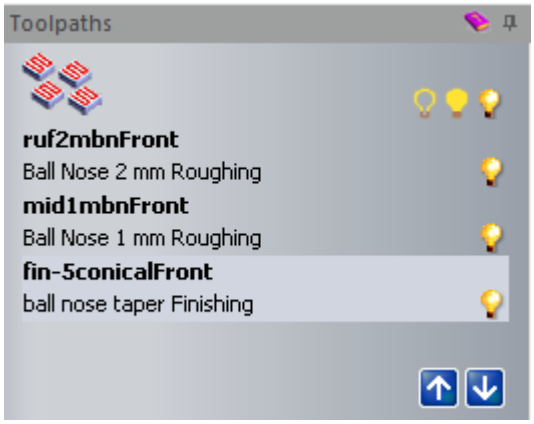
- Select **OK** to accept the Machining.



A **new model** has been created with the **new copy** of the **ArtCAM** model which contains the **toolpaths**. Within this folder are the **post processed toolpaths**.

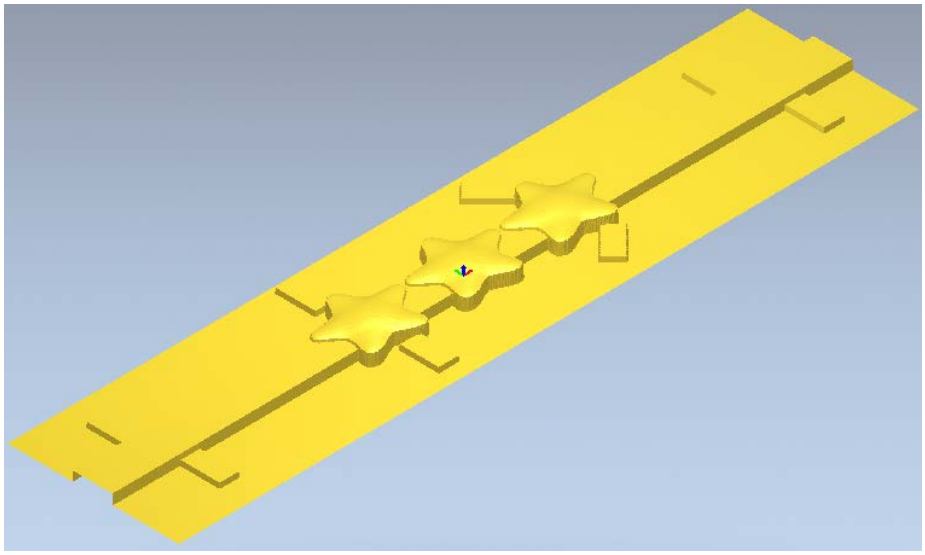


- Select the **Toolpaths** tab.

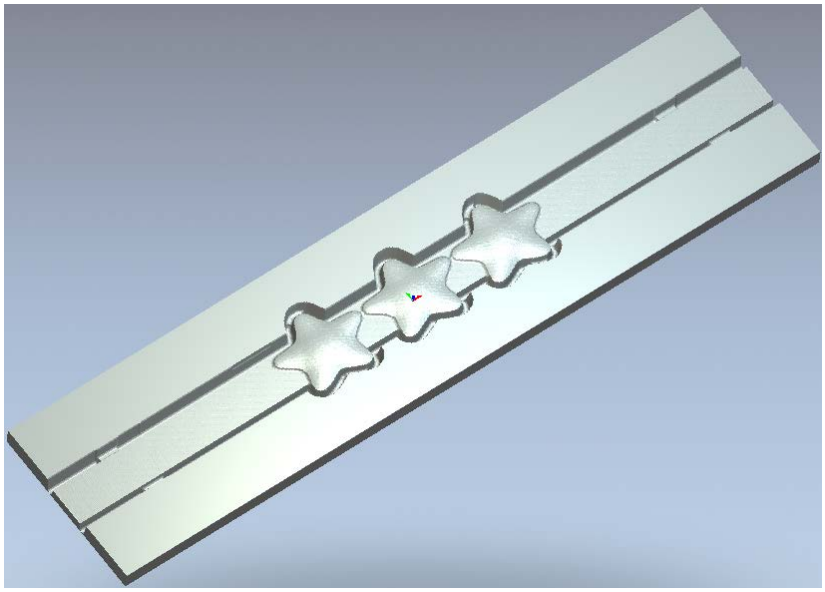


Three toolpaths have been created. You can simulate them to show the final result.

- Select **Toggle Rotary/Flat** .

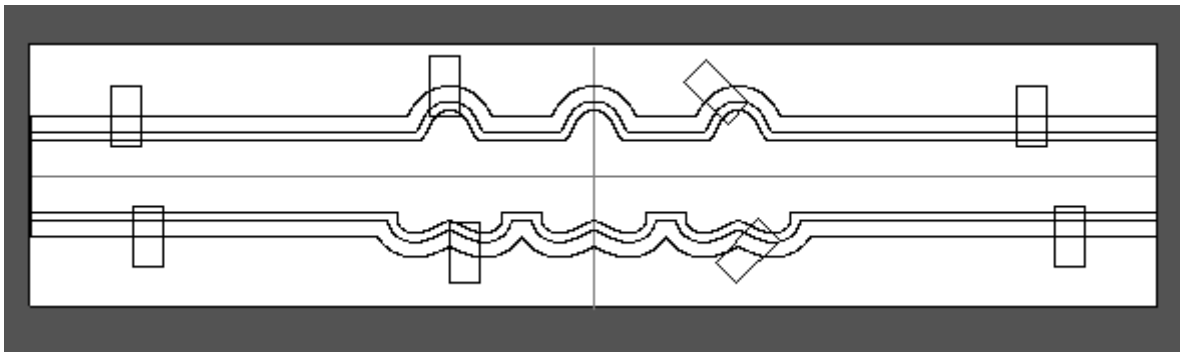


- Select **Simulate All Toolpaths** .



The **Simulation** shows that the toolpaths are limited by the vectors.

- Press **F2**.



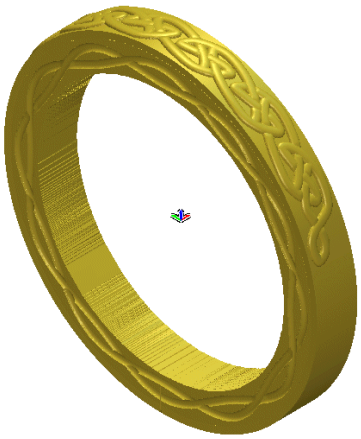
On the **2D View** you can see the vectors that were used on the specified toolpaths.

- Select **File** – **Close Project**. (Don't save the changes as you're going to need the original model one more time.)

22. Celtic Ring

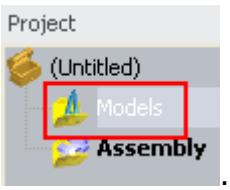
Introduction

This example builds up a ring assembly using a **Three Axis** and **Rotary** model and generates the toolpaths to machine it.

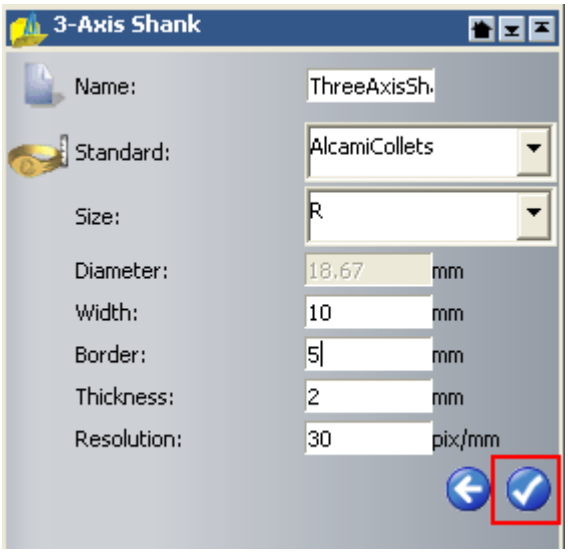


Celtic Ring Exercise

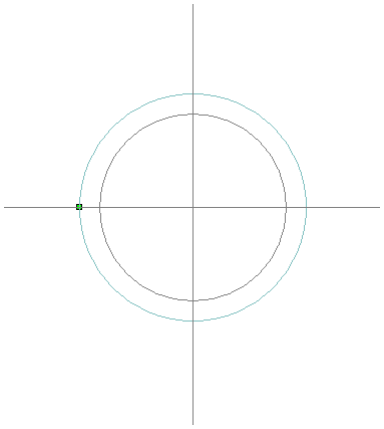
- Select **Create New Project**

.
- Select **Models** from the root **Project** folder 

.
- Select **Create a 3-Axis Blank** from **New Blanks** area.



- Leave the name as **ThreeAxisShank**.
- Select **Standard** as **AlcamiCollets**.
- Select **Size** as **R**.
- Set **Width** as **10mm**, **Border** as **5mm** and **Thickness** as **2mm**.
- Leave **Resolution** at **30**.
- Select **Accept** .

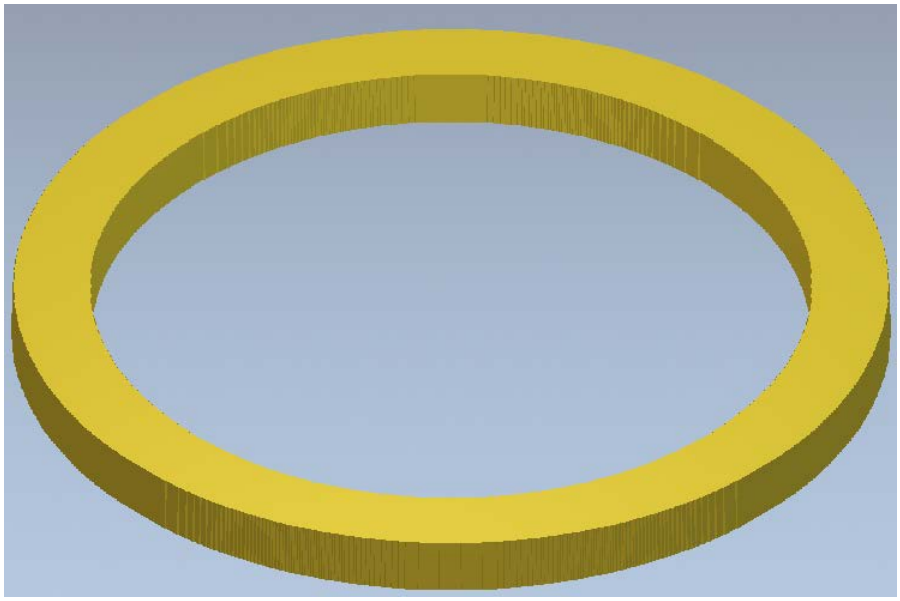


Two circular vectors have been generated to the size of the ring. A horizontal and vertical vector; which have been locked; identify the centre of the ring.

As with other ring profiles, the shape can be modified to suit.

The main ring **Relief** will be created using the **Shape Editor**.

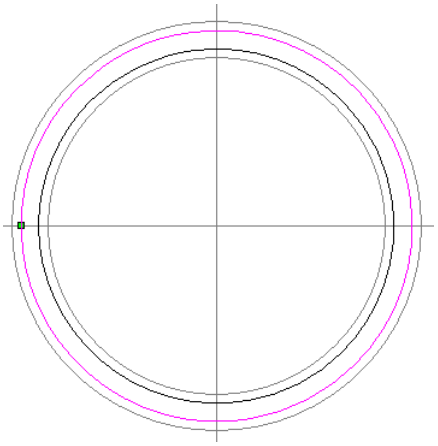
- Select the **outer** and **inner ring vector**.
- Press **F12** on the keyboard.
- Select a **Flat** profile with a **Start Height** of **1.5**.
- Select **Add**, followed by **Close**.
- Press **F3**.



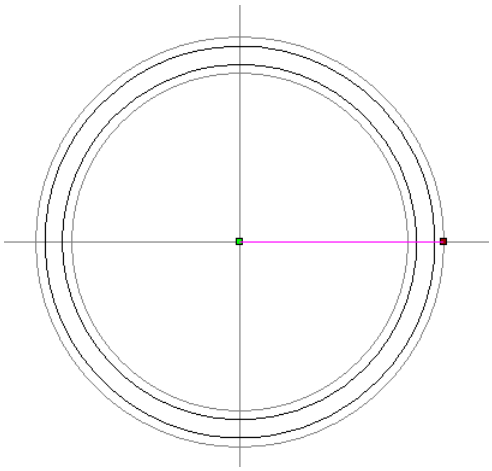
The basic ring shape appears. This represents half of the ring and is 1.5mm high.

Further **vectors** are now required so that a **weave** can be added to the edge of the ring.

- Press **F2**.

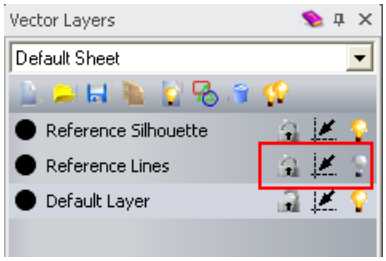


- Select **Offset Vector(s)** .
- Select the **Inner ring vector** and offset it **Outwards** by **0.5** and **1.5**.
- Close the **Offset Vectors** form.



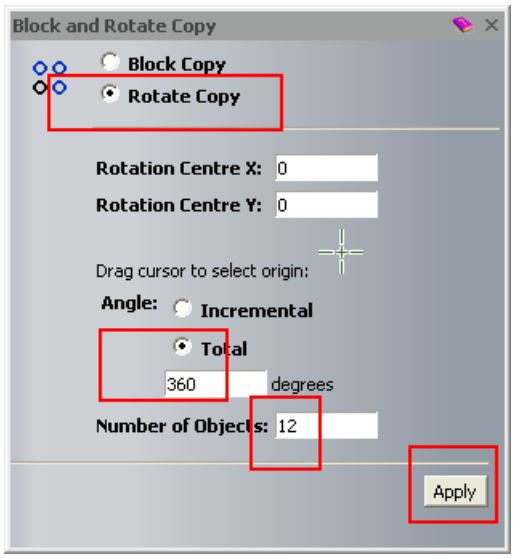
This line will be copied around to make the divisions required for the weave.

- Create a **Polyline** from the **ring centre** at **0 degrees** until it **intersects** the **outer ring vector**.

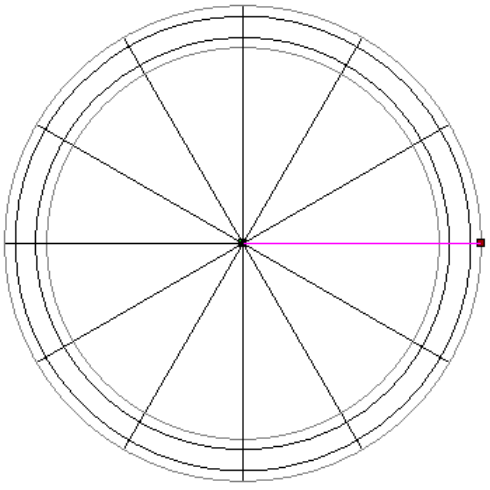


- Select **Vector Layers** and **switch off** the layer **Reference Lines**.

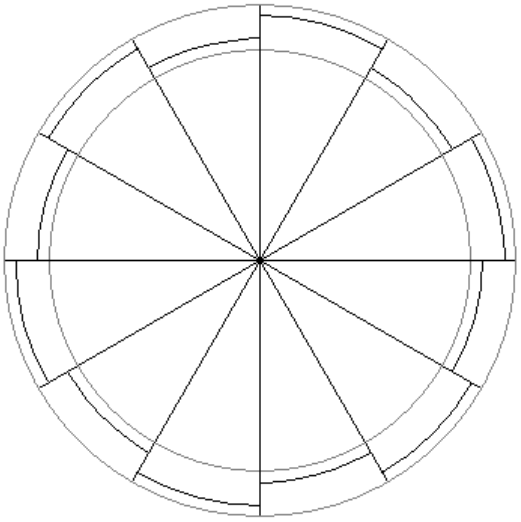
- Select the **line vector** and **Block Copy/Rotate** .



- Select **Rotate Copy**, **X0 Y0** by an **Angle Total** of **360 degrees** with **12 objects**.
- Close the form.

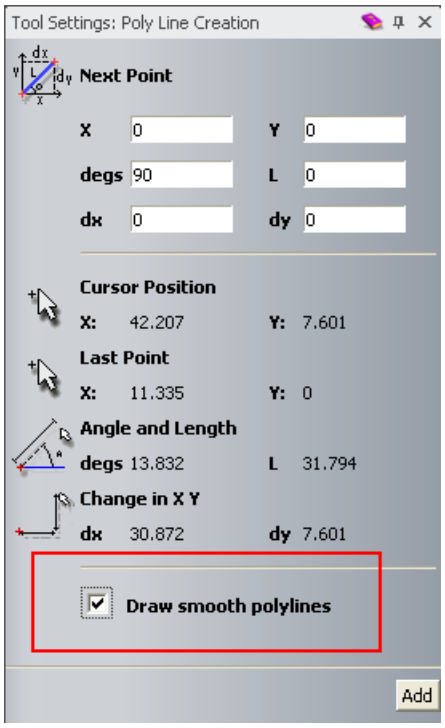


This geometry is going to be used to provide the intersection points for the new **weave vectors** to pass through.

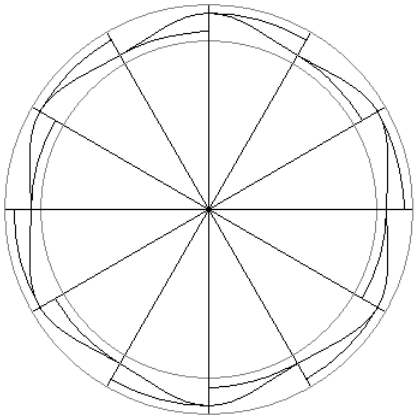


The **trim** tool is very useful for trimming a network of **vectors**. In this example the new end points will provide ideal **snap points** marking the exact route for the **weave** vector.

- Select **Trim Vectors** .
- Click on each alternate section on the **outer** and **inner offset vector**.
- Select **Create Polyline** .



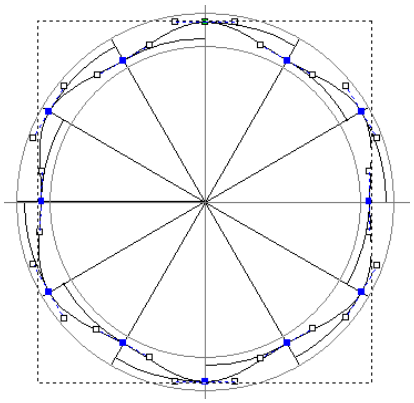
- Switch on **Draw smooth polylines** and **snap alternatively** to the **inner** and **outer offset vector**, as shown below.



The **node point** at the end needs to be smoothed

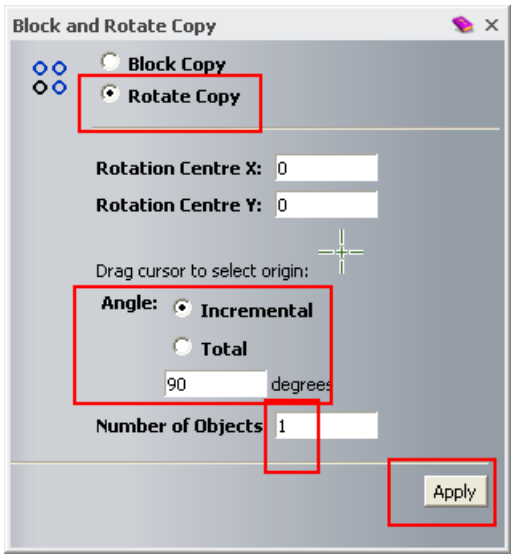
- Select the new vector.

- Press **N** on the keyboard to switch the **Node Editing** on.
- **Smooth** out the **vector** by moving the cursor over any non-tangential (**Black** or **Green**) **node** and pressing **S (**Smooth **nodes** are **blue)**.

