

PREMILLED GUIDE



Pre-Milled Workflow

- New Job (Fixture is automatically Imported)
 - Fixture must have the CYLINDER_POSITION curve.
- Import .STL File for Milling
- Import Blank File
 - Blank must have the following curves:
 - CYLINDER_ORIGIN
 - PRE_MILLED_POSITION
 - PRE_MILLED_PHASE (**Optional – For Tri-Lobes only**)
- Select Strategy for Milling
- Calculate Machining

Pre-Milled Setup Pre-Requisites

- Fixture File
 - Must be properly orientated with the machine's axes.
- Blank Files
 - One for each blank size
- Information for orientation / positioning
 - Blank – Fixture relationship
 - Drawings with measurements Help
- Generated .STL Files with Interface Geometry
 - 3Shape
 - ExoCAD
 - Dentalwings

Creating your Equipment & Blanks

- It is usually ideal to prepare your Equipment and Pre-Milled Blank files in an external CAD Software and later import it into SUM3D with all of the appropriate information.
- Some examples of this software could be:
 - **Solidworks** – Must be exported in IGES format to maintain curves and layers.
 - **Rhinoceros** – Must be exported in Rhino 4 Format.

Discussion Points

- Equipment Creation (**.EQP Files**)
- Pre-Milled Blank Creation (**.BLK Files**)

EQUIPMENT (.EQP)

The equipment defines:

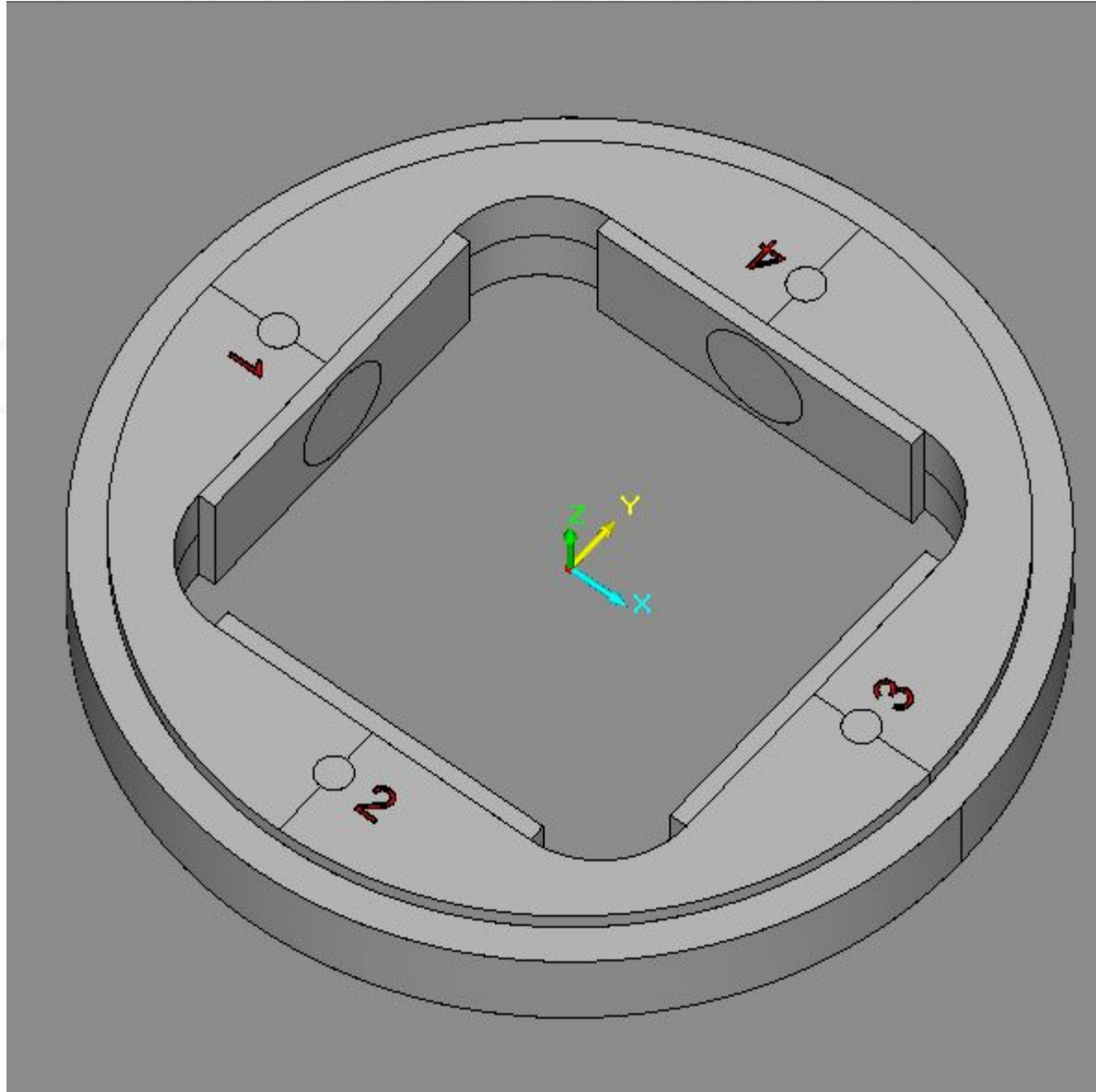
- The number of pre-milled cylinders that can be mounted on the fixture at once
- Where the premilled cylinder/s positions match up with the fixture

If the equipment / fixture only mounts one blank at a time, it must have a curve named **CYLINDER_POSITION**

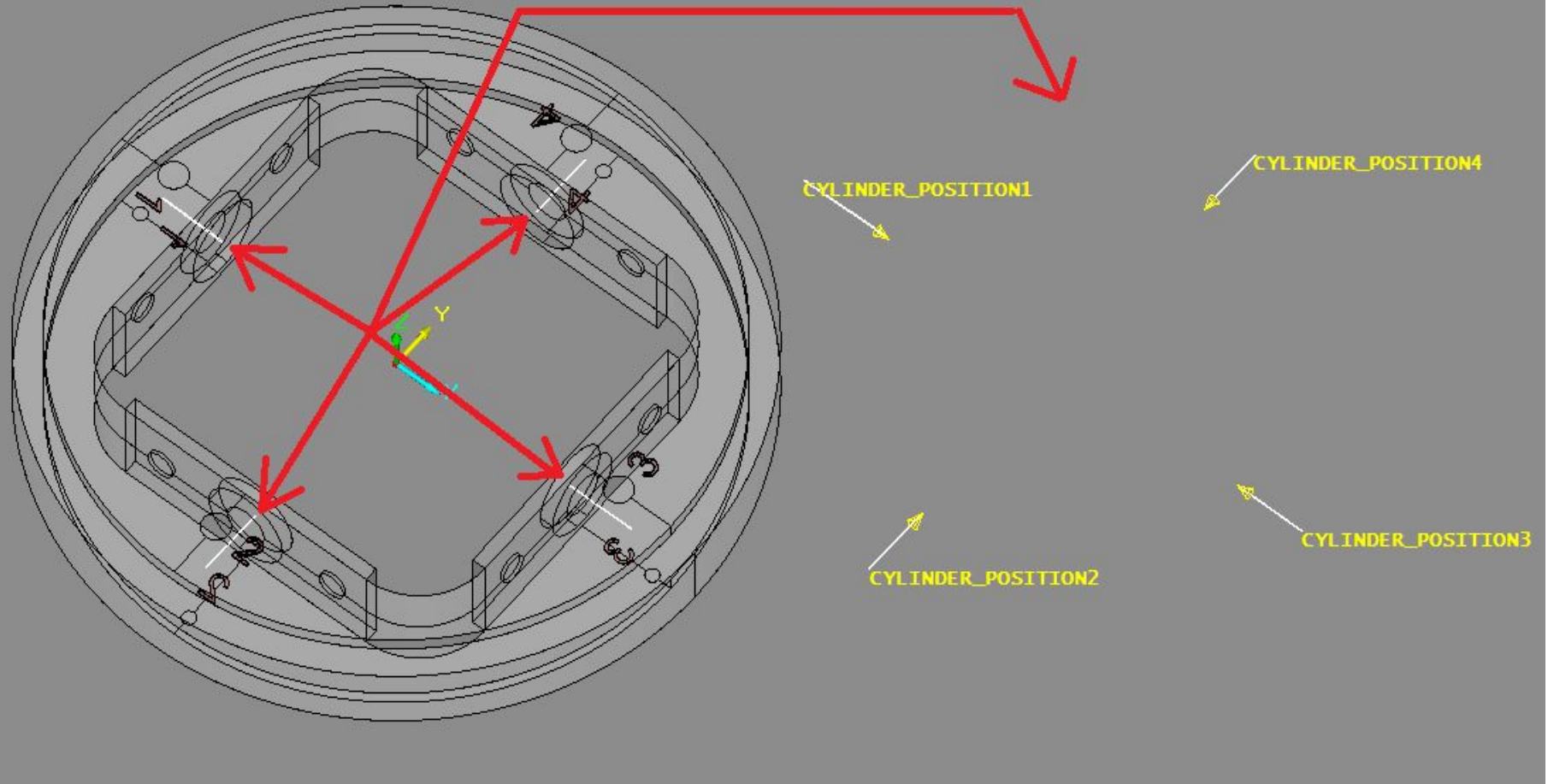
If the equipment can mount more than one premilled blanks at a time, each mounting location will need a curve that will be named in the following format:

**CYLINDER_POSITION1 / CYLINDER_POSITION2 /
CYLINDER_POSITION3** and so on...

(see following pictures)



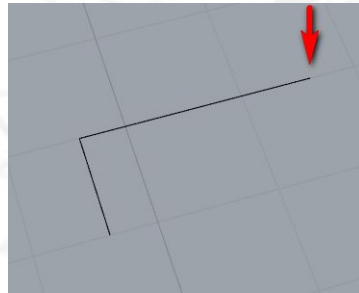
curve CYLINDER_POSITION



IMPORTANT

The Fixture must be orientated to match the X, Y & Z axes exactly as they are laid out in the actual Milling Machine.

The end of the **CYLINDER_POSITION** curve must be placed in the center of the Z axis and exactly where you want the blank's curve to match up to:



A curve in the blank will automatically align to this exact point when it is imported.

The **CYLINDER_POSITION** curve must be reside in the **-DM-Clamps** layer. (The name of the layer is case-sensitive)

IMPORTANT

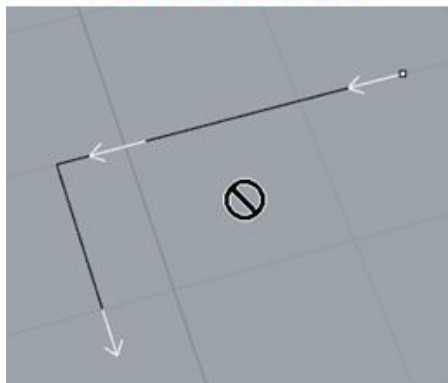
When a new CAM File is created, the equipment should automatically load (thanks to the postprocessor's customization code: **LOADEQP**). The blank will automatically align to the tip of the CYLINDER_POSITION curve.

Pay close attention to the curve direction!

The curve direction should be pointing outward toward the blank. If this direction is incorrect, the imported blank will be placed on the opposite side of the curve, which could be inside of your fixture rather than outside.

The length of the curve is not important. It is the ending point that we are concerned about for placement.