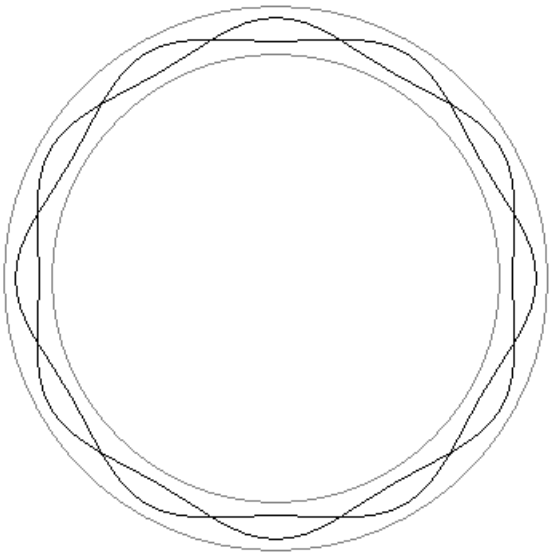


The **vector** is shown smooth.
The smoothed **Polyline** can then be copied and rotated around the centre to produce the other **weave vector**.

- Select .
- Make sure the vector is slected.
- Select **Block Copy/Rotate** .

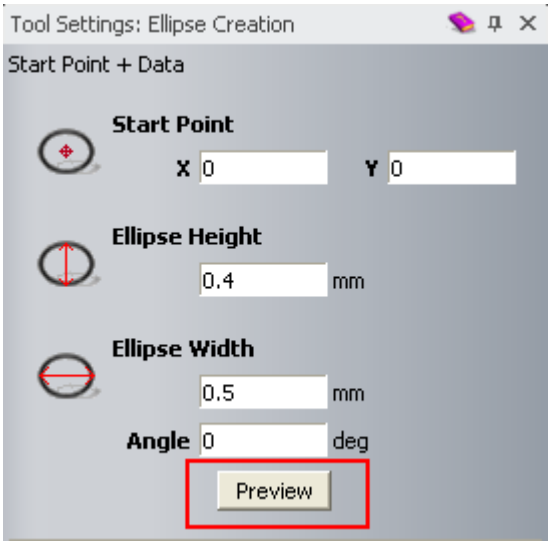


- Select **Rotate Copy** this **vector** around **X0 Y0** by **90 degrees** with **Incremental set** and **1 objects**.
- Delete the **radial polylines** and remaining segment **vectors** as shown below.

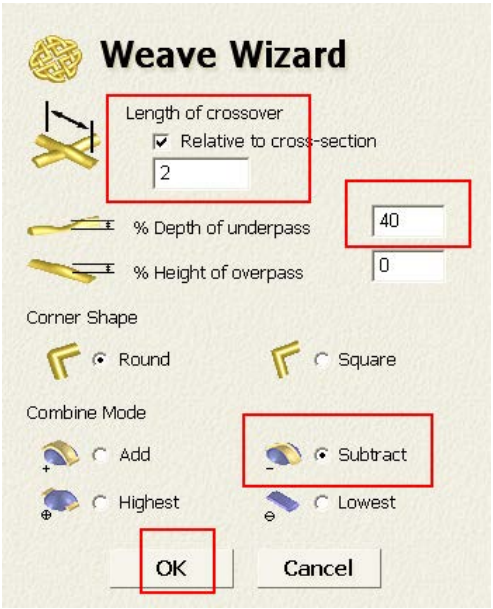


The two **weave** drive curves remain. A suitable **cross section** is now required before the **weave** can be added to the **relief**.

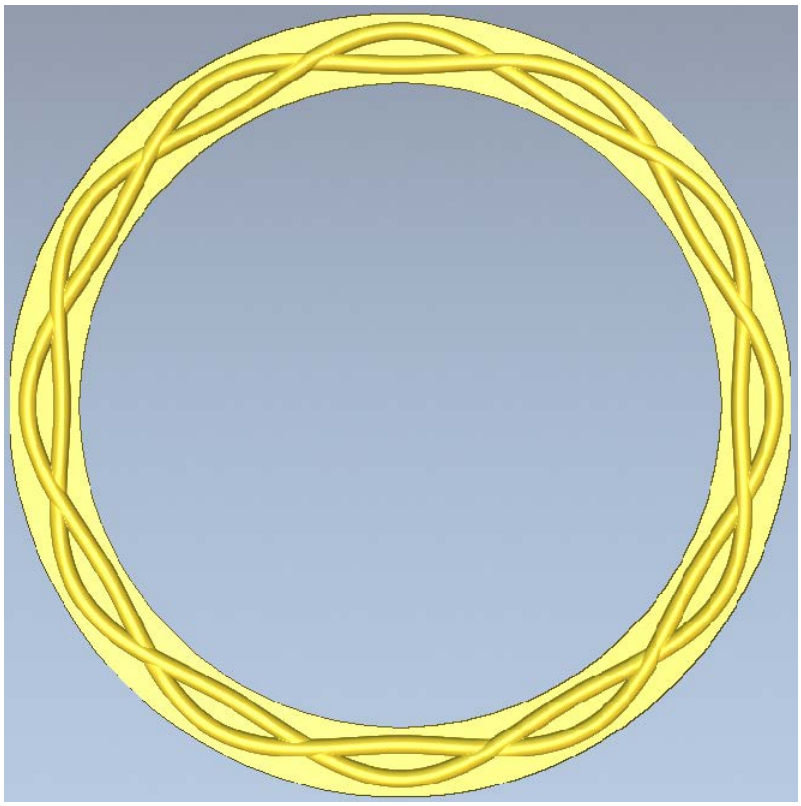
- Select **Create Ellipse** from the left toolbar.



- Create an **Ellipse** at **X0 Y0** with **Height** of **0.4mm** and **Width** of **0.5mm**.
- **Zoom in** to the centre and **Remove** the **lower half** of the **Ellipse**.
- Select both **weave** drive curve **vectors** and then the **half ellipse**.
- Select **Weave Wizard** .

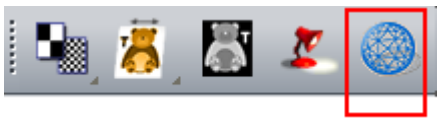


- Set the **Settings** shown.
- Select **Subtract**.
- Select **OK**.
- Press **F3**.

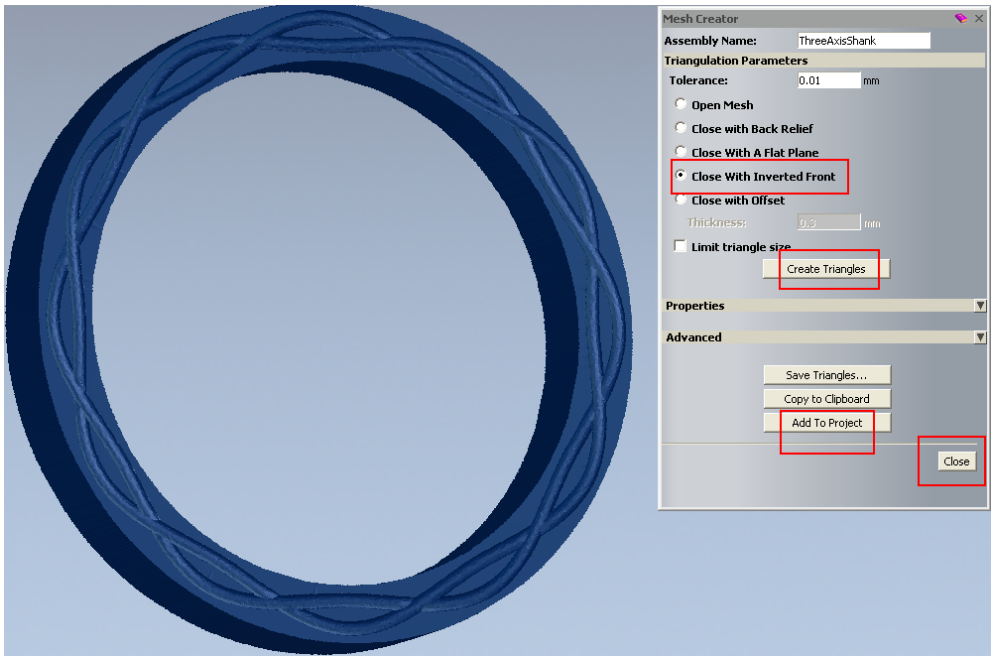


The weave design has been subtracted from the side of the ring.

To make the ring identical each side a copy of the front is inverted to make the back. This back is added to the front to make a component using the mesh creator form.

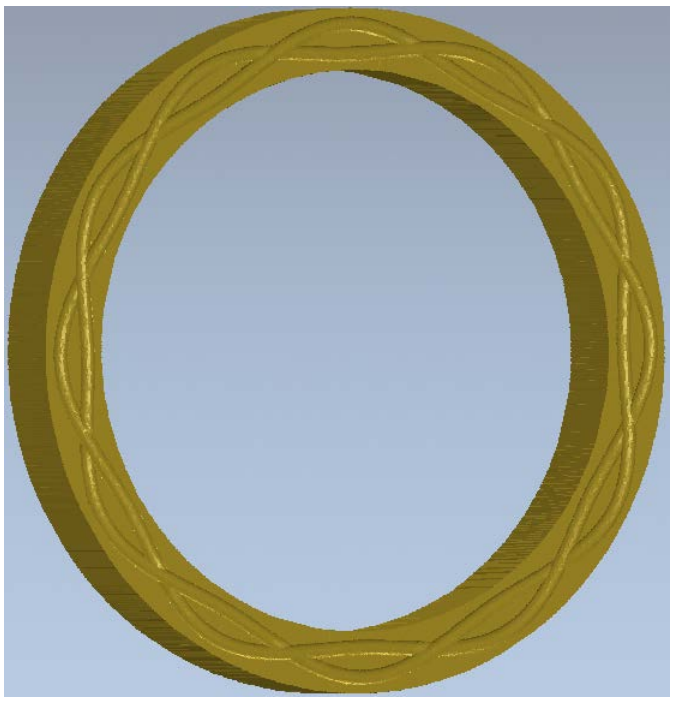


- Select **Create triangle mesh** .



- Select the option **Close With Inverted Front** and then select **Create Triangles**.

- Select **Add Project** and then **Close** the **Mesh Creator** form.
- Select **File – Close Model**.
- Select **Yes** to **Update** the changes.

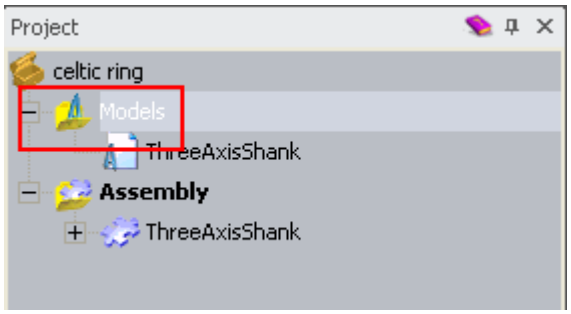


The ring is shown assembled.

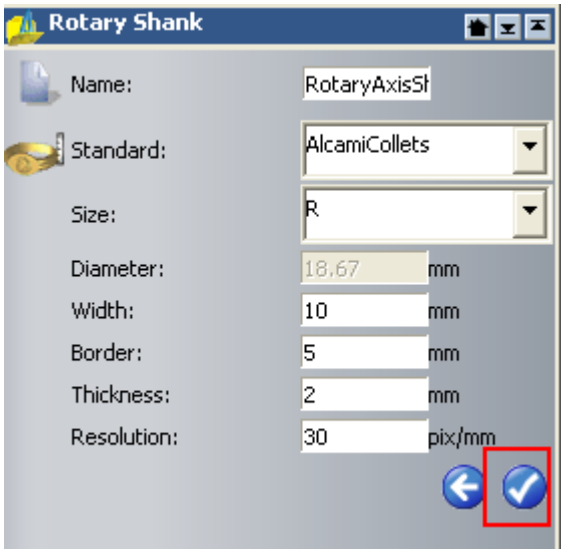
- Select **Save** .

- Browse to: **D:\users\training\COURSEWORK\JewelSmith-Jobs** and **Save** the project with the name **Celtic Ring**.

The ring now requires a weave design around the circumference. For this a **Rotary Shank** will be created as a thin slice around the outside of the existing **Project assembly**.



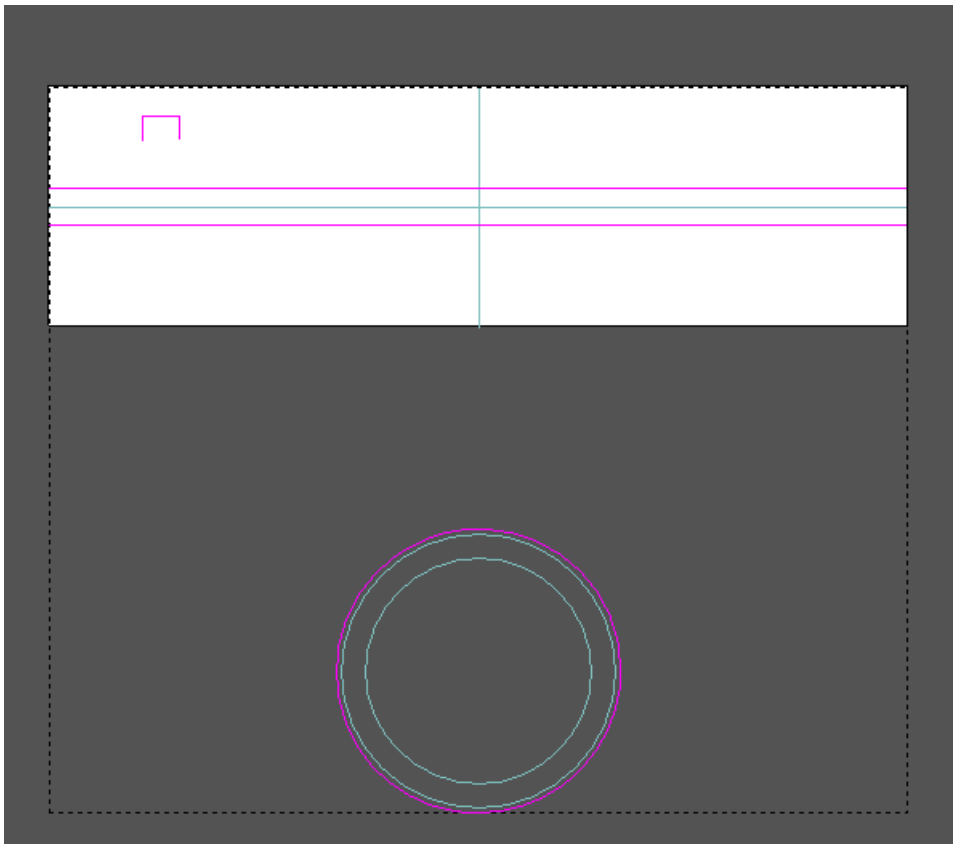
- Select **Models** from the root **Project** folder.
- Select **Create Rotary Axis Blank** .



The ring settings have been retained from the **3-Axis Shank** form applied at the start of the example.

- Select **Accept** .

The vectors need to be generated to use sweep profile, starting with the rail vectors.

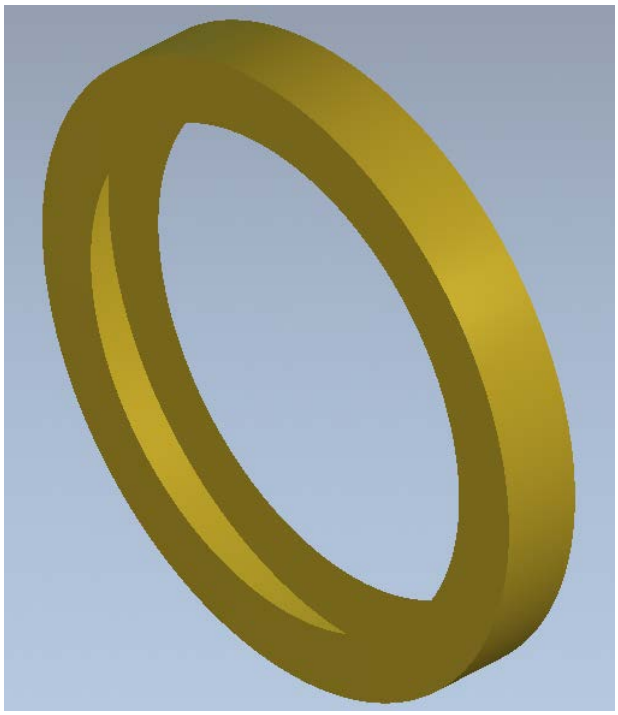


- Create **Offsets** of the central **horizontal vector** by **1.5mm** each side.
- Offset the **outer silhouette vector**, **outwards** by **0.5mm**.
- Close the **Offset Vector(s)** form.
- Create a **Rectangle** vector of **Width 3mm** and **Height 2mm**.
- Remove the **lower span** of the **Rectangle**.

The new **Rotary Shank** must be the same width as the existing **3-Axis flat ring**, which is 3mm.
The outer **silhouette** is offset by 0.5mm, which will provide extra material to the outside face of the existing ring.

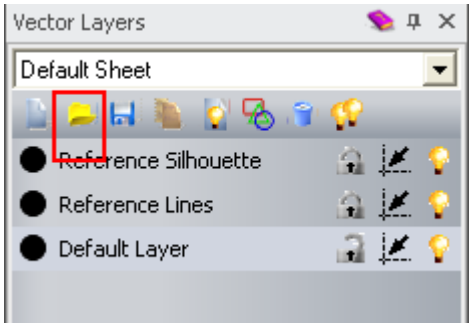
- Shift select the **two horizontal vectors**, the **section** and the **offset ring silhouette**.
- Right mouse click on the left hand corner of the graphics area and select **Rotary relief Tools**.

- Select the **Sweep Profile** from **Rotary Relief Tools**.
- Press **F3**.



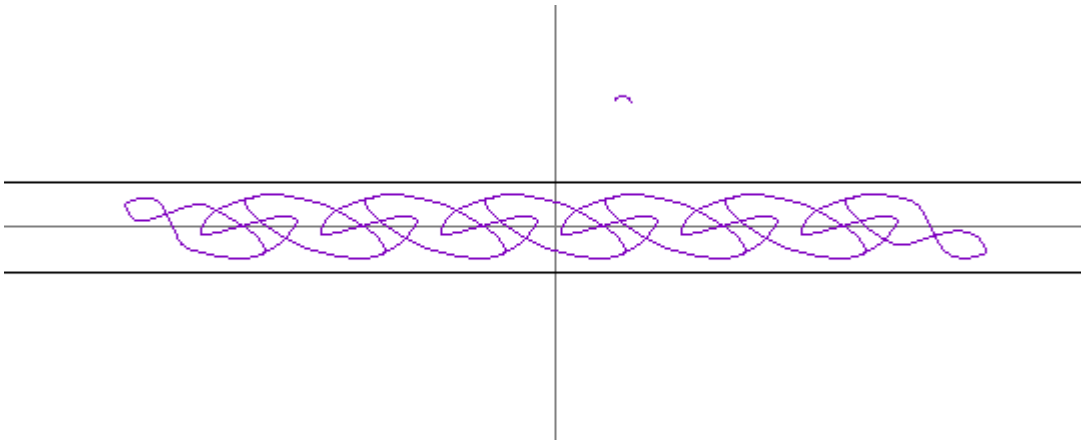
The vectors for the top **Celtic Weave** have already been generated, ready for importing.

- Press **F2**.



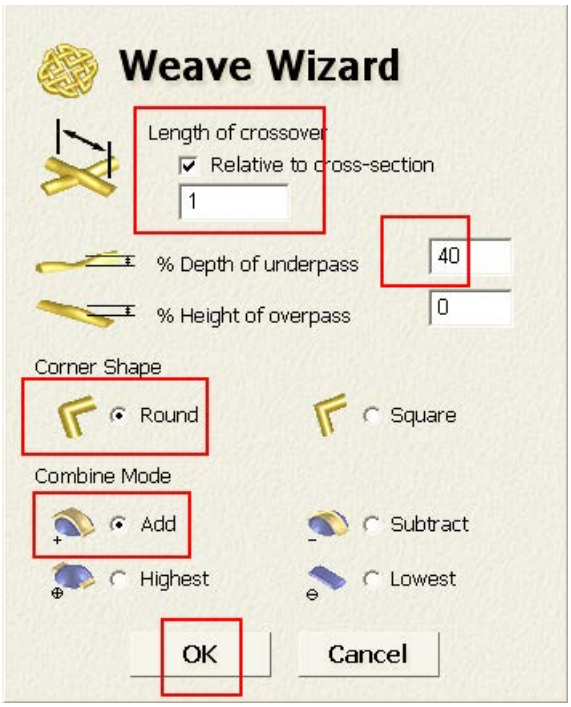
- Select the **Vector Layers** tab.

- Select **Load Vector Layer** from the **Vector Layers** tab.
- Browse to: **D:\users\trainingArtCAM Data**, select **weave-vectors.eps** and select **Open**.



When vectors are imported, ArtCAM checks to see if they are crossing. In this case there are two parts that are crossing and are marked. In this case the vector crossing is required.

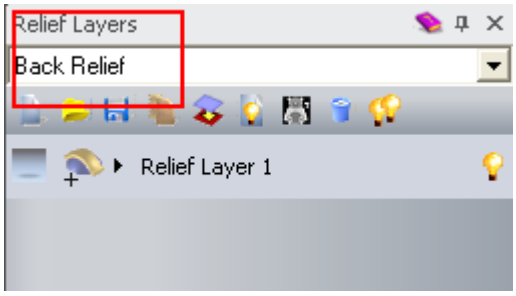
- Press **Ctrl+U** on the keyboard to **Ungroup** the vectors.
- Shift select the **weave vectors** and then the **small weave section vector**.
- Select **Weave Wizard** from the top toolbar.



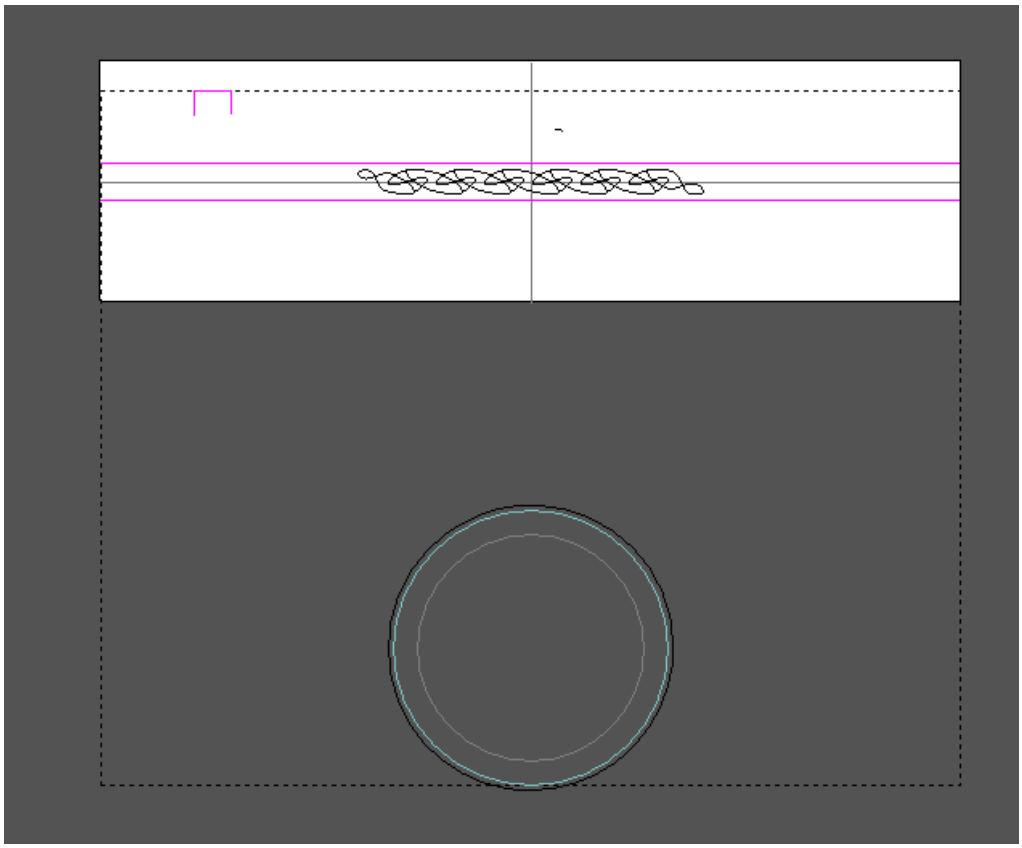
- Use the **Settings** shown.
- Select **Add**.
- Select **OK**.
- Press **F3**.

The **Weave** design has been added to the outside of the ring.
The **Back Relief** needs to removed from this to produce a **0.5mm** thick rim.

- Press **F2**.

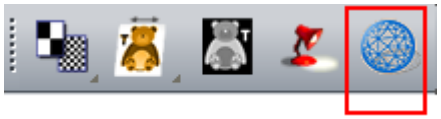


- Select **Back Relief** from the **Relief Layers** Tab.

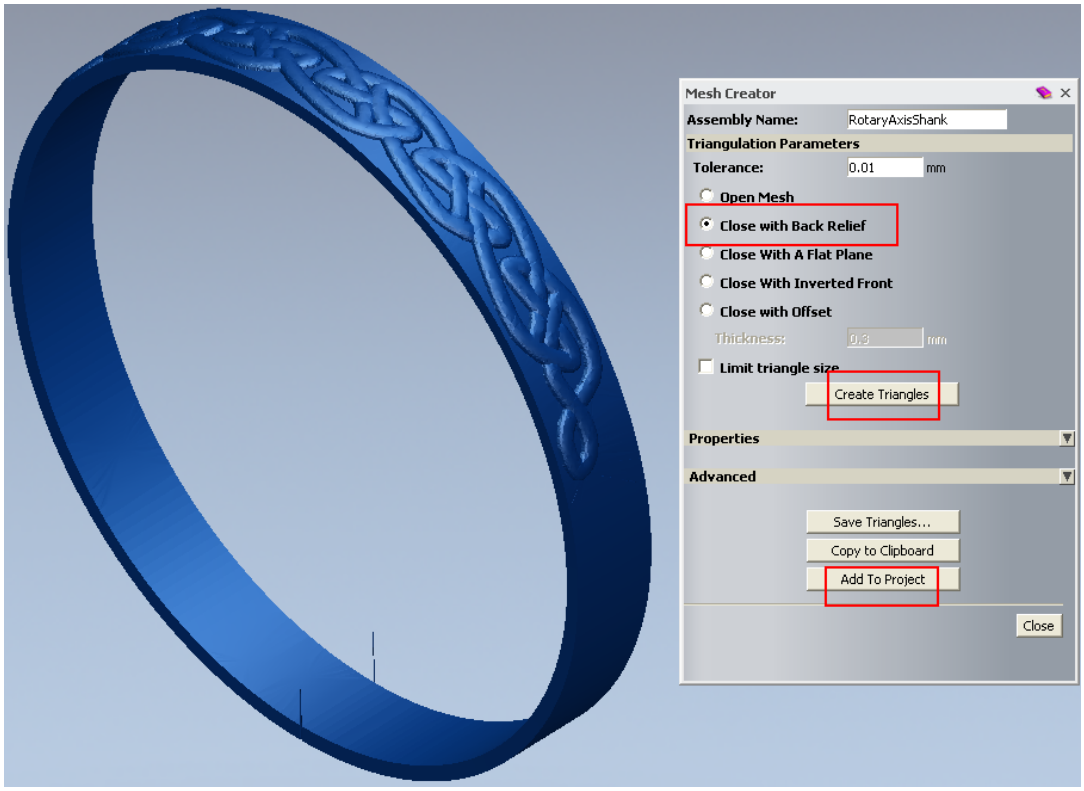


- Select the **two horizontal vectors**, the **rectangular**, **cross section** and the **outer ring silhouette** (at 1.5 mm thickness).
- Right mouse click on the left hand corner of the graphics area and select **Rotary relief Tools**.

- Select the **Sweep Profile** from **Rotary Relief Tools**.
- Press **F3**.



- Select **Create triangle mesh** .



With the **1.5mm** thick, **Back Relief** removed, the **Rotary Shank** is now displayed as a **0.5mm** thick rim.

- Select **Close with Back Relief**, followed by **Create Triangles**.
- Select **Add To Project**.
- Select **File** – **Close Model**.
- Select **Yes** to **Update** the changes.

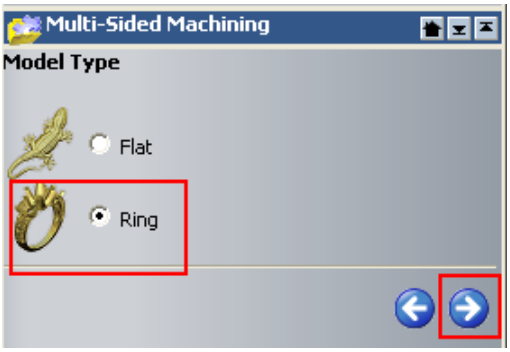
The **Project** is now made up of both components. This method could have been applied in the reverse order by creating the **Rotary Shank** first and then fitting on a very thin side detail generated using the **3-Axis Flat**.

- Select a **Shading** at your choice.

- Select **Save** .

This ring will be machined in two **3-Axis** setups to create the detail for each side face and then put onto the jig to be machined using a **4th Rotary Axis**. The **Multi-Sided Machining** option will generate **toolpaths** and **post-processed** output files for all setups as well as incorporate any **Bridges** and location pockets for a centre holding fixture (**Boss File**).

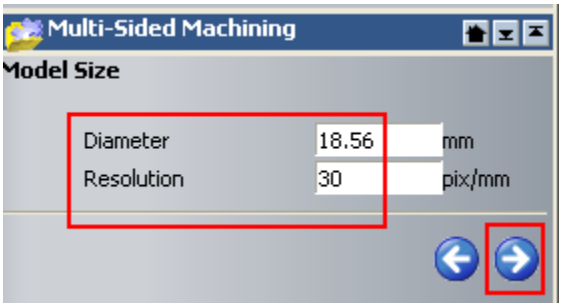
- Select **3D Machining Wizard** from the **Tools** area.
- Select **Edit Settings**.



One or other of the options is selected to control whether the machining operations are to be performed as: -

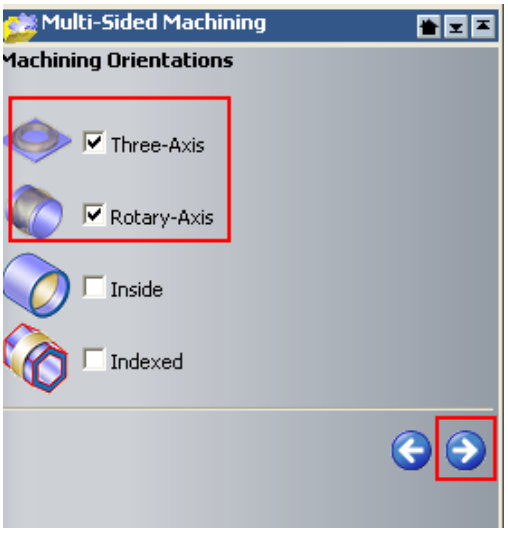
Flat: 3-Axis only.
Ring: A combination of **3-Axis**, **4th Rotary Axis** (Outside), and **4th Rotary Axis** (Inside).

- Select **Ring** and then **Next** .



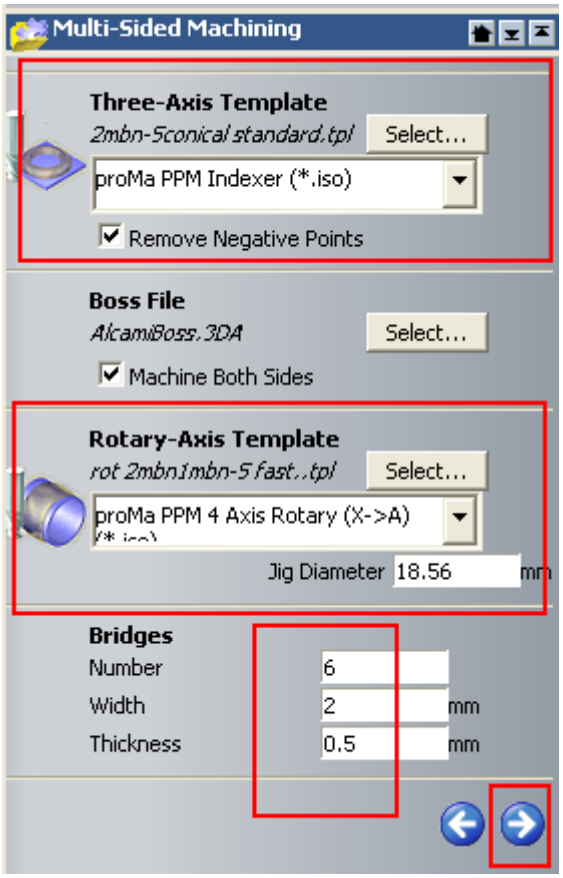
The size and resolution of the ring is shown. These can be edited at this stage if required.

- Set **resolution** as **30** and press **Next** .



Next the required combination of the **Machining Orientations** is selected.

- Select **Three-Axis** and **Rotary-Axis** and press **Next** .



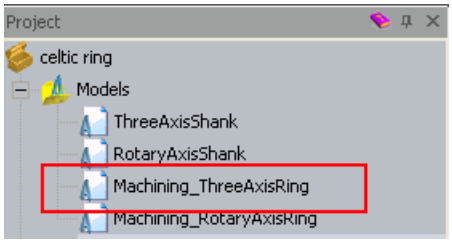
A **machining Template** is required for use with each type of machining orientation. A **Template** is specified for use by clicking the **Select** tab and locating it's correct filename in the browser.

Note: When using **Multi-Sided Machining** any **toolpath template** used must have been previously created and ideally should be stored in an area where it cannot be deleted. The **Boss File** will also be selected.

The required **post processed** output is obtained by using the down arrow to locate and select the correct **Option File**.

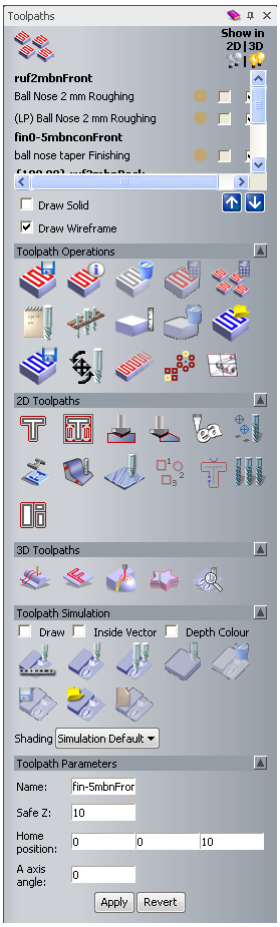
- On **Three-Axis Template**, press **Select**.
- Browse to: **ArtCAM Files** – **Toolpath templates** – **Alcami** – **Proma PPM – PPM flip flat** and open the file - **2mbn-5conical standard.tpl**.
- Use the down arrow to select **proMa PPM Indexer (*.iso)** option.
- On **Rotary-Axis Template**, press **Select**.
- Browse to: **ArtCAM Files** – **Toolpath templates** – **Alcami** – **Proma PPM – PPM rotary** and open the file - **rot 2mbn1mbn-5 fast..tpl**.
- Use the **down arrow** to select **proMa PPM 4 Axis Rotary** option.
- Set **Jig Diameter** to **18.56** (ring diameter).
- For **Boss File** press **Select** and pick the file **AlcamiBoss.3DA** from **ArtCAM Files**.
- Select the option **Machine Both Sides**.
- Enter **Bridges** as **8**, **Width** of **2mm** and **Thickness** of **0.75mm**.

- For the **Machining Output Folder**, browse: **D:\users\training\COURSEWORK\JewelSmith-Jobs**.
- Enter **Celtic ring** in the **Output prefix**.
- Press **Accept** to calculate.
- Select **Yes** to **Update** the changes.
- Select **OK**.
- Select **File** – **Close Model**.



Two further ArtCAM models have been created, and can be seen listed in the **Models** folder.

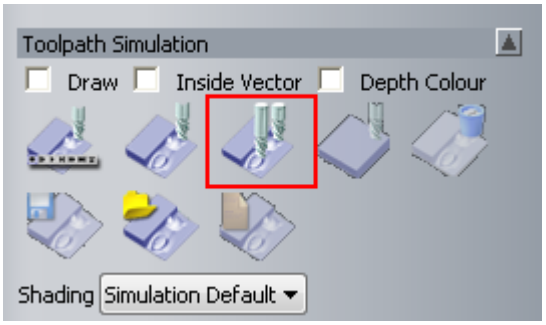
The toolpaths will now be simulated.



- Select the model **Machining_ThreeAxisRing**.
- Press **F3**.
- Right mouse click on the **left hand corner** of the graphics area and select **Toolpaths**.

The **8 Bridges** are displayed, and the location pockets for a centre holding fixture (**Boss**) have been automatically generated.

The **Front Relief** is opened as it has the two identifying dimples in the boss.



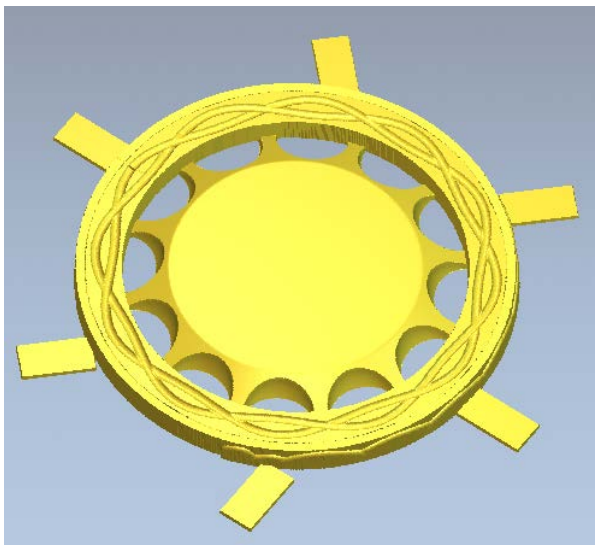
There are four toolpaths generated. Two for the front and two for the back. The back toolpaths have an angle of 180 degrees applied and are generated with the back relief active.

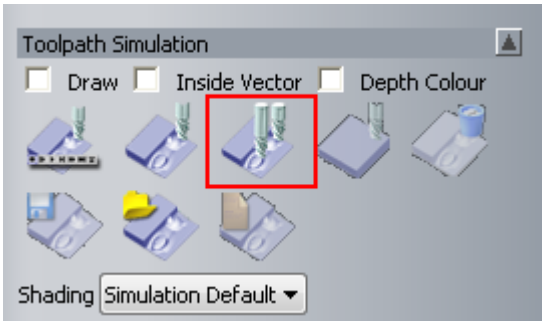
- From the **Toolpath Simulation** area, select **Simulate All Toolpaths**.

The toolpath simulation shows the result of the front toolpaths.

The back toolpaths can now be simulated.

- Select **Delete Simulation** .
- Switch on the **Back Relief** from the **Relief Layers** tab.





There are four toolpaths generated. Two for the front and two for the back. The back toolpaths have an angle of 180 degrees applied and are generated with the back relief active.

- From the **Toolpath Simulation** area, select **Simulate All Toolpaths**.

This simulation shows the complete machining of the back.

The rotary toolpaths do not need any attention and can be left alone. There are a total of 4 output files in the directory.