Incorrect



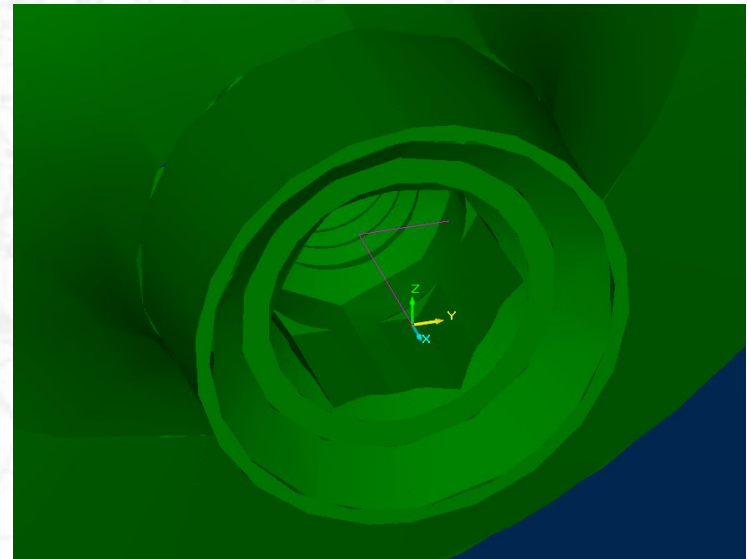
Correct



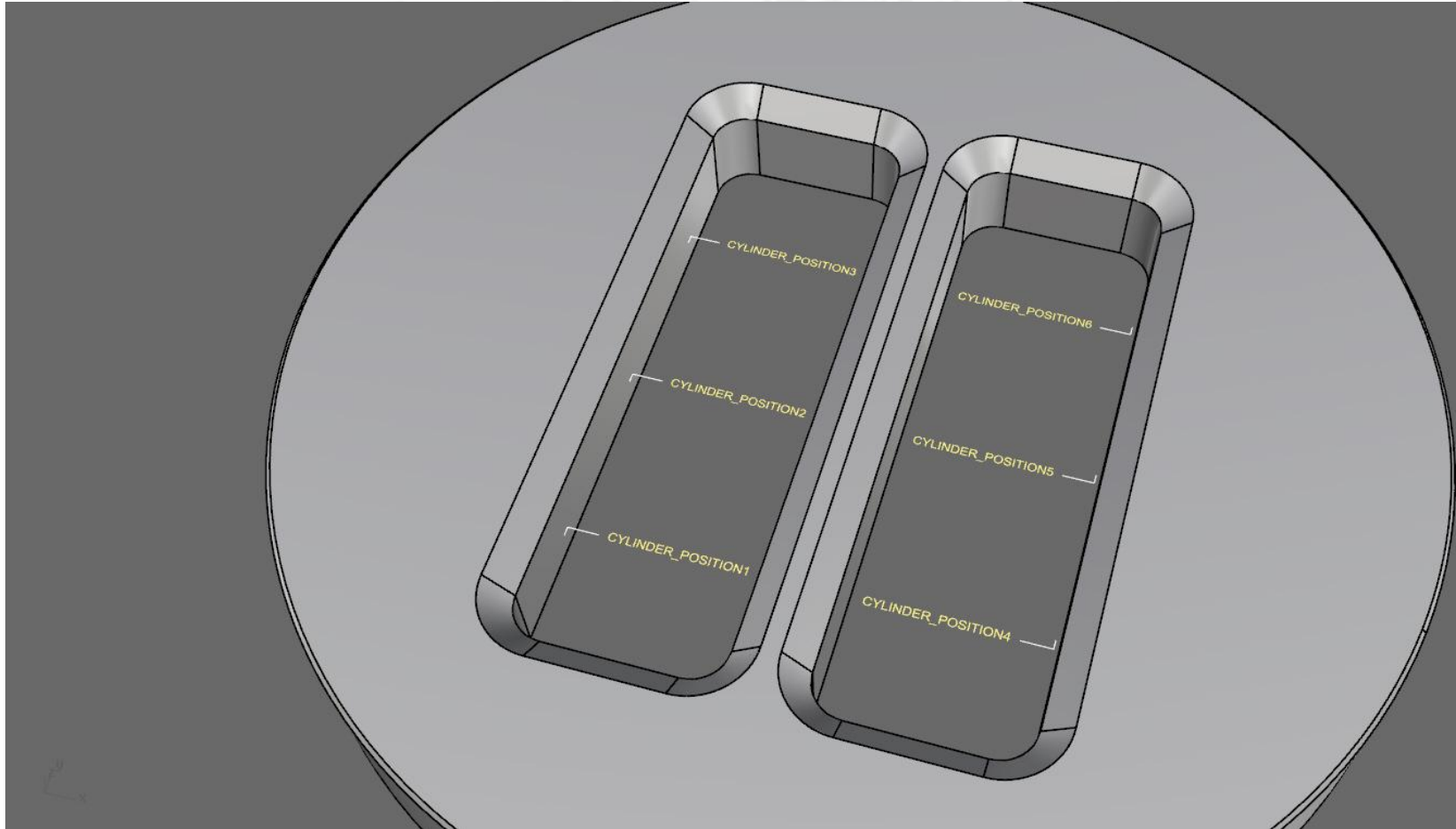
IMPORTANT

The CYLINDER_POSITION curve should have an “L” shape. In this way, in addition to defining the pre-milled cylinder’s position, the CYLINDER_POSITION curve will also be used to orientate the flat surface of the hex which ensures that the facial orientation of the manufactured abutment is correct.

Note: For Trilobes, the anti-rotational feature will be defined by a different curve in the Blank File.



CYLINDER_POSITION curve “L” shape sample

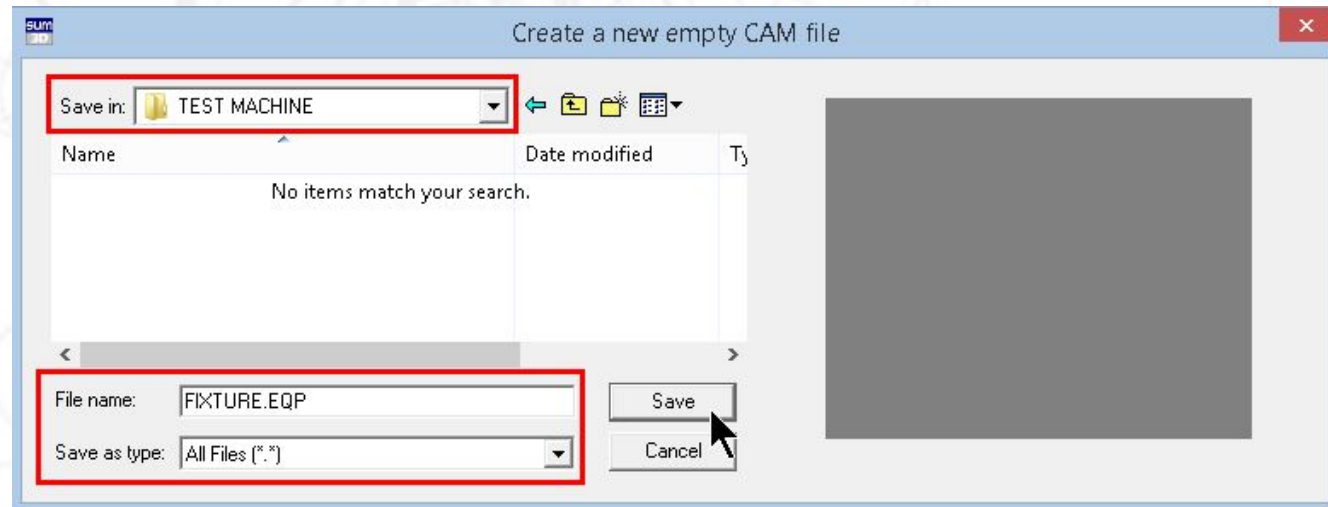
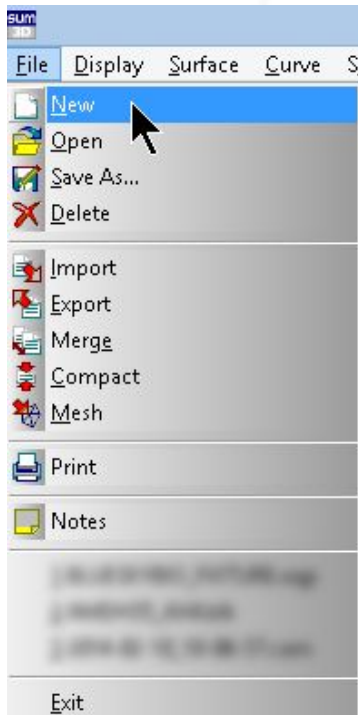


Converting your prepared file into an Equipment File (.EQP)

- Before SUM3D can use your prepared equipment file, it needs to be imported.
- Follow the steps on the following slides to prepare the file in SUM3D for regular use.

Converting your prepared file into an Equipment File (.EQP)

1. Open SUM3D (Maximum Level UI)
2. Go to **File > New** on the File Menu
 - Navigate to the C:\sum\DENTAL\SUP**<MACHINE NAME>** directory and give your fixture a name and change the Save as type to: “All Files”. Don’t forget to include the .eqp as the file extension after the name as shown below:

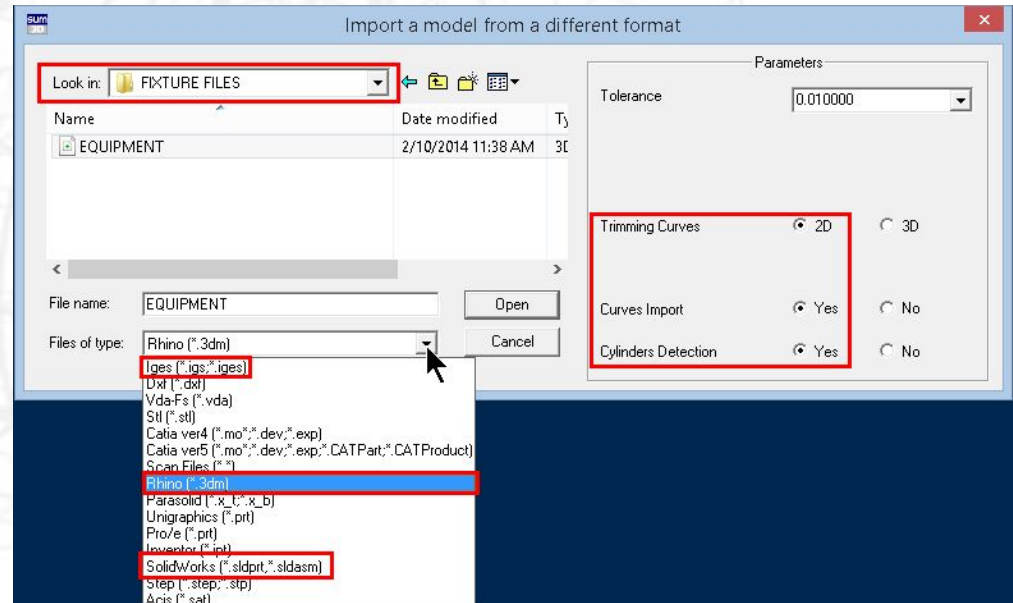
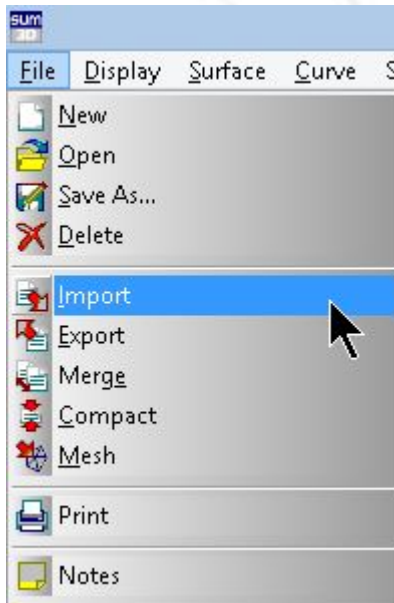


Converting your prepared file into an Equipment File (.EQP)

You should now see a blank CAM file.