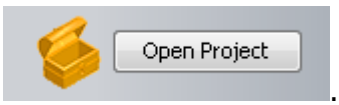
- Select **File** – **Close Project**.
- Save the changes.

23. Relief Machining

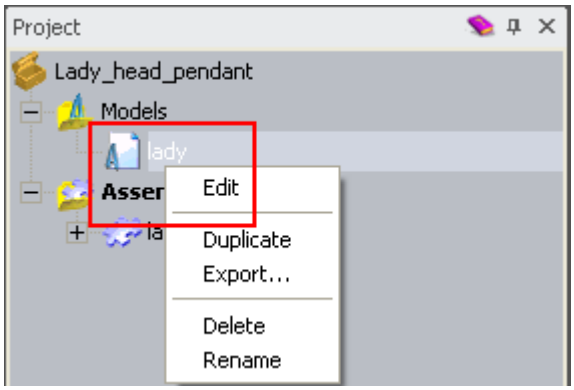
Introduction

Toolpaths are generated within an **ArtCAM** model and then a copy is saved out in the required machine tool format. To speed up this process, once a set of toolpaths have been generated, they can be set as a **Template**, which can then be applied to other models.

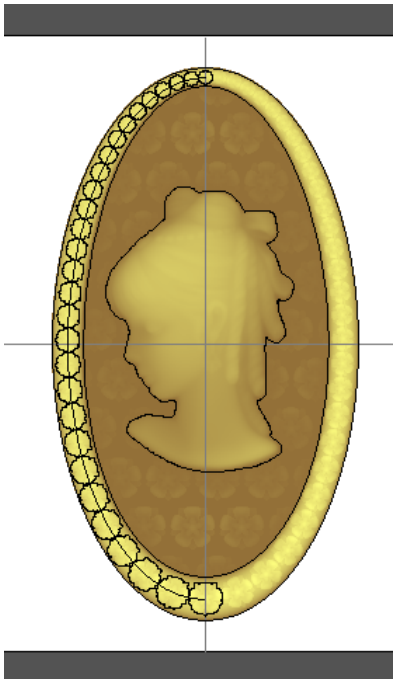
Toolpath generation of a Pendant

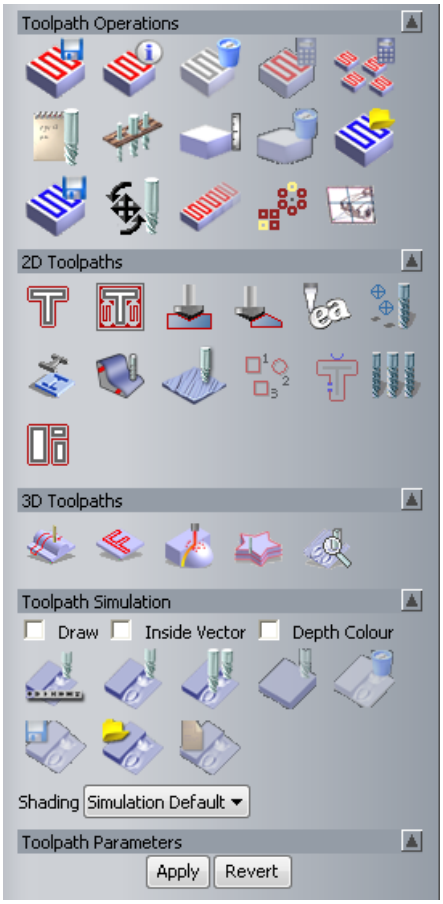
- Select **Open Project** 

.
- Browse to: **D:\users\trainingArtCAM Data** and select the project **Lady_head_pendant.3dp**.



- Expand the **Models** tree and open the model **Lady** (right mouse click and select **Edit**).



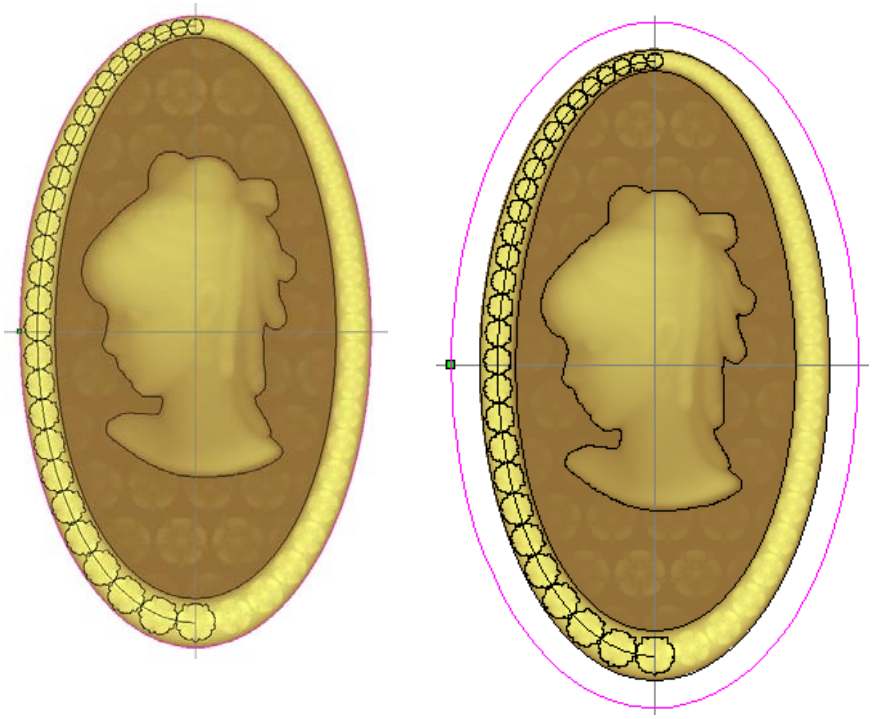


The model has been generated and it is the relief we want to machine. All machining commands are located in the **Toolpaths Tab**.
Before the machining is generated, a new vector needs to be generated to limit the machining inside it.

The **Toolpaths** page is segregated into four main categories including **Toolpath Operations**, **2D Toolpaths**, **3D Toolpaths**, and **Toolpath Simulation**.

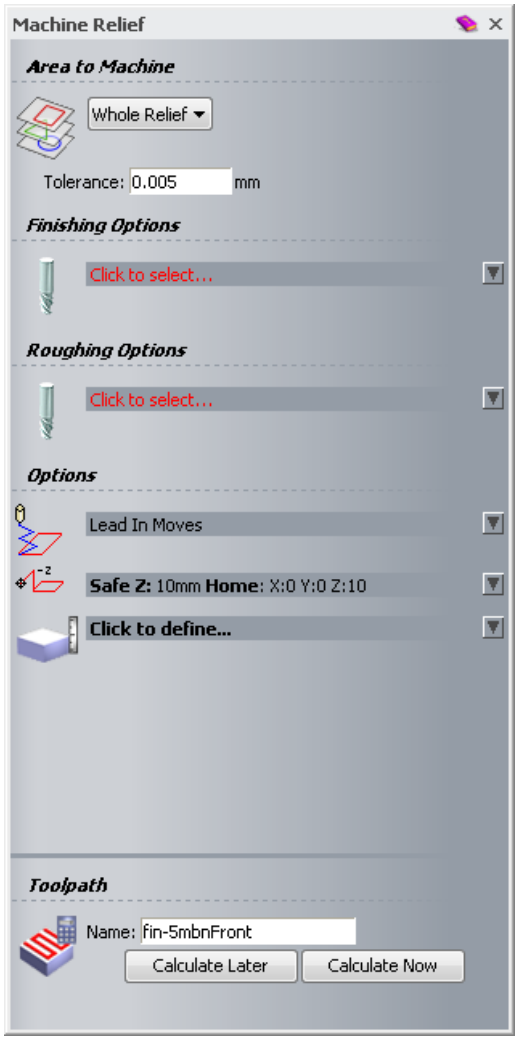
A comprehensive **Tools database** is accessed from within the individual toolpath strategy forms. The user can add to or modify the stored tool definitions as required.

When a toolpath is created it will be displayed in the graphics area and the filename registered in the area to the top of the **Toolpaths** page. These filenames are selectable for such actions as **Toolpath Simulation**, or to reopen the original machining form for editing purposes.



This new vector will be used to limit the toolpath to within the vector. This will reduce the tooling times.

- Select the **outer vector**.
- Select **Offset Vector(s)** .
- Select an **Offset Distance** of **2mm**, **Outwards** and **Radiused**.
- Select **Offset** and then **Close** the form.
- Right mouse click on the left hand corner of the graphics area and select **Toolpaths** to display the **Toolpaths options**.
- Select **Machine Relief** from the **3D Toolpaths** area.



Area To Machine – this either applies to the **Composite Relief**, the area within the **Selected Vector** or an **Automatic Boundary**.

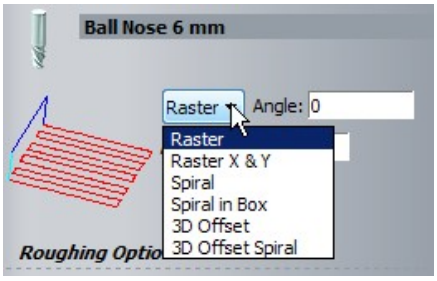
Finishing Options – allows the **Finishing tool**, **cutting strategy** and **angle** to be defined here.

Roughing Options – allows the **Roughing tool**, **cutting strategy** and **angle** to be defined here. The **Z slices** (thickness of each cut) is also defined here.

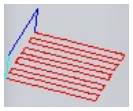
Lead In Moves – For harder materials, this option is used to apply a ramping move of the tool into the material instead of the default vertical plunge.

Safe Z, **Home –** Sets the **Safe Z height** (rapid move) and **Start/End** position of the tool.

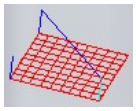
Material Thickness – This can be defined here or as shown previously.



When a **Tool is selected** for the **Finishing operations**, a number of **machining strategies** (for cutting) are available. These will be summarised below.

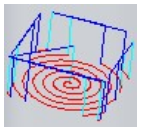


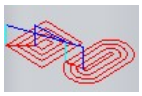
Raster - Creates the strategy along one direction. The default angle of **0 degrees specifies the X direction** (therefore angle of **90 degrees** would change to a **Y direction** cutting direction).

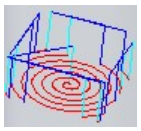


Raster in X and Y - Repeats the above strategy in both **X** and **Y** direction.

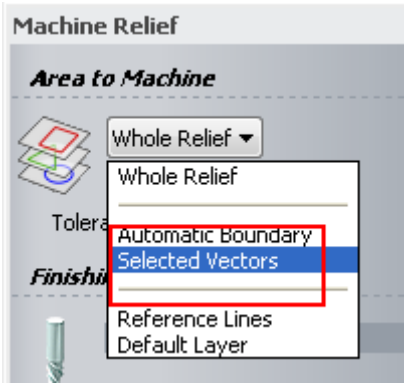
Spiral - Creates a spiral strategy limited by the model.

 **Spiral in a box** - Creates a spiral strategy trimmed to the model.

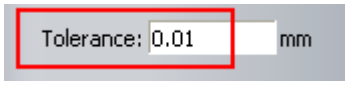
 **3D Offset** - Follows the outer contour offsetting the **Toolpath** with a **Stepover** relative to the **3D** form.

 **3D Offset Spiral** - Same as **3D Offset** but creates a **spiral** instead of a **stepped offset**.

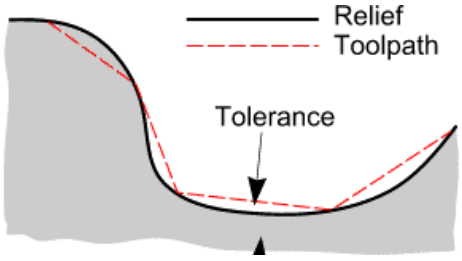
- Select the **new offset vector**.



- Select the option **Selected Vectors** from **Area to Machine**.



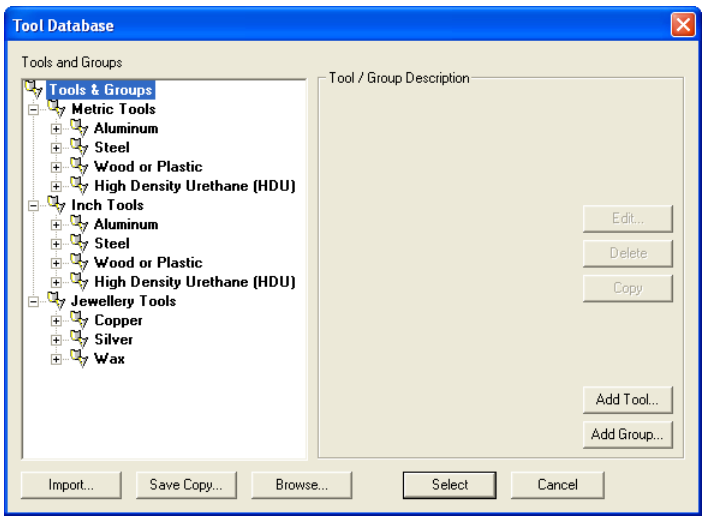
- Change to **Tolerance** to **0.01mm**.



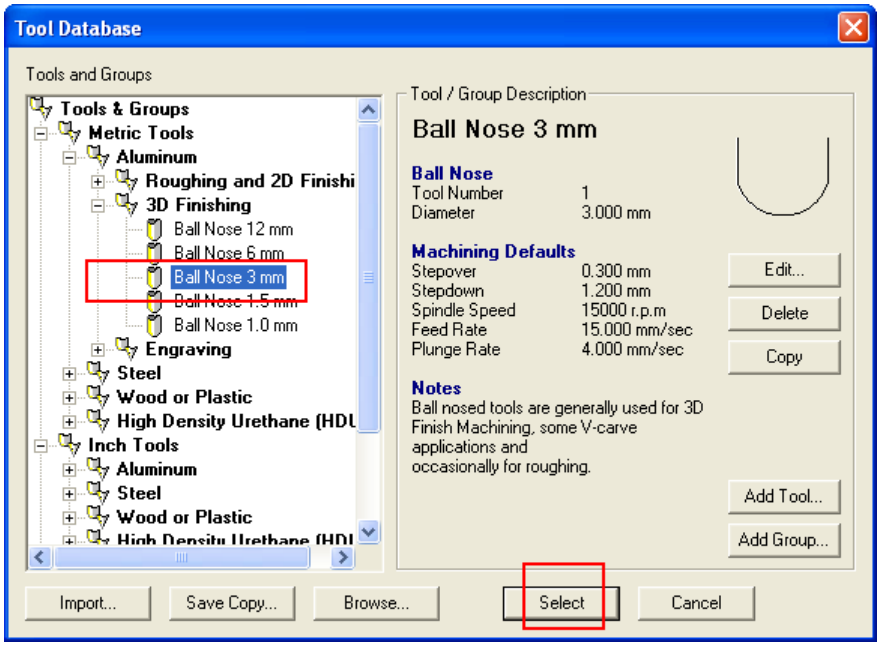
Tolerance determines how accurately a cutter path follows the true shape of the **Relief**, the actual value being the maximum permissible deviation from the **Relief** form.

- In **Finishing Options**, select

to launch the **Tool Database**.



- By selecting the sign next to the names, browse to **Metric Tools** - **Aluminium** - **3D Finishing**.



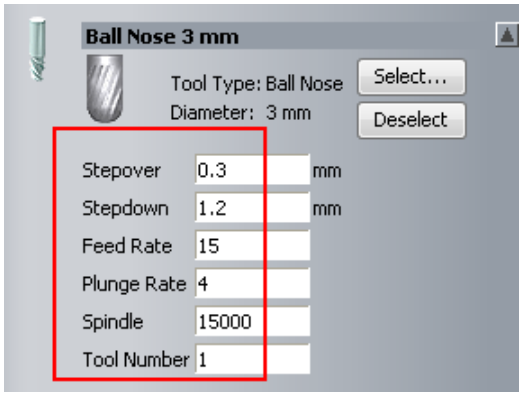
When a tool is selected (highlighted) in the left hand window, the tool data and description is displayed on the right-hand side of the form.

Individual tools can be **Edited**, **Deleted** or **Copied**.

New Groups and **Tools** can also be created for customisation.

- Select a **Ball Nose 3mm** and press **Select**.

The **3mm Ball Nose tool** and its parameters are now **loaded** into the **Machine Relief form**.



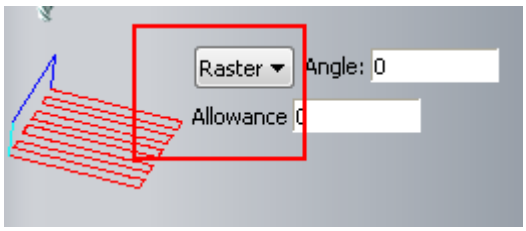
The **default tool parameters** (for Aluminium 3mm Ball Nose) are shown. Changing values in this form do no affect the original tool stored in the database.

The **Stepover** is the distance between passes.

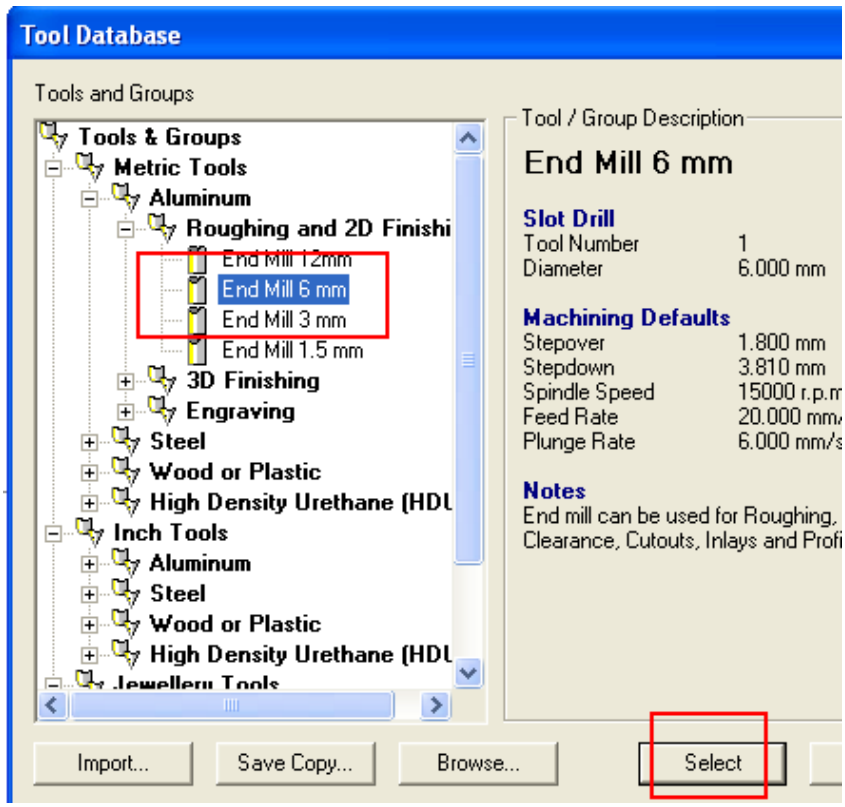
The **Stepdown** is the incremental depth of cut (slices).

A **Tool number** is essential if outputting to a machine tool fitted with an automatic tool changer.

- Select the **down arrow** to reveal the default settings for the selected tool.

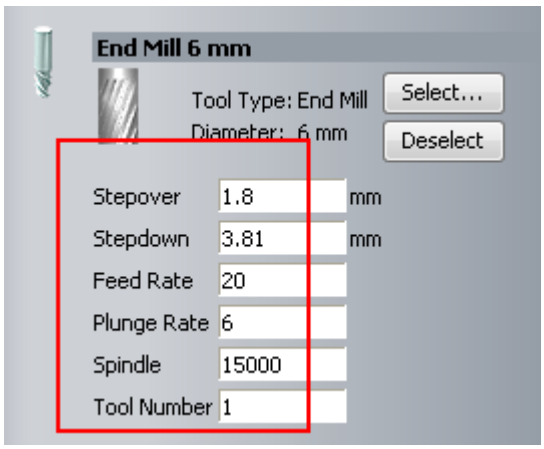


- Select **Raster** as **Toolpath Strategy**.
- In **Roughing Options**, select to launch the **Tool Database**.



- In **Roughing Options**, select

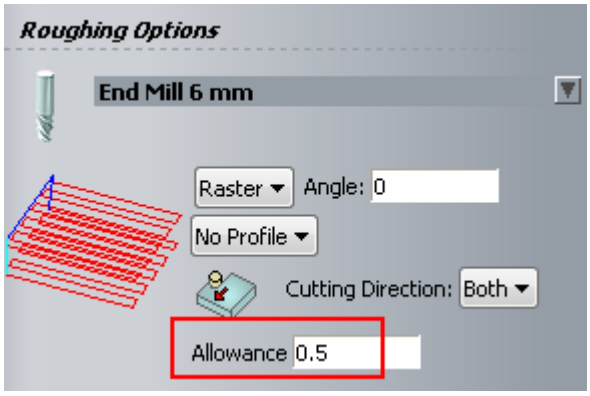
to launch the **Tool Database**.
- Browse **Metric tools**, **Aluminium**, **Roughing** and **2D Finishing** and then select **End Mill 6mm**.



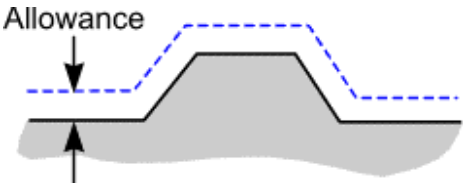
The **Feed Rate**, **Plunge Rate** and **Spindle Speed** are based on the tool manufacturer recommendations but can be adjusted to suit the machine tool and material used and how rigidly it is clamped down.

A unique **Tool Number** value must be input if the **toolpath** is for a machine tool with an automatic tool changer. If not, the value can be left as **1**.

- Press **Select**.



- Enter **0.5mm** for the tool **Allowance**.



The **Material Allowance** is the specified thickness of material that is left on over the actual **relief** when the toolpath is created.

So based on the above figure, **0.5mm** of material will remain on the relief after machining has completed. This can be therefore regarded as a semi-finish, where a final tool (to be calculated later) will complete the finishing with an allowance of zero.

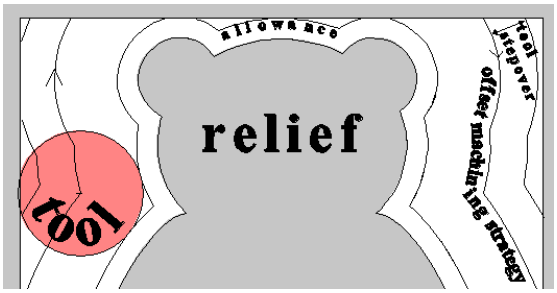
The advantage of running a **Semi Finishing toolpath** is that it removes the steps left by the previous **Roughing Pass**, leaving a more consistent material removal rate for the final finishing operation.

The **Roughing Tool** (first operation) will now be defined.

Roughing will remove the excess material from around the **Relief** up to the specified **Material Allowance** and **Tolerance** values. For efficiency, a relatively large tool is generally used for this operation. **Roughing** splits the **Material** into **Z Slices** and performs the selected **Area Clearance** strategy (**Raster** or **Offset**) on each one.

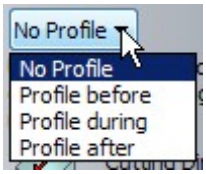
- Ensure the **Raster strategy** is selected with an **Angle** of **0 degrees**.

Offset Roughing



With the **Offset** strategy, the tool moves are offset inwards from the shape of the **Complete Relief** or limiting **Vector**, and outwards from the shape of the **Relief** contour. Individual tracks are separated by the **Step over** distance.

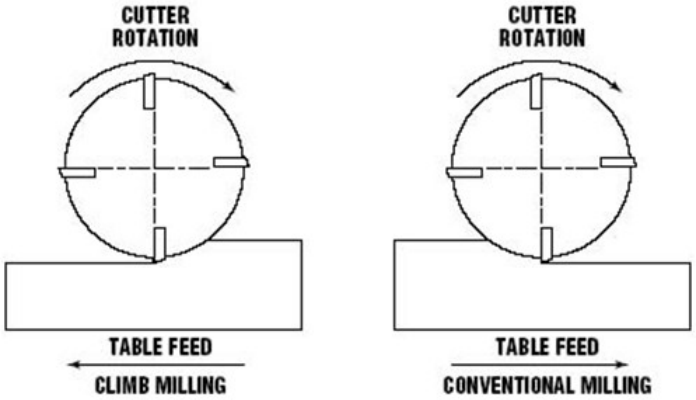
Selecting a profile will Add a profile 'clean up' pass either before, during or after each Z slice is machined. In this example the **Z Slices** will be machined using a **Raster** strategy without the addition of a **Profile Pass**.



- Do not select a **Profile Pass**.

The default **Angle**: **0** (along **X**) for the **Raster** strategy can be changed if required.

The cut direction of the tool can be selected here from either **Conventional** or **Climb Milling**.



In **Conventional Milling**, the teeth of the tool meet the block of material at the bottom of the block. With this action, the teeth of the tool slide along until sufficient pressure builds up to break through the material surface.

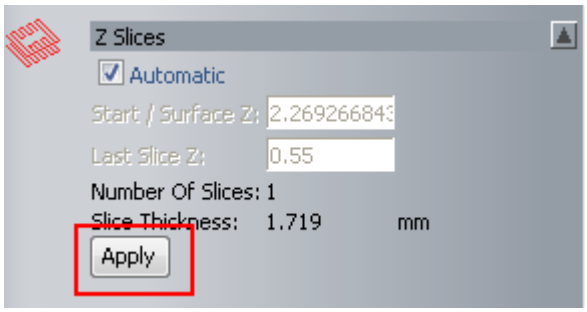
In **Climb Milling**, the teeth of the tool meet the block of material of material at the top of the cut, at the thickest part of the cut.

Climb milling often provides a better finish, permits greater tool feed rates and prolongs the life of the tool.

- Leave the **Cutting Direction** as **Both**.

- Ensure the **Allowance** is **0.5mm**.

The **Allowance** will leave **0.5mm** of material after machining. The semi-finishing toolpath will then reduce the material from **0.5** to **0.25mm**. Then finally zero on the final finishing strategy.



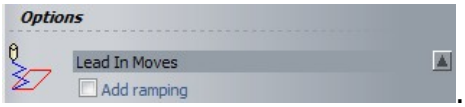
- Select **Apply** in the **Z slices** area.

On clicking **Apply** the number of **Z slices** (depth of each cut) is automatically calculated. The automatic figure of **1 slices** each at **1.719mm**, was calculated from the tool **Stepdown** (set as 3.81mm), Distance to bottom offset and Allowance.

Start/Surface Z (this is the initial height from where the first **Step Down** value will be subtracted).
The **Last Slice Z** defaults to the height of the **Material Allowance** above **Relief** base level. This value can be modified upwards to leave more material on the base level if required.

These values can be customised to suit (e.g if a thicker base is required) by altering the **Tool Stepdown value**, **Material thickness**, or by **unticking** the Automatic box and entering suitable settings.

- Leave the values as calculated automatically.

- Leave **Add Ramping Moves** unticked 

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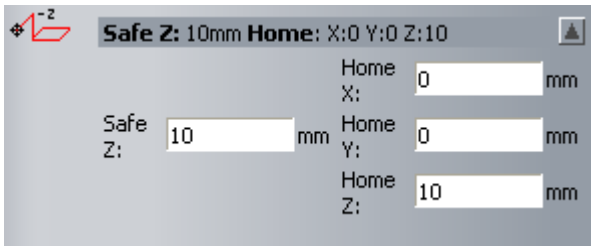
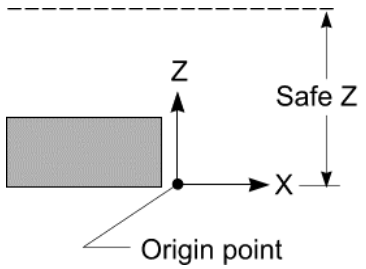
Ramping Moves are applied to avoid plunging, especially where harder materials are being machined. If **Add Ramping Moves** the user has access to a selection of ramping options to control the **Angle**, **Length**, and incremental **Height** of ramp moves.

- Select the down arrow on the **Safe Z** and **Home** bar.



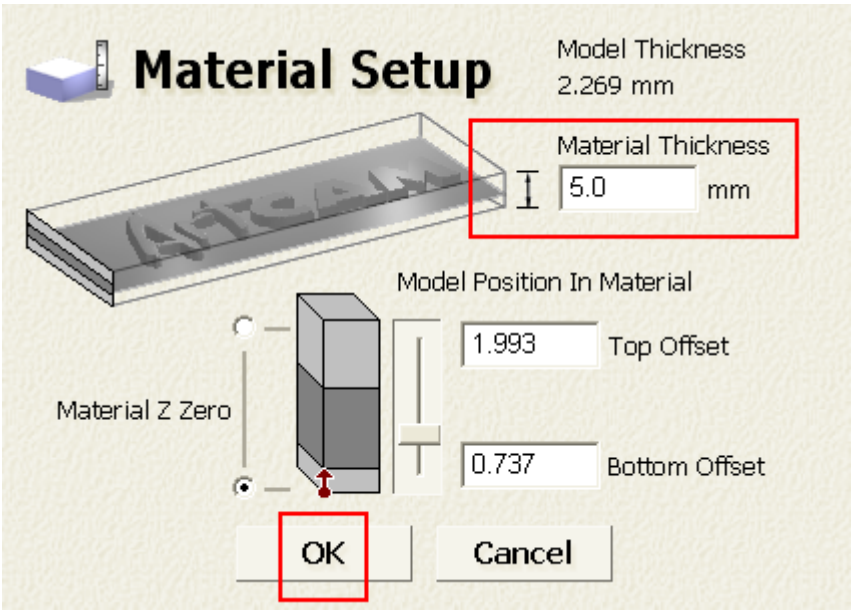


- Set **Safe Z** at **10** and the **Home Position** as **X0 Y0 Z10**.

Safe Z is the user defined height in Z above the material where the tool can safely perform rapid moves to and from plunge positions.

Note: Do not forget to consider the heights of clamping and fixture components, if applicable.
The tool **Home Position** defines the **Start** (**1st move**) and **End** (**last move**) of the **toolpath**. It is not permitted for the selected **Z** value that is less than the **Safe Z** value.

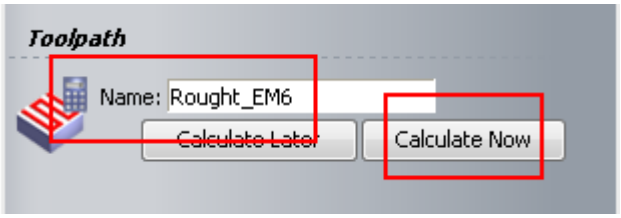
- Left mouse click next to the **Material Setup** icon to define the **Block of material**.



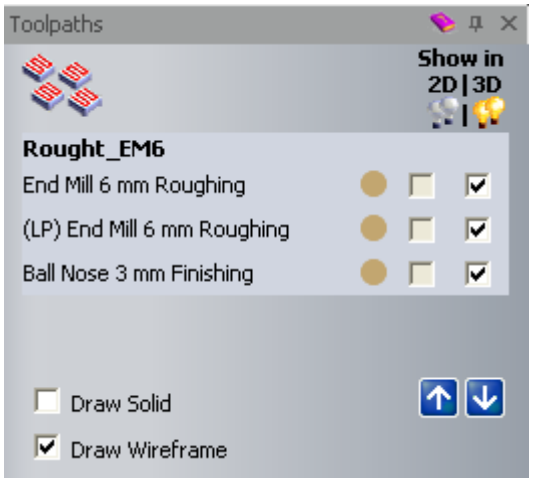
- Enter a **Material Thickness** of **5mm**, a **Top Offset** of **1.993mm** and a **Bottom Offset** of **0.737mm**.

The **Material Thickness** allows you to input the **thickness of the material to be machined**. The **current relief height** is also displayed **(5.115)**. If the **Material Thickness** is greater than the **Relief Thickness**, a value for top or bottom offset can be entered.

- Select **OK** on the **Material Setup** form to accept the **Material Thickness** values.



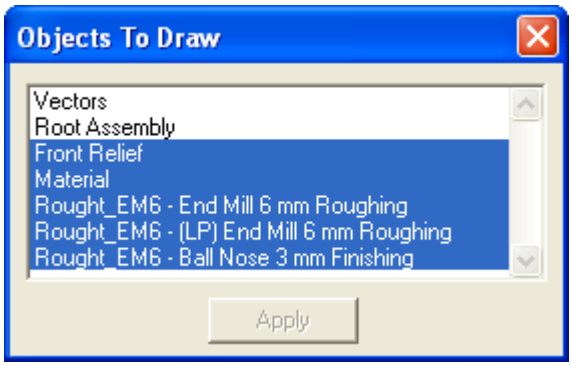
- Enter the **Name** as **Rough_EM6**.
- Select **Calculate Now**.
- Close the form.



The **Toolpath** appears at the top of the **Toolpaths** page. The **Toolpath** can be shown or hidden by ticking or unticking the relevant **Show in - 3D** column boxes.

The **Roughing** process has created **two** toolpaths. The second toolpath (**labelled LP – Last Pass**) is a small incremental slice (left over by the main roughing process) that is remove in a single and final stage. This is used to improve the finish of the toolpath.

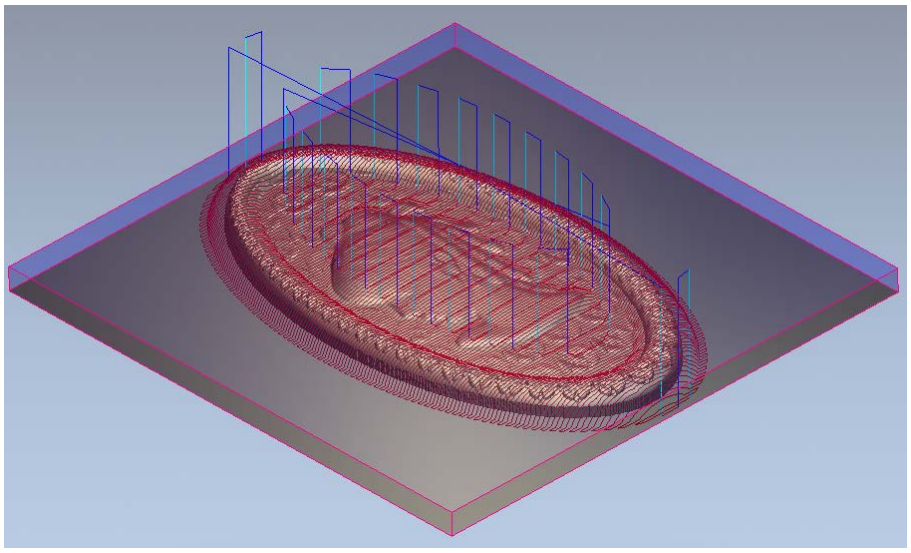
The **Objects To Draw** icon at the top of the **3D View**, allows the user to toggle the visibility of all entity types (not just machining toolpaths).



You can toggle between different objects by clicking on them and by selecting **Apply** to display the selected items in the **3D View**. The **Vectors** and the **Root Assembly** are undrawn.

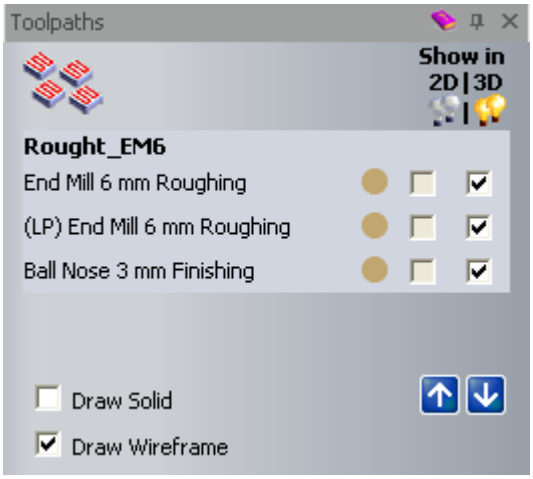
- Select **Objects To Draw** on the **3D View** toolbar.
- Press **F3**.

- Select **Toggle Assembly Visibility** from the **3D View**.

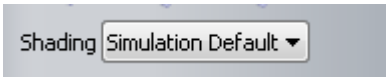


The **Toolpaths** have been generated as red lines in the **3D View**. The dark blue lines are **Rapid moves** in **Safe Z** and the light blue lines are **Plunge moves**.

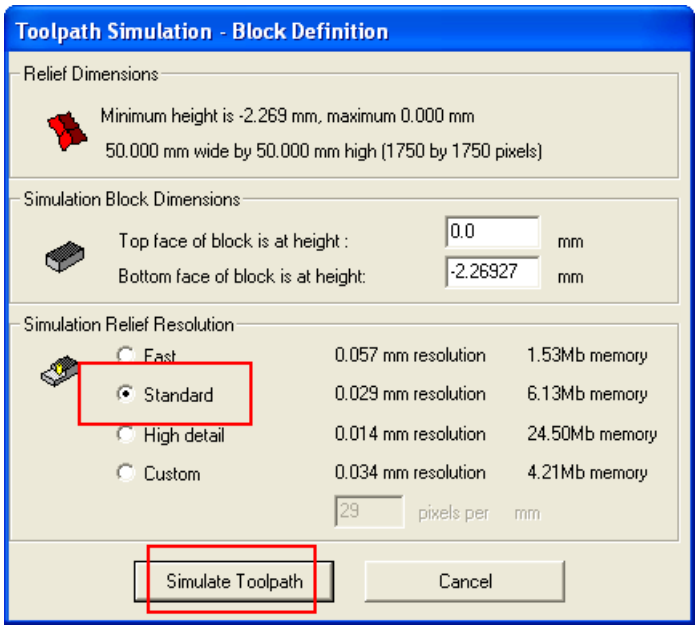
The material is displayed in blue around the **Relief** in the **3D View**.



- Select the toolpath **Rough_EM6**.

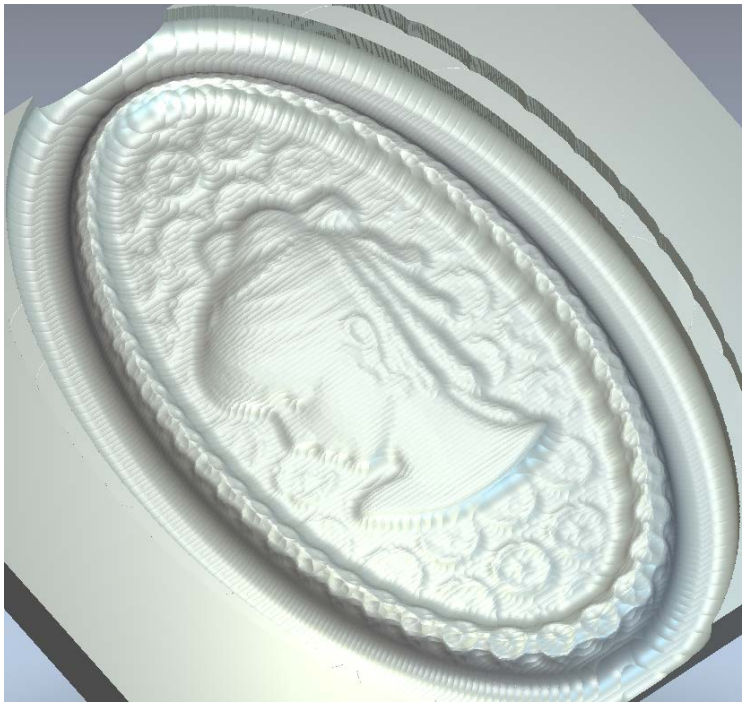


- Select the **Shading** as **Simulation Default**.
- Select **Simulate Toolpath Fast** .