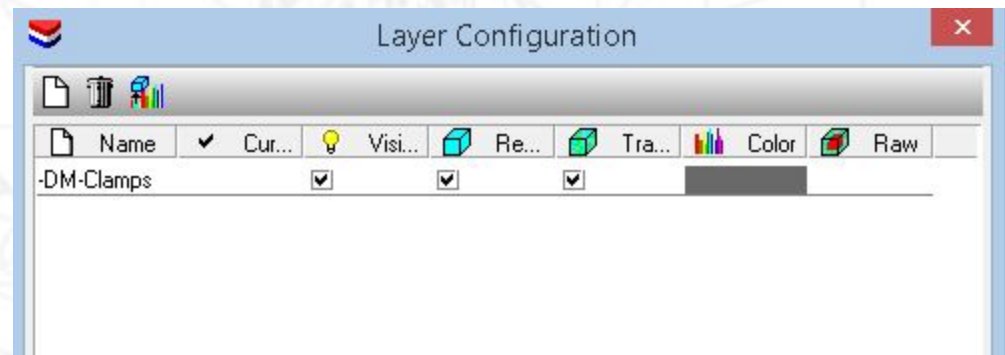
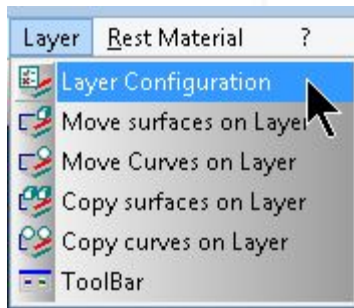
3. Click on **File > Import** on the File Menu

- Change the Files of Type drop-down to match the format that you exported.
- Navigate to the location of your Equipment File that you exported from you CAD Software and select it from the list
- Ensure that your options to the right are all set to Yes and that the Trimming Curves is set to 2D.



Converting your prepared file into an Equipment File (.EQP)

- Check the Layer Configuration to ensure that you have everything assigned to the correct layer (For the equipment this should be in the -DM-Clamps Layer):



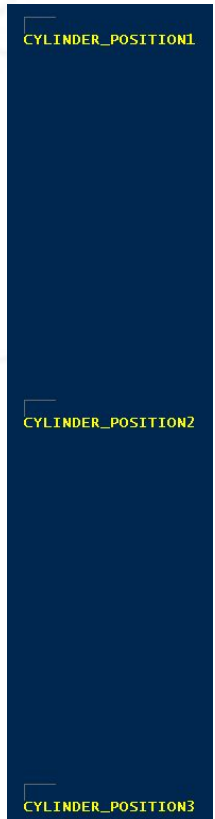
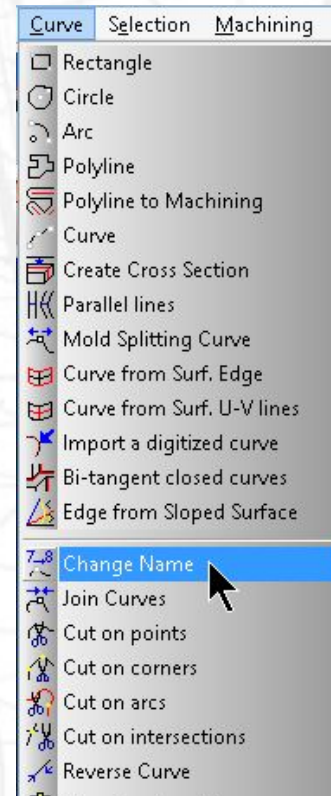
Converting your prepared file into an Equipment File (.EQP)

- Click on Curve > Change Name to check the Names of the Curves to verify that these are correct:

NOTES:

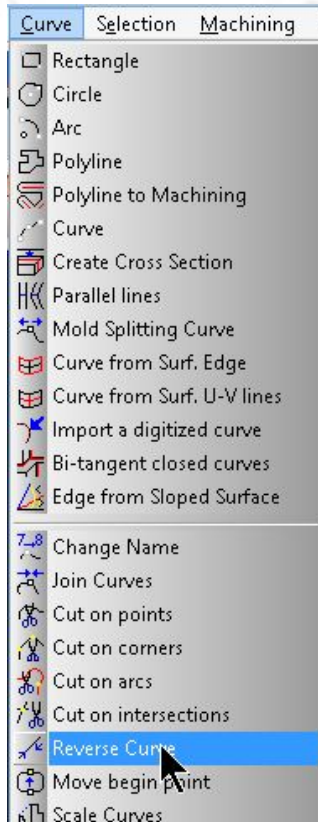
Remember that if you have only one holder, it will be named **CYLINDER_POSITION**

The example screenshot to the right illustrates a fixture that can hold 3 Pre-Milled Blanks at a time.



Converting your prepared file into an Equipment File (.EQP)

- Click on Curve > Reverse Curve to check the Names of the Curves to verify that these are correct:



OK



NOT OK



Converting your prepared file into an Equipment File (.EQP)

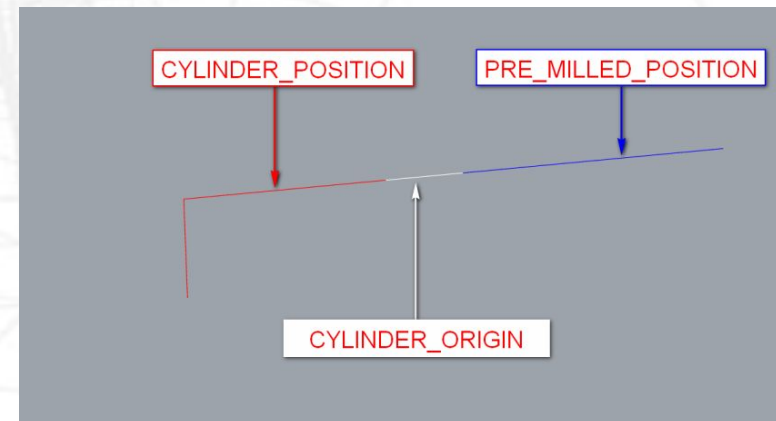
- If the Curves and the Layers are correct, you should be able to simply close out of the SUM3D Software and continue with the Pre-Milled Blank creation.