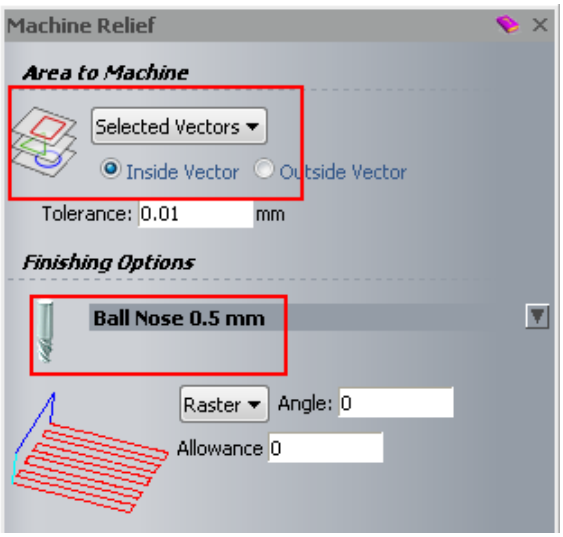
Relief Dimensions: shows the overall dimensions of the relief.
Simulation Block Dimensions: gives the size of the block. This should be at least as big as the minimum and maximum height of the relief plus any height (or depth) of the engraving features.
Simulation Relief Resolution: specifies the quality of the image that you require. Obviously the lower the resolution the greater the speed of calculation.

- Select **Standard** from the **Simulation Relief Resolution** section.
- Select **Simulate Toolpath**.



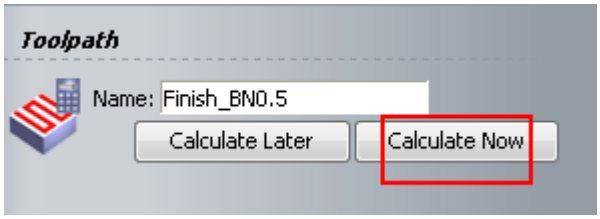
The image shows the result of the **Toolpaths** simulation for the selected tools and toolpath strategies.

- Select the **offset vector**.
- Select **Machine Relief** .



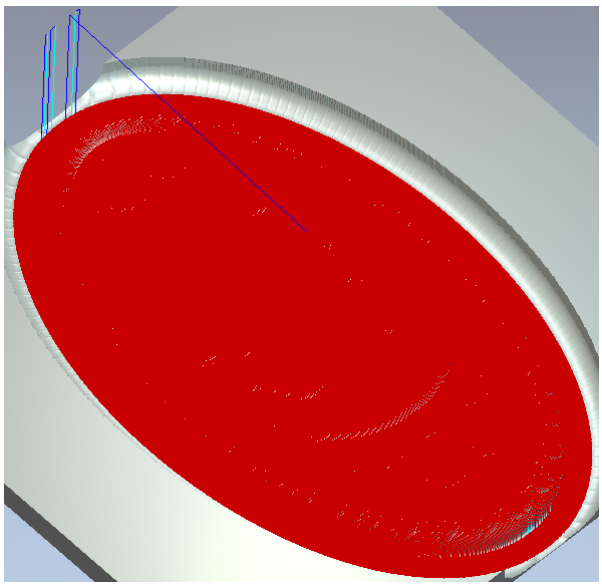
This tool is ideal for finish machining, as it is small enough to cut the detail.

- Select **Selected Vectors** and **Inside Vector**.
- Select **Ball Nose 0.5mm**.

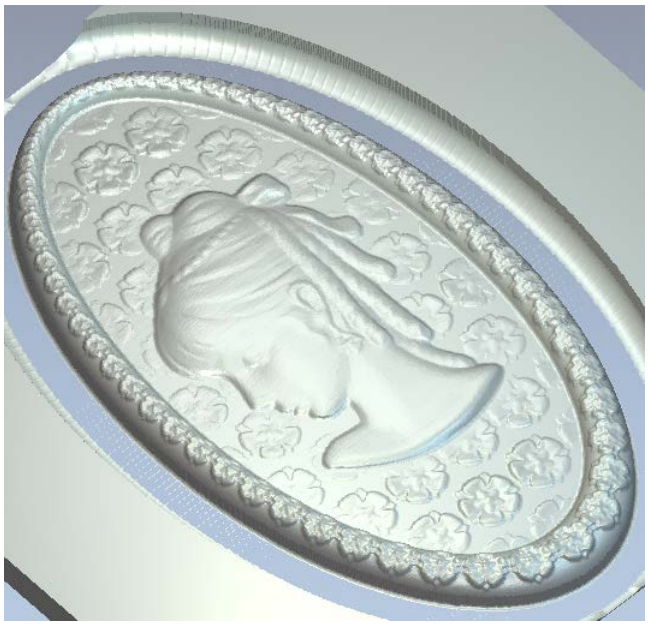


- Change the **Name** to **Finish_BN0.5** and select **Calculate Now**.
- Close the form.

- Select the toolpath **Finish_BN0.5** and select **Simulate Toolpath Fast**



The red machining lines are closer together. This will take longer to machine but provide a high quality toolpath.

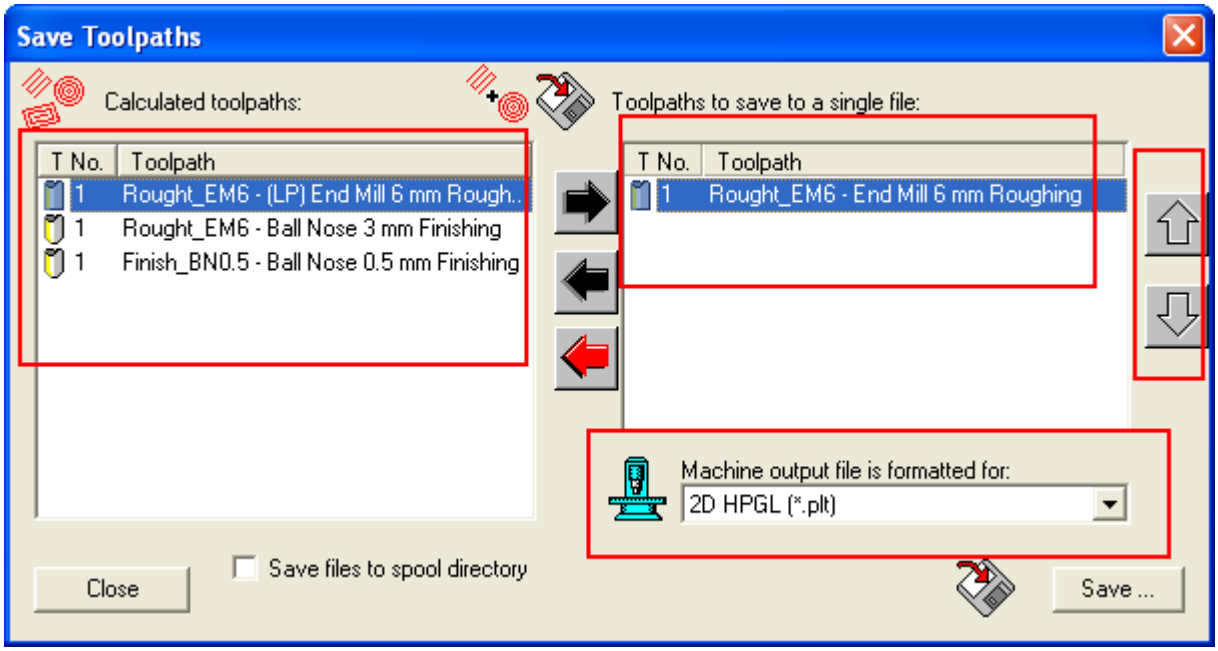


- Select **File** – **Save**.

To machine these toolpaths a copy must be saved in your CNC machine format, which will be stored in the computer as a separate file/s.

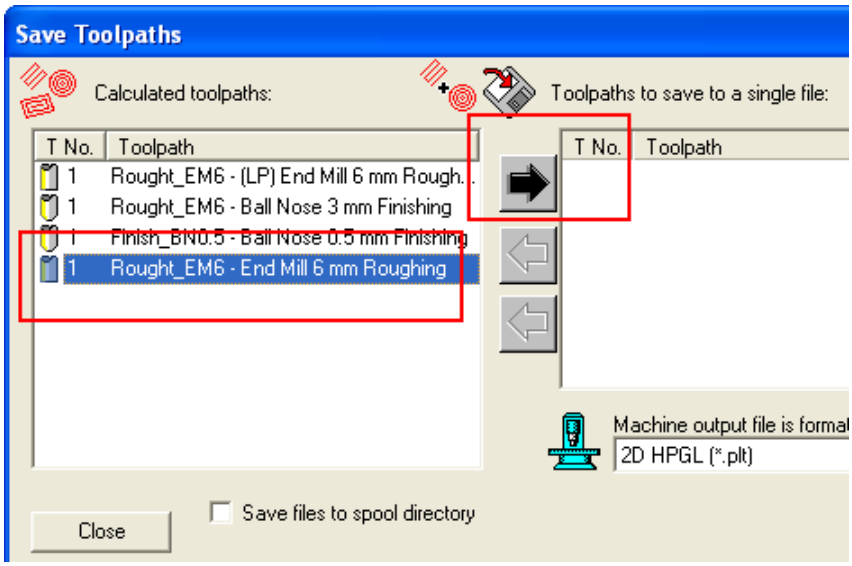
These files can be copied onto the pc that runs the CNC machine and used to machine the model.

- Select **Save Toolpaths** from the **Toolpath Operations**.



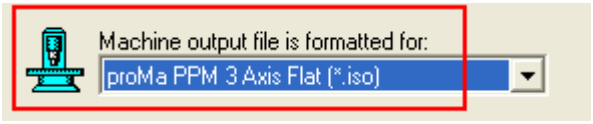
When the **Save Toolpaths** dialogue is opened all the unselected toolpaths generated so far are listed in the left hand window. If one of the toolpaths is currently selected it will appear in the right hand window. Filenames in each window can be selected and transferred from one side to the other using the central **Arrow** buttons.

All the files in the right hand window will be included for output into one machining file. In many applications where the machine tool has a manual tool change it is usually necessary to create a separate output files for toolpaths using the same tool definition. If the machine tool has an automatic tool changer then it is possible to include all the toolpaths in one large output file.

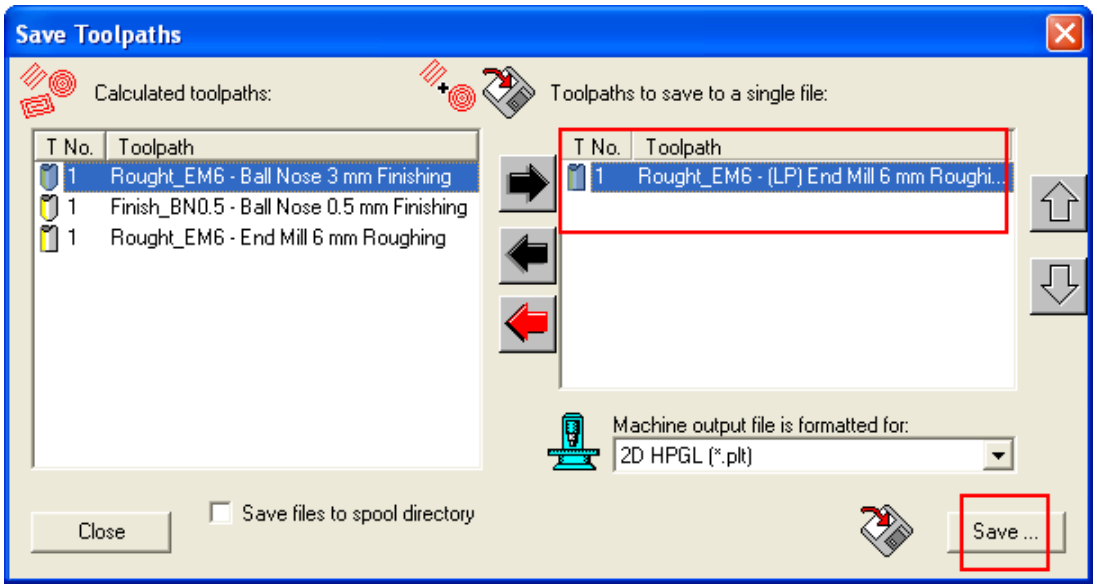


- Select the toolpath – **Rough_EM6 – End Mill 6mm Roughing** and the **right black arrow** to transfer the toolpath to the **right hand window**.

- Make sure **Save files to spool directory** is unticked.



- From **Machine output**, select **Proma PPM 3Axis Flat**.
- Select **Save** from the **Save Toolpaths** form.
- Browse to: **D:\users\training\COURSEWORK\JewelSmith-Jobs** and enter the **File name** as: **Lady-R-EM6**.
- Select the **left black arrow** to transfer the toolpath to the left side.



- Select the toolpath – **Rough_EM6 – (LP) End Mill 6mm Roughing**, press the **right black arrow** to transfer it to right side.
- Select **Save**.
- Browse to: **D:\users\training\COURSEWORK\JewelSmith-Jobs** and enter the **File name** as: **Lady-R-EM6-LP**.
- Select the **left black arrow** to transfer the toolpath to the left side.
- Repeat the same procedure for the remaining toolpaths.

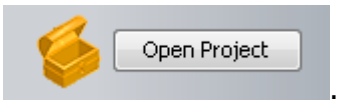
The computer has now stored 4 toolpaths. The files are the ones that you open to run the machine tool, which in this case is a Proma.
The toolpaths can also be saved as a **Template**. This is required when using the **Multi-sided Machining Wizard**.

- Select the toolpath – **Rough_EM6** from the **Toolpaths** area.
- Select **Save Toolpath as Template** .
- Enter as **File name** – **Rough-EM6** and select **Save**.

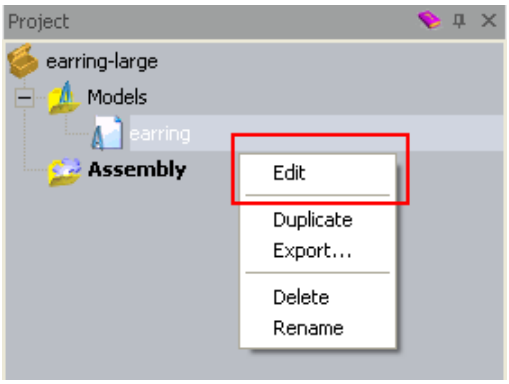
This template can be used for future projects by selecting **Load Toolpath Template** .

- Select **Save** .
- Select **File** – **Close Model**.
- Select **File** – **Close Project**.

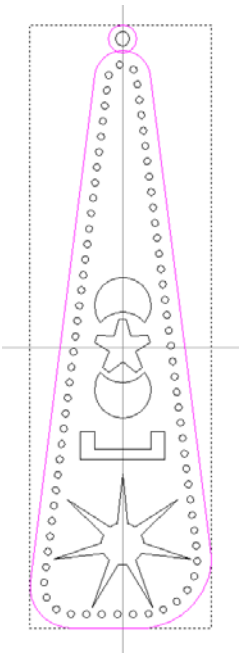
Toolpath generation of an Earring

- Select **Open Project** 

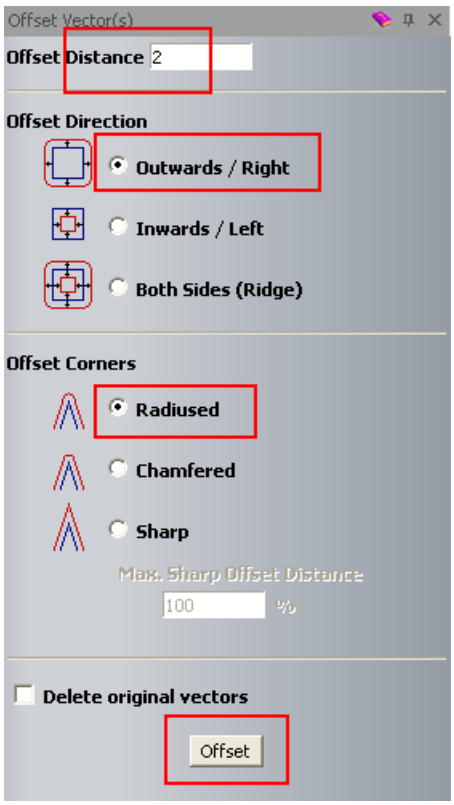
.
- Browse to: **D:\users\trainingArtCAM Data** and select the project **Earring-large.3dp**.



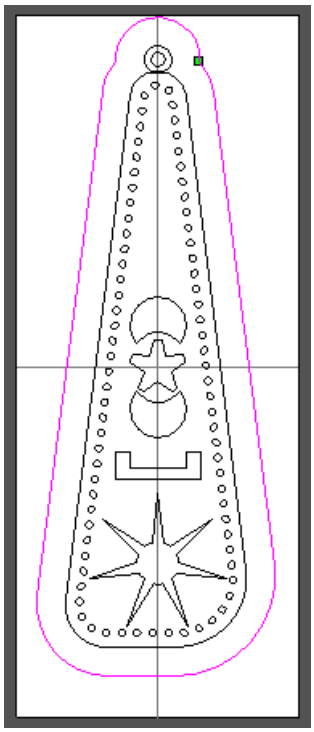
- Expand the **Models** tree and open the model **earring** (right mouse click and select **Edit**).



- Select the **outer vector** and the **top outer circle vector**.
- Select **Offset Vector(s)** .



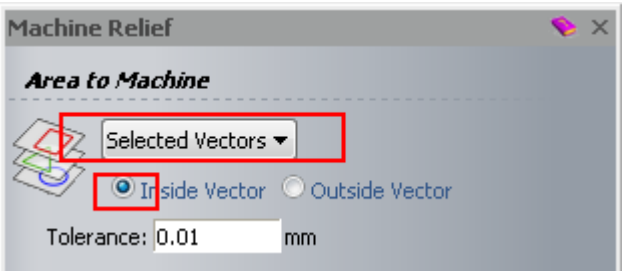
- Enter an **Offset Distance** of **2mm**, **Outwards**, **Radiused** and press **Offset**.
- Select **Close**.



This vector will be used to limit the toolpath.

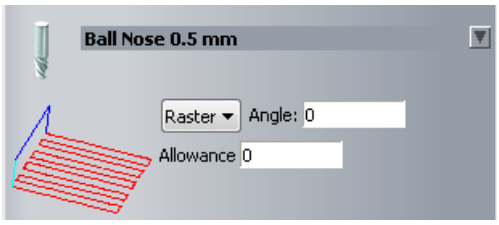
- Right mouse click on the left hand corner of the graphics area and select **Toolpaths** to display the **Toolpaths tab**.

- Select **Machine Relief** .
- Select the **new offset vector**.

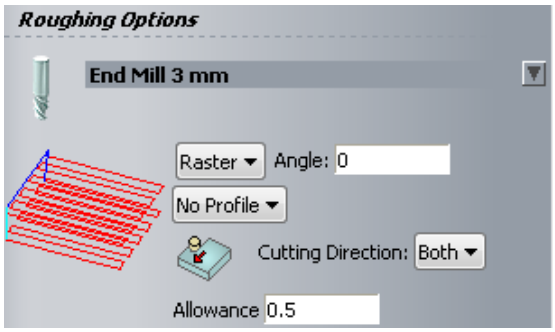


- Select the option **Selected Vectors**.

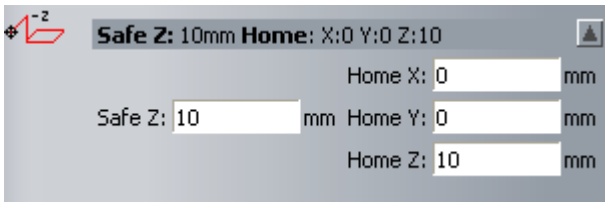
- Keep the option **Inside Vector** selected.



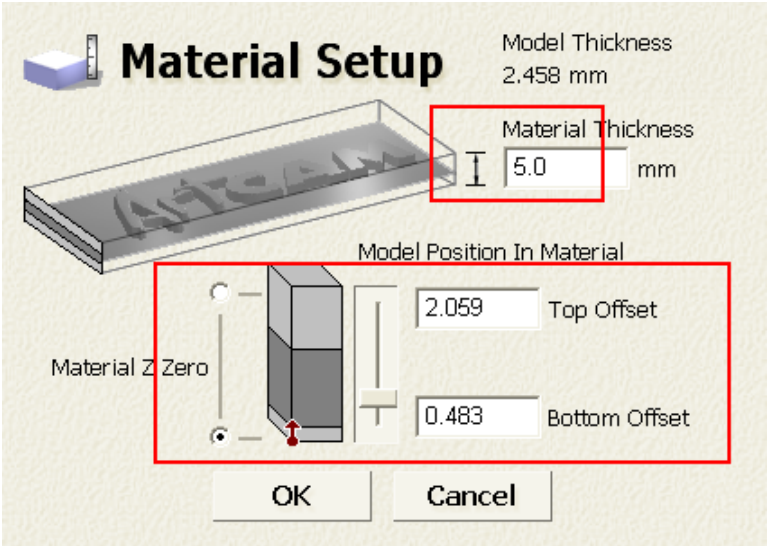
- Select a **Ball Nose 0.5mm** from the **Tool Database**.
- Leave **Raster** as the toolpath strategy, the **Angle** of **0** and the **Allowance** of **0**.



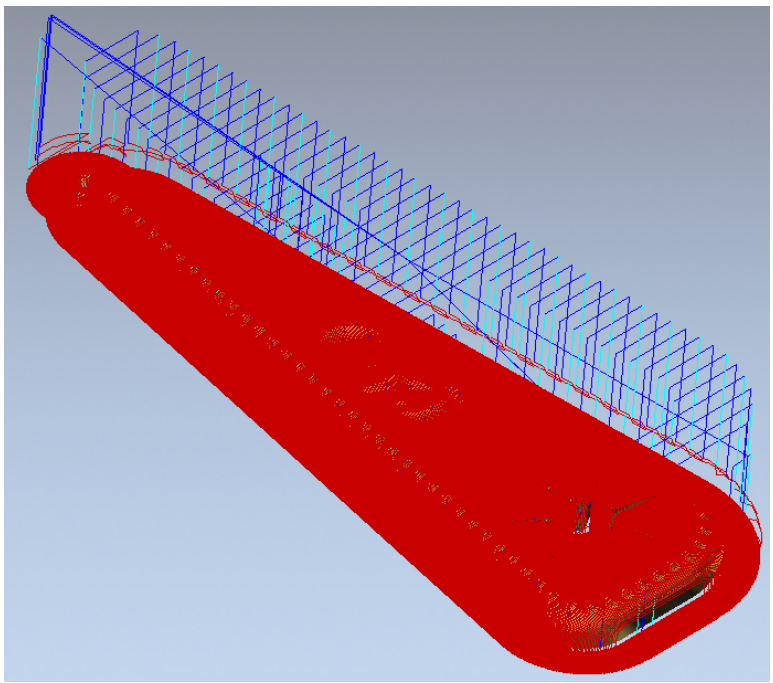
- Select an **End Mill 3mm** as roughing tool from the **Tool Database**.
- Enter an **Allowance** of **0.5mm**.



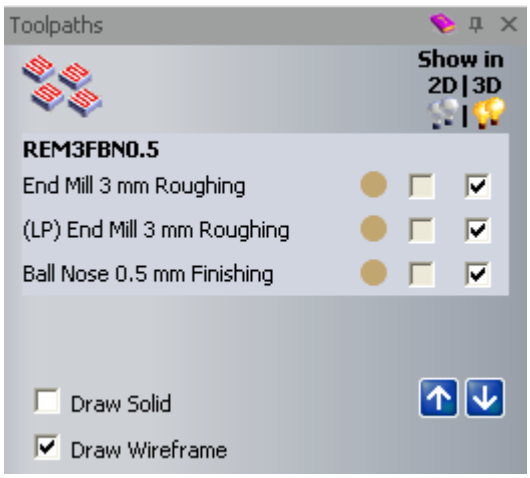
- Set the **Safe Z** as **10**.
- Set the **Home positions** as **X0 Y0 Z10**.



- Enter a **Material Thickness** of **5mm** and move the **slider up** to get an **Offset** position for the **Top** and **Bottom** of the model as shown on the image.
- Select **OK**.
- Enter as **Name** – **REM3FBN0.5**.
- Select **Calculate Now**.
- Close the form.
- Press **F3**.
- Select **Toggle Material Visibility** from the **3D View**.

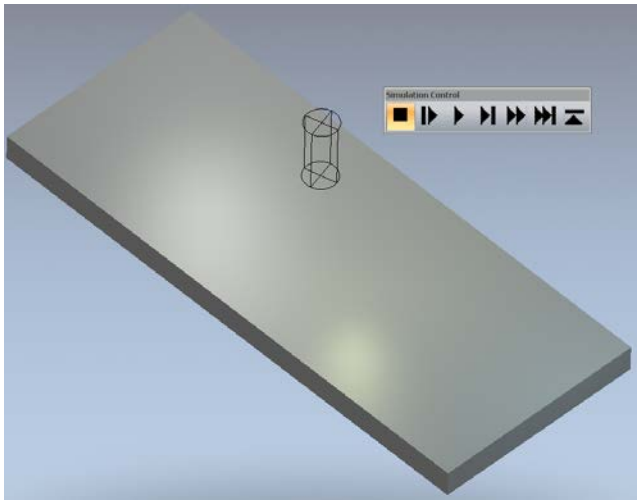


The toolpath has been generated.



- Select the toolpath – **REM3FBN0.5** from the **Toolpaths** list.

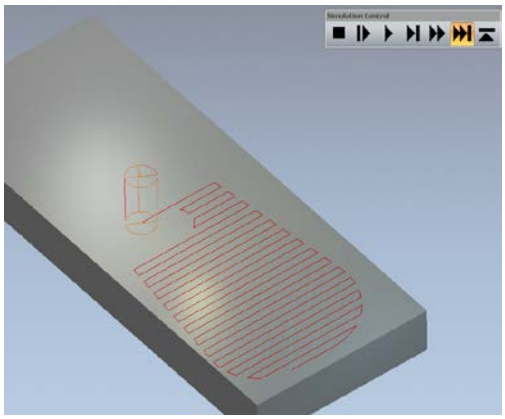
- Select **Simulation Control Bar** from the **Toolpath Simulation** area.

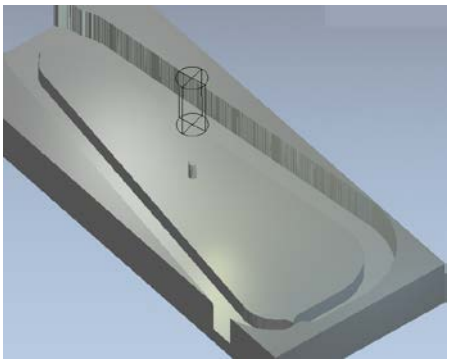


With this option the highlighted tool is drawn (End Mill 3mm first), along with a control panel to control the speed of the simulation.

For example, selecting will simulate at normal cutting speed.

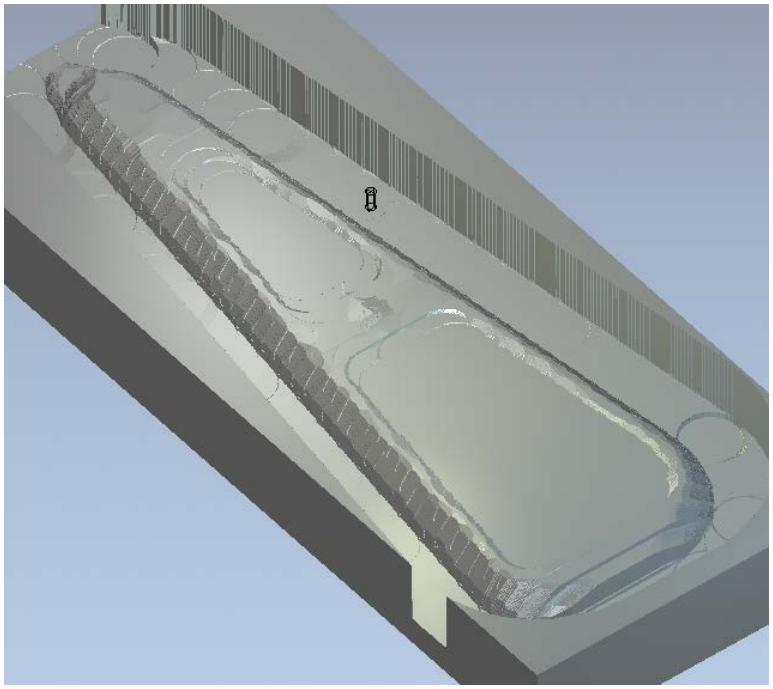
- Select **Run at Max speed to next retract** .





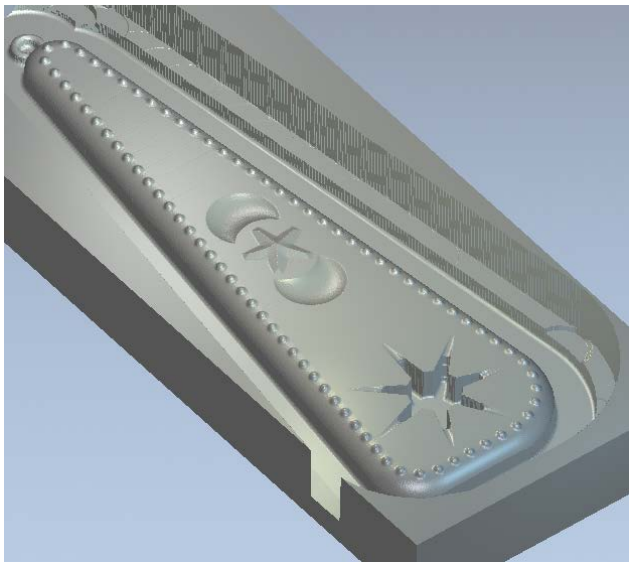
The simulation stops (and retracts) at the end of the first toolpath **End Mill 3mm Roughing**.

- Select **Run at Max speed to next retract** .



The simulation shows the result of the second toolpath strategy.

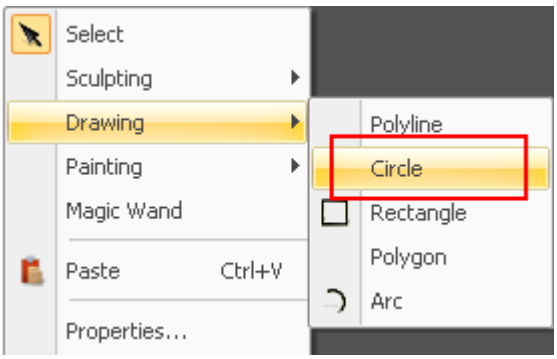
- Select **Run at Max speed to the next retract** .



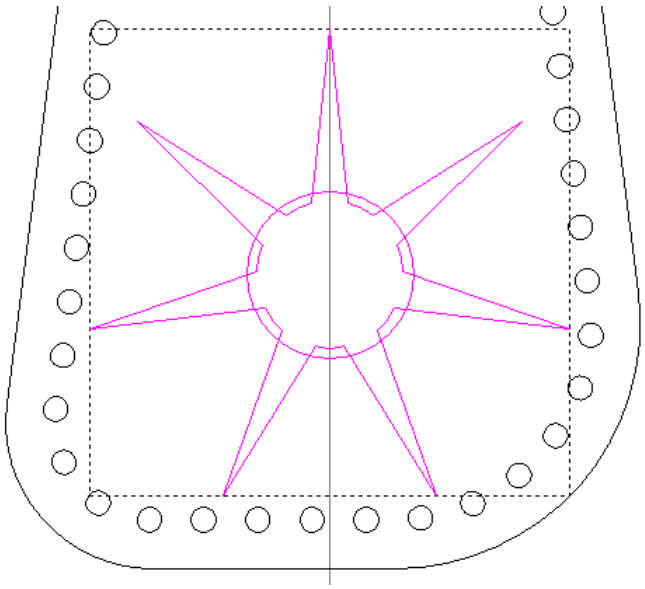
The simulation shows the finished result. It is not necessary to do a simulation if you are confident of the toolpaths, but it is a good visual check.

If the finish toolpath was edited to use a smaller tool, then the machining would take too long. It is better to just machine the areas with a tiny tool that is required. To identify these areas vectors can be drawn around the area in the model.

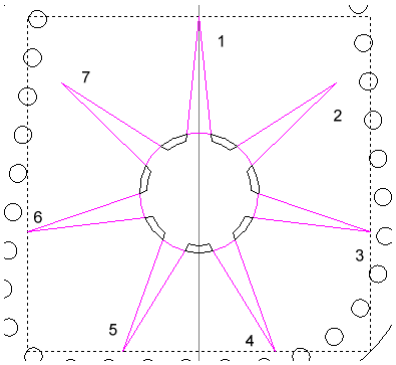
- Press **F2**.



- Right mouse click on the graphics area and select **Drawing** – **Circle**.
- Create a **Circle** at **X0 Y-14** with a **Radius** of **1.7mm**.
- Select **Preview**.
- Right mouse click on the graphics area to accept the new **Circle** and close the form.

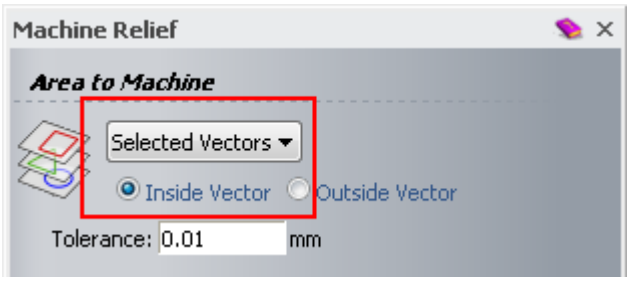


- Select the **new Circle** and the **Star vector** and select **Trim Vectors** .

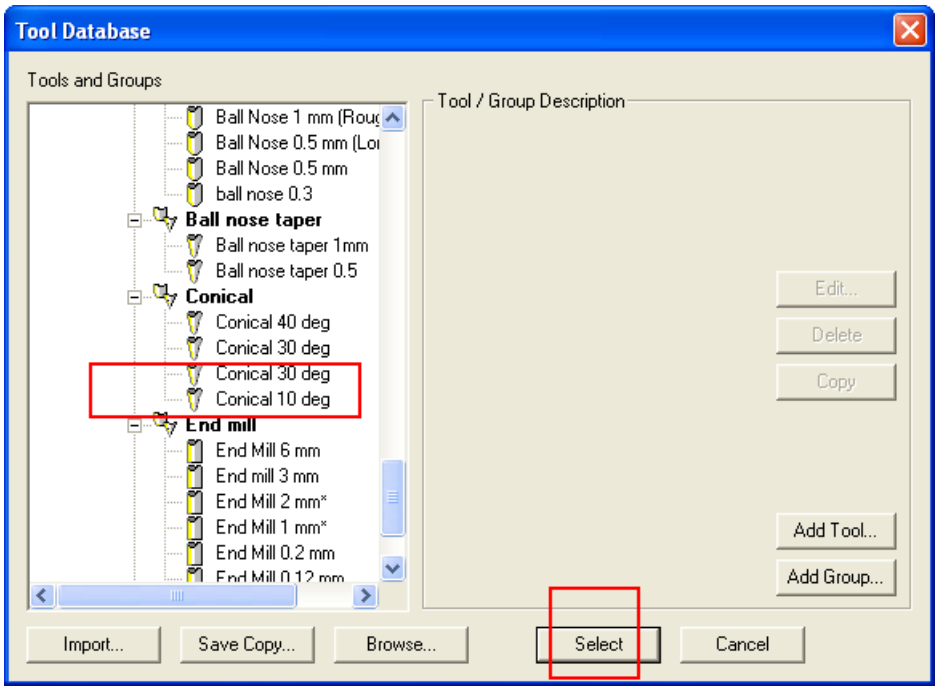


Trim vectors will produce closed vectors to machine inside. If your vectors are not closed then the machining will not be produced.

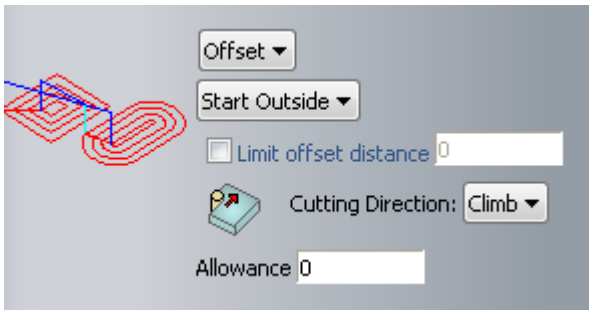
- Select the **seven outer vectors**.
- Select **Machine Relief** .



- Select **Selected Vectors** from the **Area to Machine**.

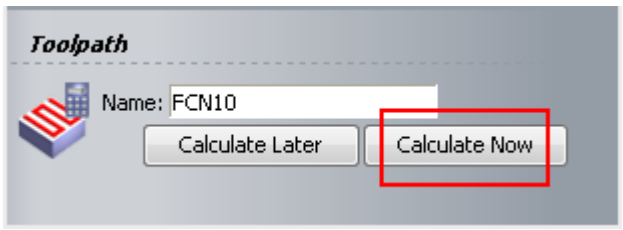


- In the **Finishing Options** select a **10 deg Conical tool** from **Jewellery Tools** – **Wax** – **Alcami Wax – Conical**.

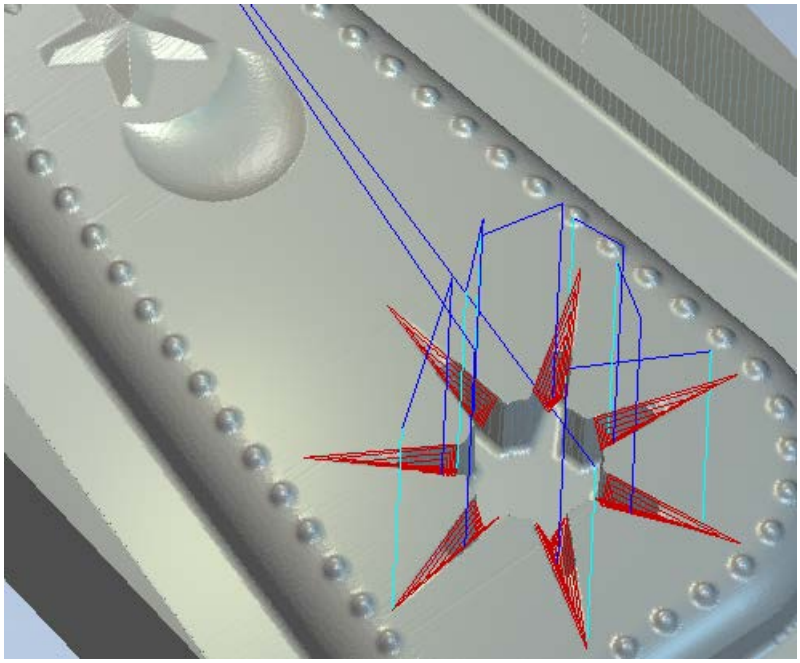


An offset strategy has been selected to ensure the tool follows the vectors to produce a clean cut in the model.

- Select the strategy **Offset**.
- Select **Start Outside**.
- Select **Cut Direction** as **Climb**.
- Select an **Allowance** of **0**.