Pre-Milled Blanks(.BLK)

Pre-Milled Blank Files (.BLK)

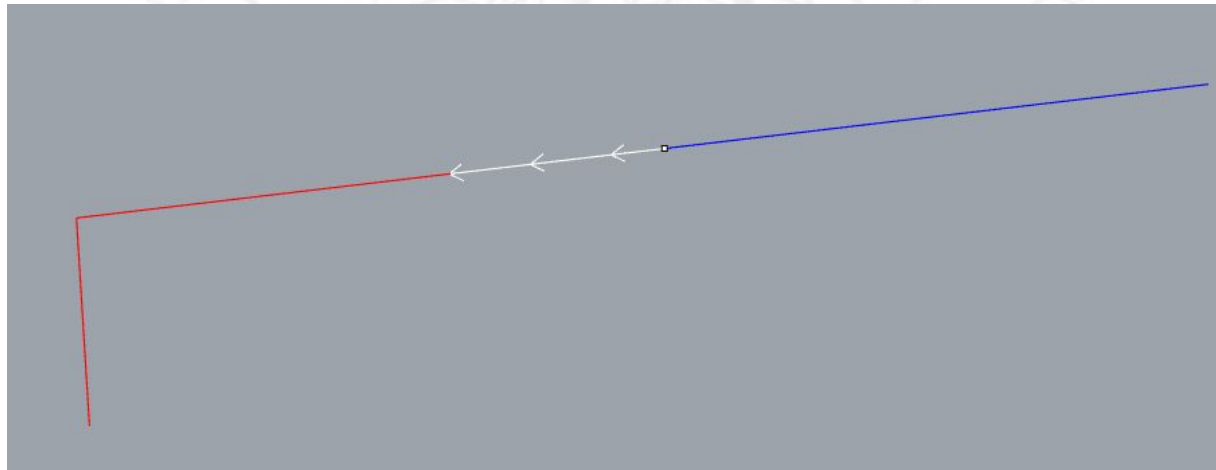
The .BLK file must meet the following requirements:

- The Pre-Milled Blank Surface and Curves must reside within the **-DM-O1** Layer.
 - NOTE: It is -DM-**O1** not -DM-**01** (Letter O, not Number 0)
- If there are protection surfaces, these must be created and reside in the **-DM-Y** Layer.
- The Following Curves must be present:
 - CYLINDER_ORIGIN
 - PRE_MILLED_POSITION
 - PRE_MILLED_PHASE (**Only for Tri-Lobes**)



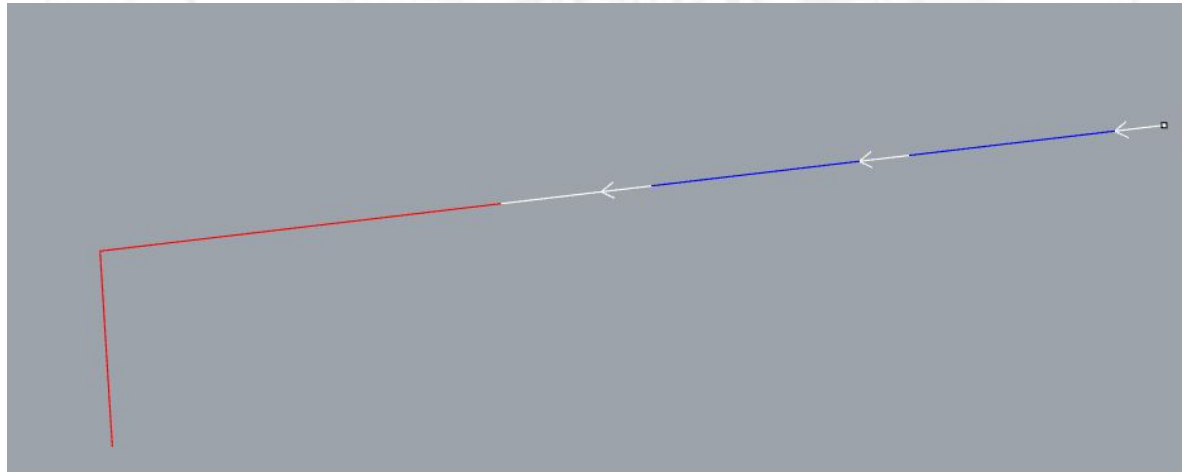
CYLINDER_ORIGIN Curve

- The CYLINDER_ORIGIN curve's purpose is to match up with the CYLINDER_POSITION Curve on the equipment.
- The direction of this curve should be in opposition to the CYLINDER_POSITION Curve on the equipment.
- This curve must reside in the -DM-O1 Layer.



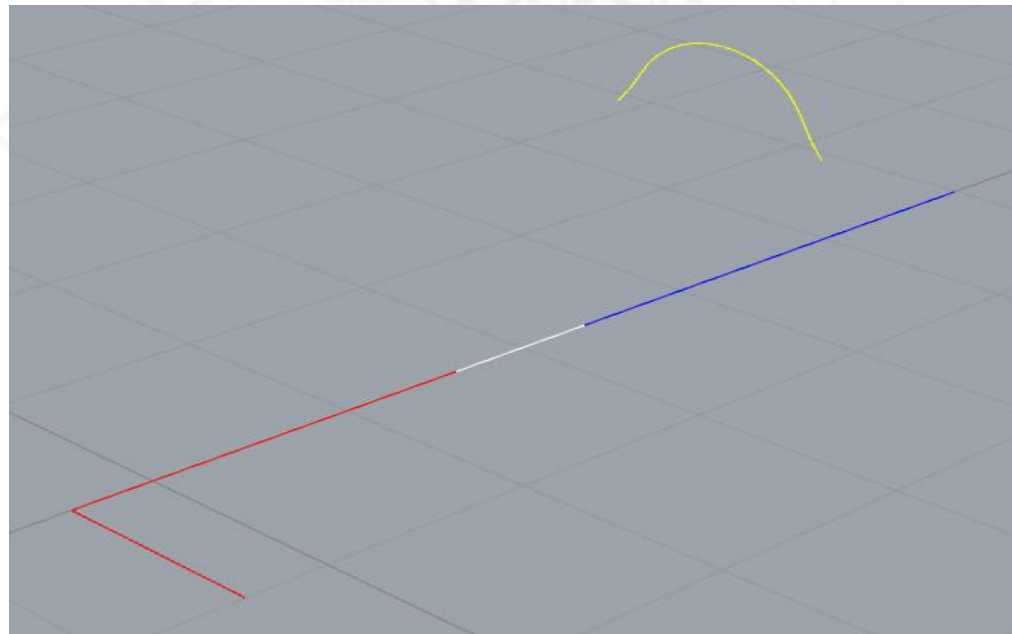
PRE_MILLED_POSITION Curve

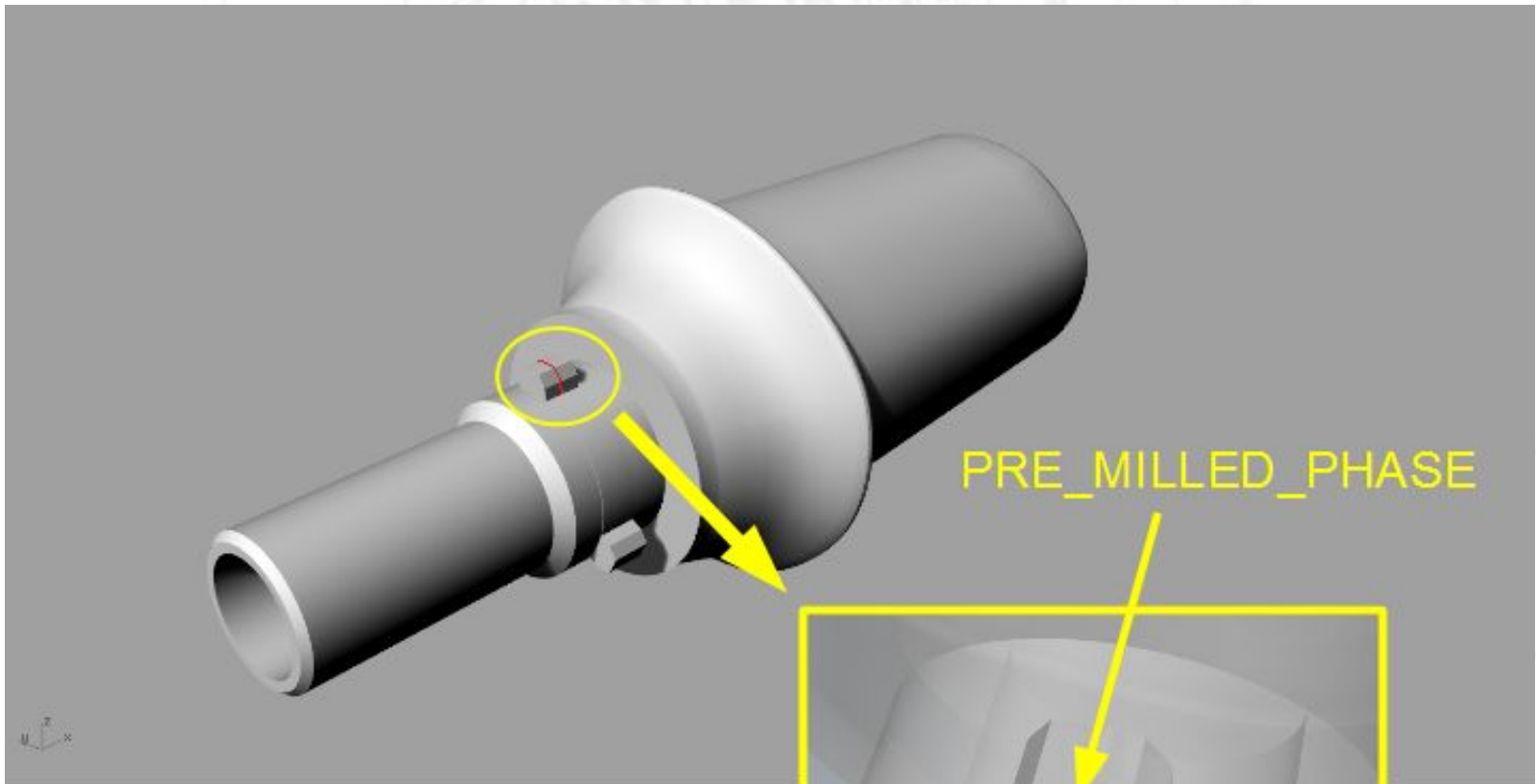
- The PRE_MILLED_POSITION curve's purpose is to place **.STL file** in correct position within the blank. This curve must also reside in the -DM-O1 Layer.

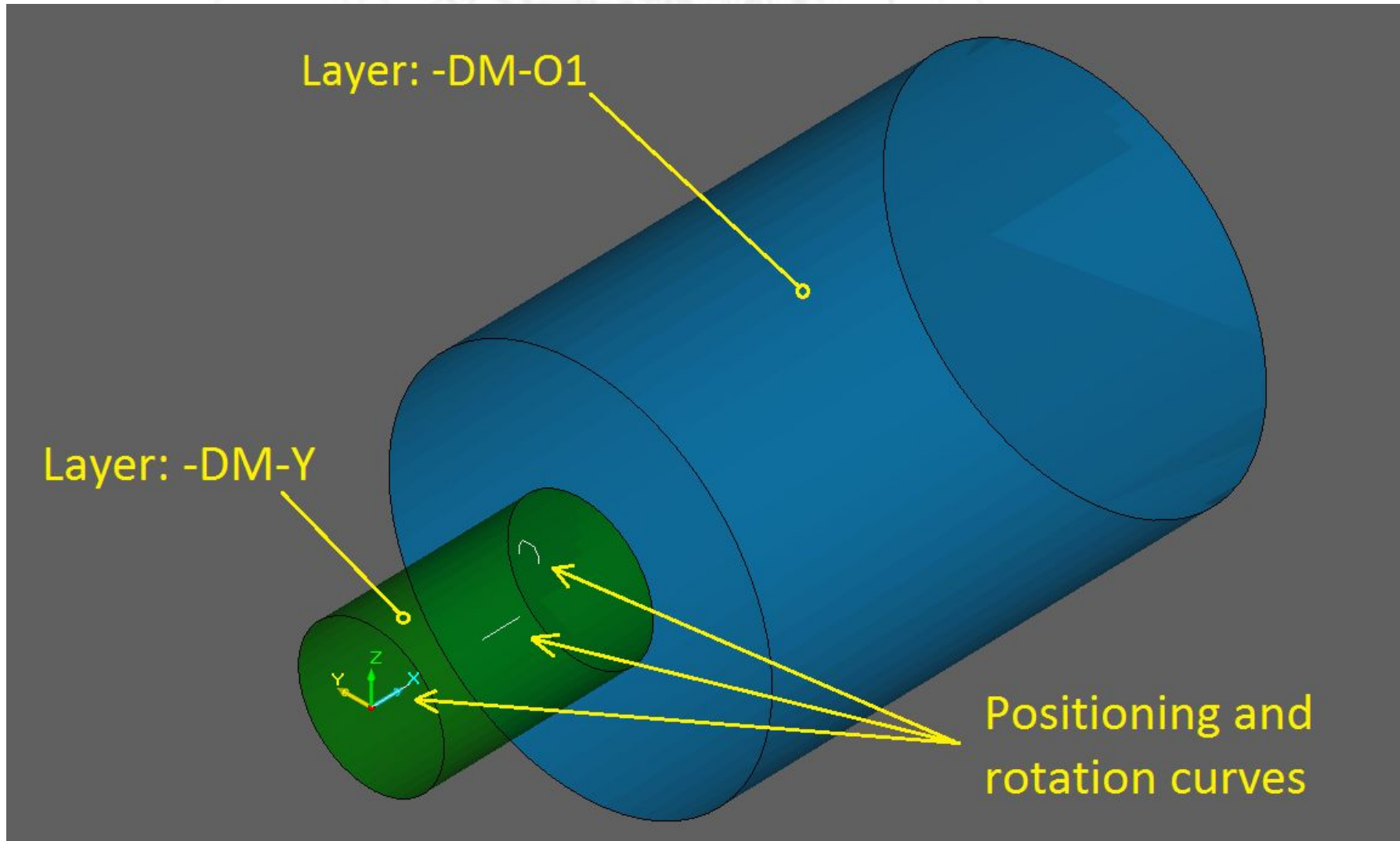


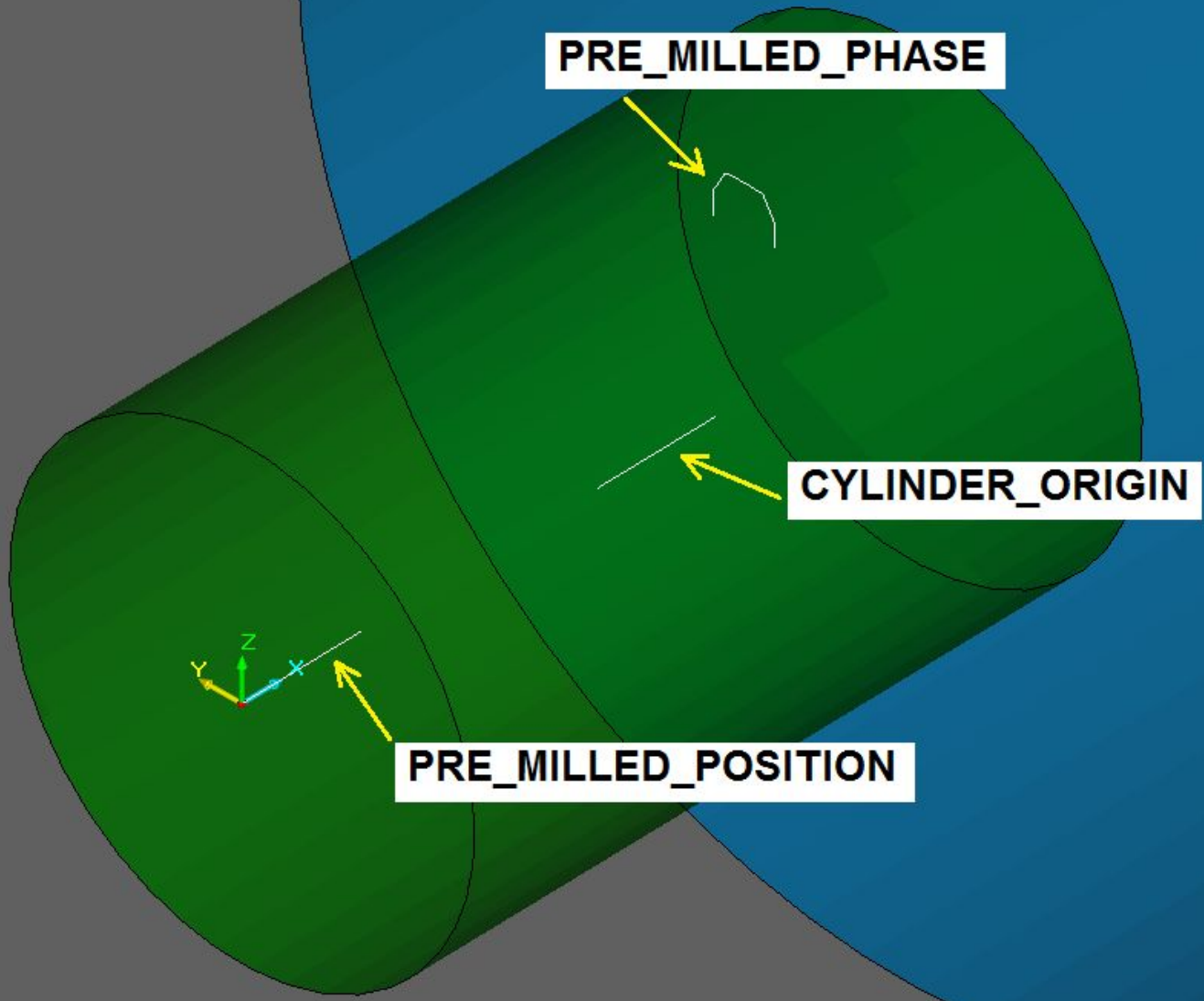
PRE_MILLED_PHASE Curve

- This curve is used to match up the rotation orientation of the tri-lobes (or similar shapes) on an abutment. This curve must also reside in the -DM-O1 Layer









TEST SUM3D - 1.cam

File Display Surface Curve Selection Machining Delimitation Execution Utility Configuration Layer Rest Material ?

Machining
Material: Titan grade 5

Workflow wizard

Layer Configuration







Name	Current	Visible	Rendering	Transparency	Color	Raw
-DM-clamps	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
-DM-01	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
-DM-Y	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		

Diagram illustrating the mapping of layer configurations to machining parameters:

- Red arrows point from the **Raw** column of the Layer Configuration table to the **PRE_MILLED_POSITION** parameter.
- Red arrows point from the **Color** column of the Layer Configuration table to the **PRE_MILLED_PHASE** parameter.
- Red arrows point from the **Color** column of the Layer Configuration table to the **CYLINDER_POSITION1** parameter.
- Red arrows point from the **Color** column of the Layer Configuration table to the **CYLINDER_ORIGIN** parameter.
- A green arrow points from the **Raw** column of the Layer Configuration table to the **CYLINDER_POSITION1** parameter.

4,3

1

CYLINDER_ORIGIN and PRE_MILLED_POSITION

For both these curves, the “hook” is corresponding to their ends.

The **CYLINDER_ORIGIN** curve is used to place the object at the end of the CYLINDER_POSITION curve, that is located on the equipment (that must be imported into the working file before the abutment import and before the cylinder stock import).

The **PRE_MILLED_POSITION** curve is used to reposition the abutment that has been imported. The end more “external” of the abutment hole axis (or another cylindrical part) is positioned at the end of this curve.

PRE_MILLED_PHASE

Previous picture also show an additional curve (not mandatory), it's the PRE_MILLED_PHASE curve.

It allows to orient the “timing” of the imported abutment in order to correspond to the “cylinder” timing.

If this curve is not there, the “timing” executed during the abutment import remains applied, otherwise a correspondence between the shape of curve PRE_MILLED_PHASE (whose orientation is not important) and the shape of imported abutment is searched.

The PRE_MILLED_PHASE curve must represents a portion of the abutment geometry, enough to determine the unequivocal correspondence to the shape of the imported abutment.