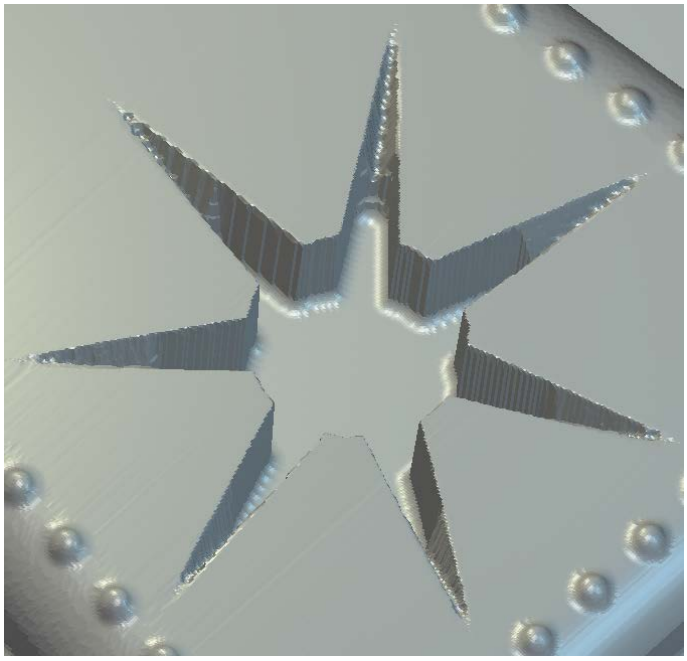


- Enter a **Name** as **FCN10** and select **Calculate Now**.
- Close the form.
- Press **F3**.



The toolpath contain seven areas of machining with tool lifts between each area.
The toolpaths follow the contour of the initial vector.
This new toolpath can now be simulated.

- Select the toolpath **FCN10** from the **Toolpaths** list.
- Select **Simulate Toolpath** .



The toolpaths are now ready to be saved.

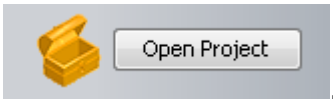
- Select **File** – **Save As**.
- Browse to: **D:\users\training\COURSEWORK\JewelSmith-Jobs** and save the file with the name – **Earring_machined**.

24. Ring flat machining

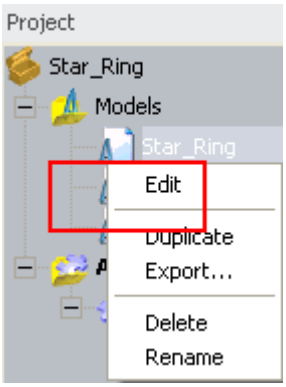
Introduction

The machining of a **ring** is almost the same process as machining a **Flat** piece. **JewelSmith** will turn the moves into rotary automatically when it is output in the **CNC** machine format.

Machining the Star ring

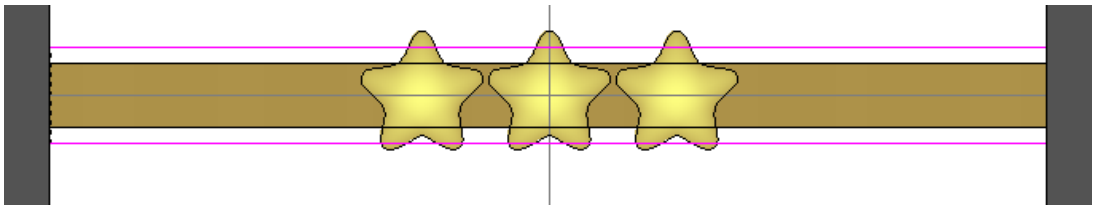
- Select **Open Project** 

.
- Open the saved project - **Star-ring.3dp**.

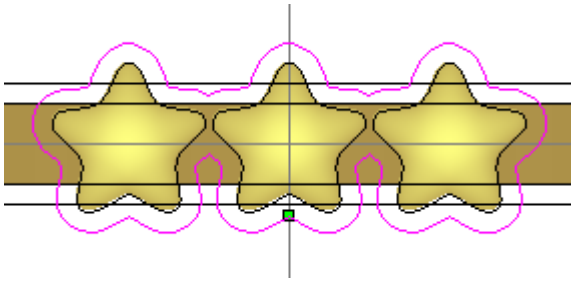


The model has been generated and it is the relief we want to machine. All machining commands are located in the toolpaths tab. Before the machining is generated, a new vector needs to be generated to limit the machining inside it.

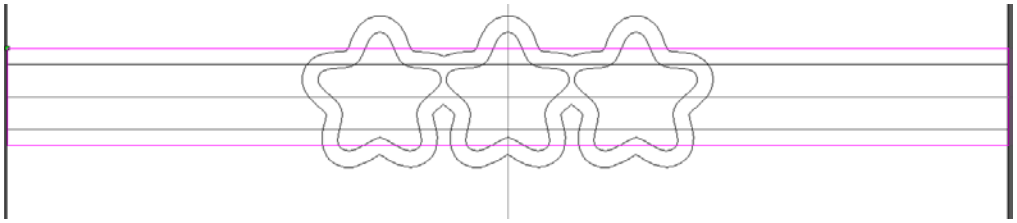
- Expand the **Models** area and open the model **Star-ring**.
- Press **F2**.



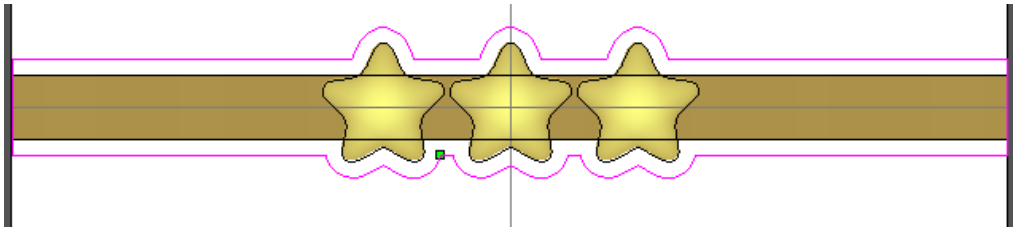
- Select the **top outer horizontal line** and **Offset** it by **1mm Inwards**.
- Select the **bottom outer horizontal line** and **Offset** it by **1mm Outwards**.



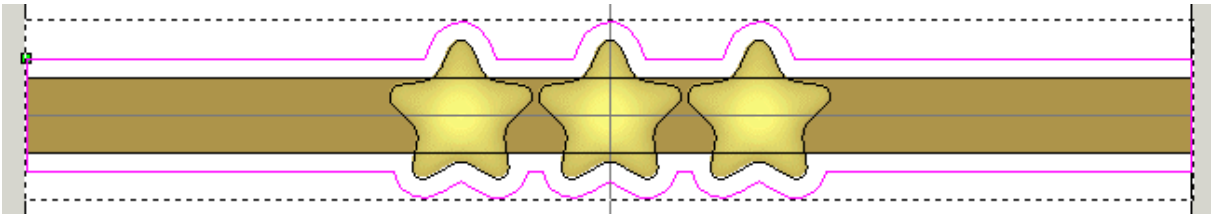
- Select the **three Star** vectors.
- Offset the **Star** vectors **outwards** by **1mm**.
- Close the **Offset Vector(s)** form.



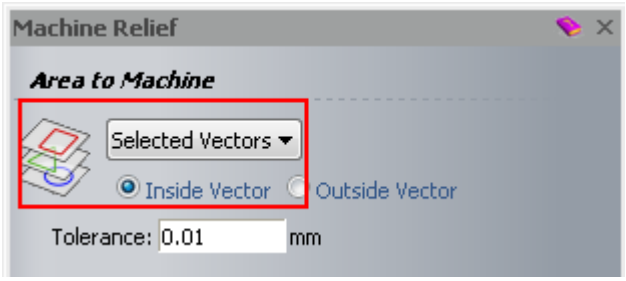
- Close the **new vector** with a **line**.
- Select the **closed vectors** and the **offset star vector**.



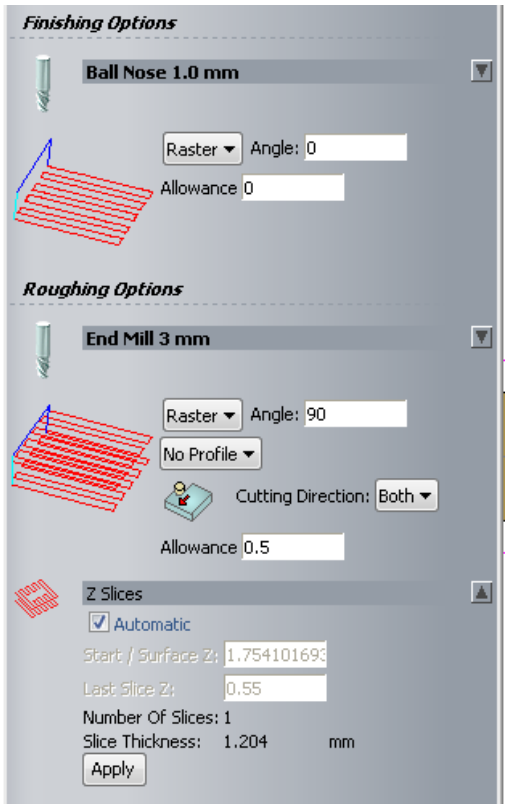
- Select **Weld Vectors** .

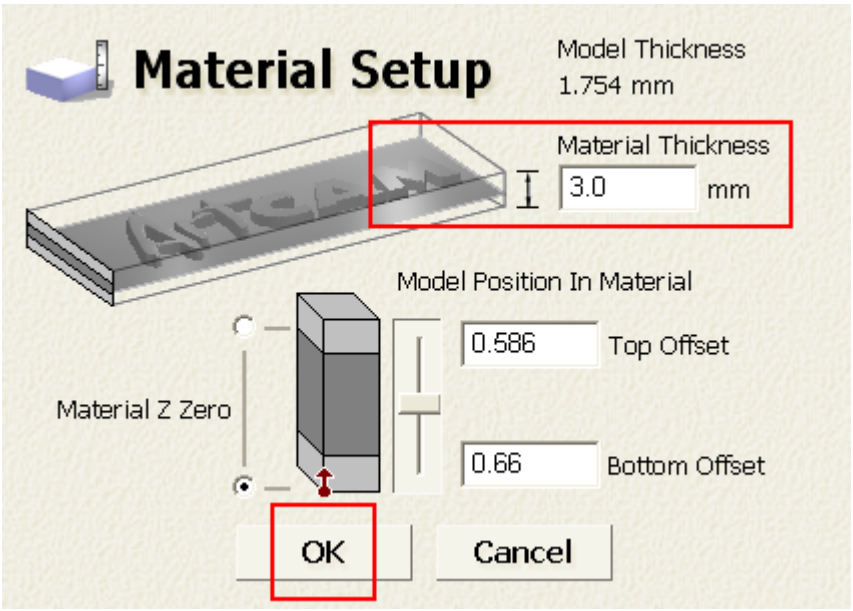


- Select the **Toolpaths** tab.
- Select **Create Machine Toolpath** .



- Select the option **Selected Vectors**.





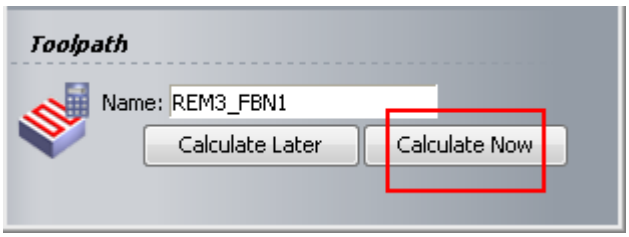
- Select **Material Thickness** and specify the settings shown above.

The Raster angle of 90, makes sure that the toolpath is created across the job, so when it is machining it will machine a pass and then indent around for the next pass.

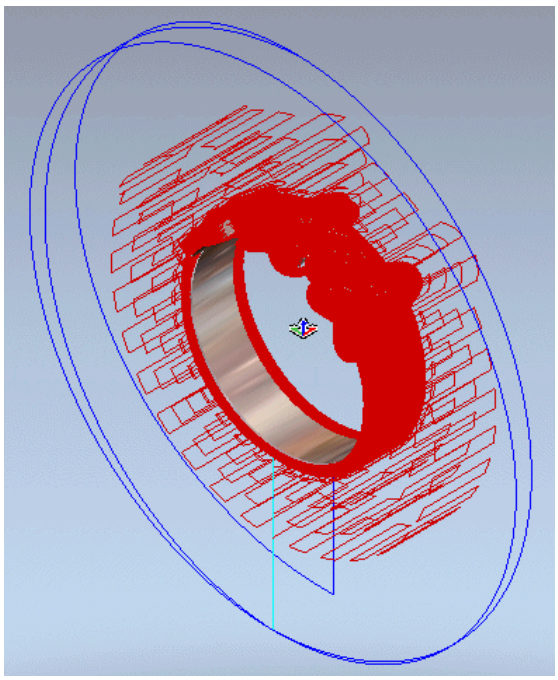
Note: the toolpath is shown in black and is exaggerated for this explanation.

The allowance of 0.25 leaves 0.25mm material on the job for further finishing. If you are using a really tiny tool for the finishing operation, you can reduce this amount to 0.1mm. The tolerance is how closely it machines the ArtCAM model

The Safe Z of 10 is measured upwards from the inside surface of the ring. As the origin of the JewelSmith is in the centre of the model, the home position is left at X 0 Y0.



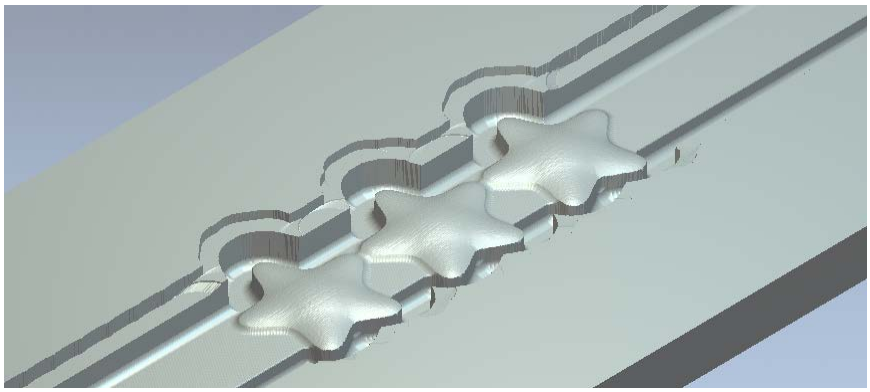
- For the toolpath **Name**, enter **REM3_FBN1**.
- Select **Calculate Now**.

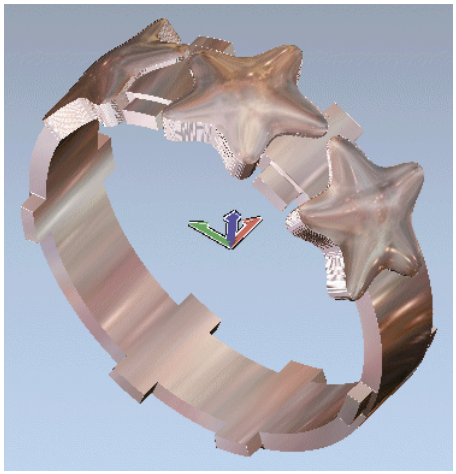


ArtCAM generates the toolpath as red lines in the **3D View**. The dark blue lines are rapid moves in Safe Z and the light blue lines are plunge moves.

The finish toolpath can now be machined.

- Select **Simulate Toolpath Fast** .





The simulation shows the extent of machining on the ring as a flat **Relief** by machining the rough and then the finish toolpath.

Note: Using this process you need to build in **bridges** to support the model when machining. Here some **rectangles** have been **merged** into the model with a height of **0.75mm**.

- If required select **Save the Toolpaths** .
- Select **File – Close Project** and save the changes.

Keyboard Shortcuts

View Control

ArtCAM Function	Shortcut
Display Reference Help	F1
Display 2D View	F2
Display 3D View	F3
Toggle Through Left Panel Tabs (Project, Assistant & Toolpaths)	F4
Toggle Left Panel Visibility (Project, Assistant & Toolpaths Tabs)	F6
Toggle Right Panel Visibility - (Layers & Add In Tabs)	F7
Preview Selected Relief Layer	F10
Toggle All Visibility - Vector Layers	Alt + V
Toggle All Visibility - Bitmap Layers	Alt + B
Greyscale From Composite Relief	Alt + G
Display Add In Tab - (Right Panel)	Shift + F6
Toggle Notes	Alt + N
Refresh Left Panel - (Project, Assistant & Toolpaths)	Ctrl + Alt + Shift + B

Managing Models

ArtCAM Function	Shortcut
Create New Model	Ctrl + N
Open Existing Model	Ctrl + O
Save Model	Ctrl + S
Create New Sheet	Ctrl + Alt + Shift + S

General Editing

ArtCAM Function	Shortcut
Copy to ArtCAM Clipboard	Ctrl + C
Paste from ArtCAM Clipboard	Ctrl + V
Cut to ArtCAM Clipboard	Ctrl + X
Undo Last Action	Ctrl + Z
Redo Last Action	Ctrl + Y
Delete	Delete

Vector Drawing

ArtCAM Function	Shortcut
Create Vector and return to home page	Return
Create Vector and Continue Drawing	Space Bar
Cancel and Return to Assistant's page	Esc
Constrain Angle of Linear Span between Points	Ctrl
Maintain Aspect Ratio	Shift
Close Polyline to form Polygon	Tab

Vector Grouping

ArtCAM Function	Shortcut
Group Vectors	Ctrl + G
Ungroup Vectors	Ctrl + U

Vector Editing

ArtCAM Function	Shortcut
Select Vectors Mode	Esc
Select All Vectors	Ctrl + A
Edit Selected Vector	E
Node Editing Mode	N
Convert Span (Linear or Bezier) to Arc	A
Convert Span (Linear or Arc) to Bezier	B
Convert Span (Bezier or Arc) to Line	L
Cut Span	C
Remove Span	R
Insert Point (Node)	I
Insert Start Point or Set Point (Node) as Start Point	P
Toggle Smoothing on Point (Node)	S
Delete Point (Node)	D
Align Selected Points (Nodes) in X-axis	X
Align Selected Points (Nodes) in Y-axis	Y
Move Selected Vector Up	↑
Move Selected Vector Down	↓
Move Selected Vector Right	→
Move Selected Vector Left	←
Transform Vectors Mode	T
Display Transform Vectors Page in Assistant	T, T
Display Measure Page in Assistant	M
Display Vector Clipping Page in Assistant	Ctrl + Alt + Shift + C
Display Vector Slice Page in Assistant	Ctrl + Alt + Shift + V

Vector Alignment

ArtCAM Function	Shortcut
Centre in Page	F9
Align Left	Ctrl + ←
Align Horizontal Centre	Shift + ←
Align Right	Ctrl + →
Align Top	Ctrl + ↑
Align Vertical Centre	Shift + ↓
Align Bottom	Ctrl + ↓

Bitmap Colours

ArtCAM Function	Shortcut
Toggle Linking Between Primary and Secondary Colours	Ctrl + L
Link All Colours	Ctrl + K
Reset All Colour Links	Ctrl + R

Relief's

ArtCAM Function	Shortcut
Display Shape Editor	F12
Reset Selected Relief Layer	Shift + Delete
Copy Relief	Ctrl + Shift + C
Display Offset Relief Dialog Box	Ctrl + Alt + Shift + O

ArtCAM Cursors

Cursors:

Vector Selection mode cursor → Standard cursor when in Vector Selection mode.

Move Vector cursor → Vectors can be moved when this cursor is visible.

Node Editing mode cursor → Standard cursor when in Node Selection mode.

Span cursor → Available in Node Editing mode, when hovering over a span. It has a specific right mouse click menu to edit spans.

Node cursor → Available in Node Editing mode, when hovering over a node. It has a specific right mouse click menu to edit nodes.

Object Snap Cursors:

Snap to node.

Snap to midpoint of line.

Snap to center of bounding box.

Snap to X axis of start point (for polyline creation only).

Snap to Y axis of start point (for polyline creation only).

Snap to horizontal Guide Line.

Snap to vertical Guide Line.

Snap to intersection of horizontal and vertical Guide Lines.