IMPORTANT

The PRE_MILLED_PHASE curve must be positioned in same area in which the corresponding part to be coupled (it's into stl file to import) will be placed, in order to be able to determine the unambiguous correspondence with the shape of the imported abutment.

If that curve were to be placed in a not correct point, a "matching error" message will appears during the blank import (cylinder premilled. "blk").

Enhancement 2015

In order to allow to correctly position the "pre-milled abutments" even when it is expected that the interface (connection) type in the STL file has wrong or possibly unknown sizes, has been added the capability to add to the name of the connection positioning curve in the .blk (pre-milled cylinders) files, a key that allows to "click" a point on the STL connection interface, that will be moved to the curve position. The key to add to the "PRE_MILLED_POSITION" curve is "_PICK".

If SUM3D detects that the positioning curve in the ".blk" file has name "PRE_MILLED_POSITION_PICK", wait for the manual "picking" of a point on the connection, that will be moved (with all the abutment) to the end of the curve PRE_MILLED_POSITION_PICK.

Enhancement 2015

In the creation of the BLK files (cylindric blanks) for the pre-milled abutments, it's now possible to insert, in the field for the name of the PRE_MILLED_POSITION curve, a diameter and depth for the detection of the coupling plane, useful for the correct positioning of the abutments with "internal" type interface

Example:

PRE_MILLED_POSITION_3.8_5.5

it means that at the end of the curve will be located the coupling plane of the abutment, reachable in the space defined by the given "diameter" and "depth" values: 3.8 mm e 5.5 mm

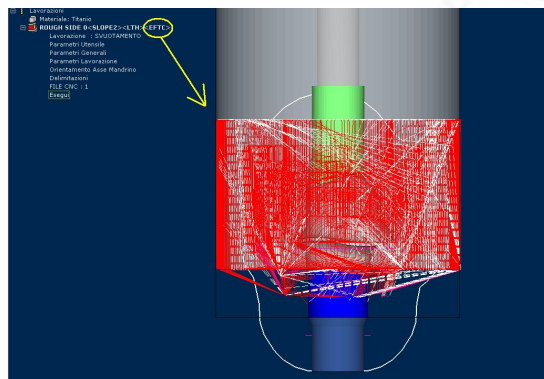
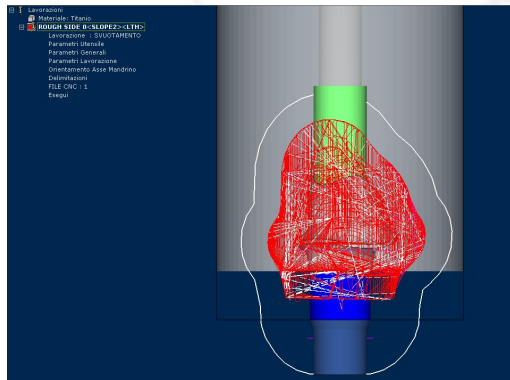
The "_" letter is used as separator among the key PRE_MILLED_POSITION, the value for diameter and the value for depth

The detection method for searching of the coupling plane is the same already used in the "REPLACE" operations, for the "internal" type interfaces

Machining Strategy

<EFTC>

(Extend Fence To Cylinder)



Option for 4 axis continuously 360 degree (like a lathe)

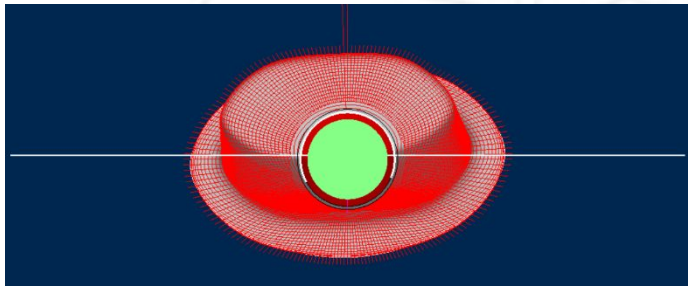
If you have a 4 axis machine, the rough process need to be modified with EFTC so the material will be remove completely for the right finishing. (see the picture)

Otherwise some material doesn't allow the right finishing process.

Machining Strategy

<PREM2>

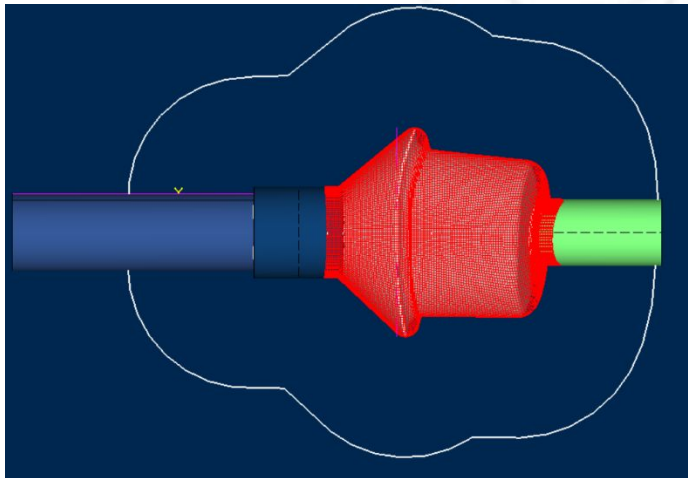
<PREM2/ang1/ang2/step/oversize><PD..>



•**ang1**
tool axis rotation angle related to the machining angle. Normally it's zero

•**ang2**
angular pitch along the points of spiral's turns applied after previous longitudinal movements

•**step**
step (millimeters) of spiral's coils



•**oversize**
oversize material to left in longitudinal movements that will be removed by spiral movements

•<PD...>
Previous **Diameter**, diameter of previous used tool, in case of similar machining in sequence with tools of different diameters (bigger diameters). In this case machining will be applied only where a bigger previous tool didn't properly finish the surface.

Machining Strategy

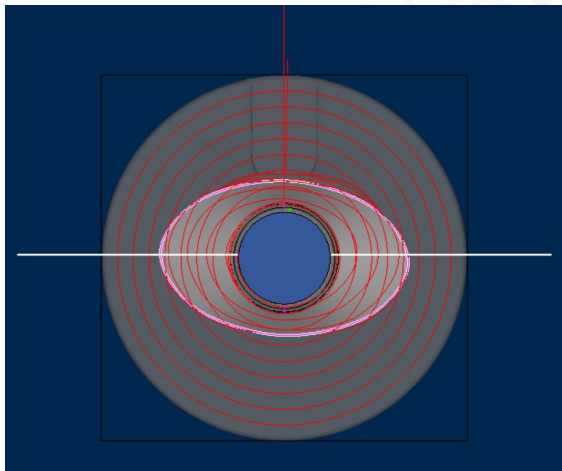
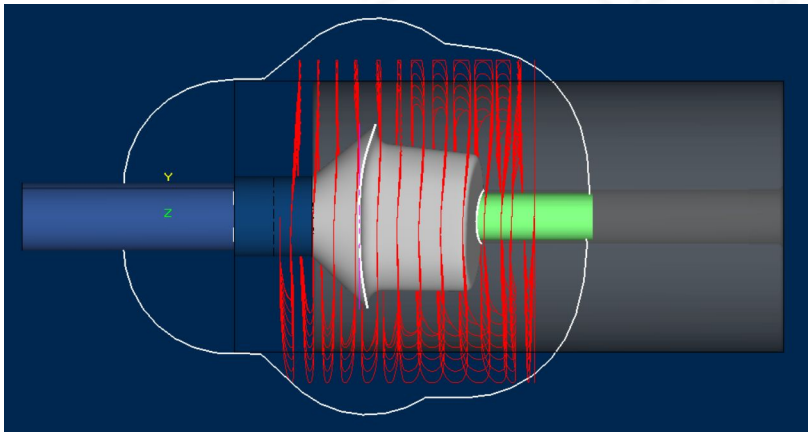
<PREM2>

<PREM2/ang1/ang2/step><SO><ZI0.5>

ROUGHING 4 AXES

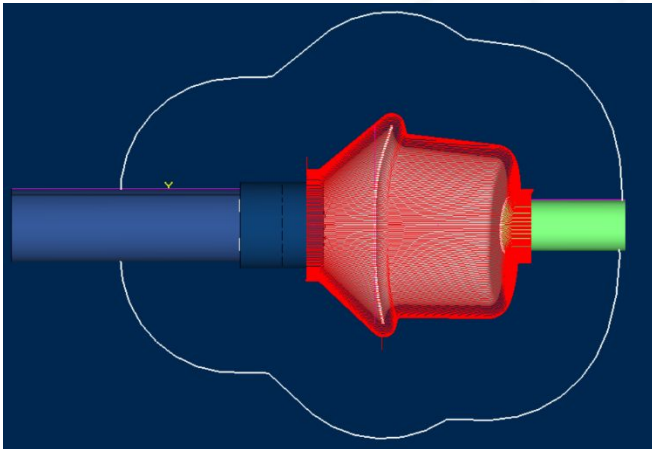
ZI...

Z Increment with the increment value between passes



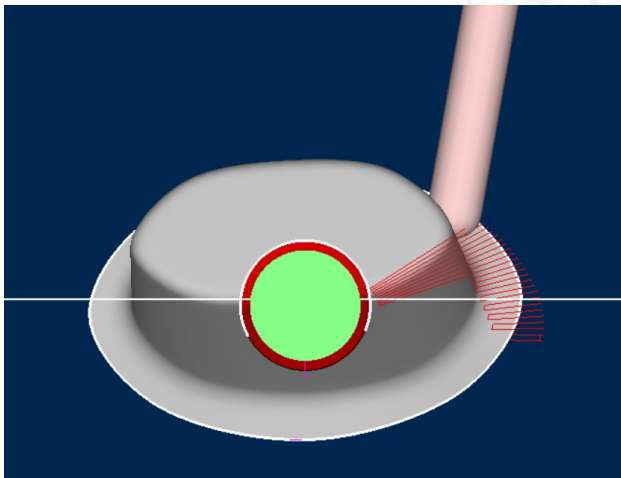
Machining Strategy

<PREM3>



This machining operation allow to mill in 3 axis <PREM3> or in 4 axis <PREM3/...>. The fourth axis will be inclined in order to mill under the equator.

Sample: <PREM3/10> the angle will be inclined 10 degree in order to machining better the area near the equator (top-bottom)



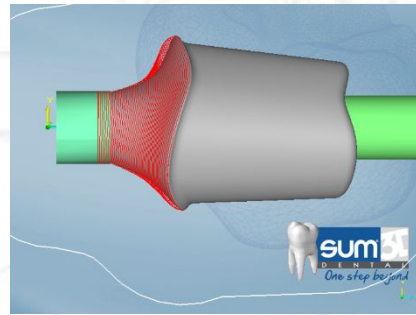
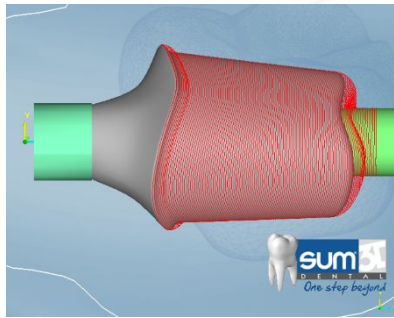
Machining Strategy

<SO>

Spiral only

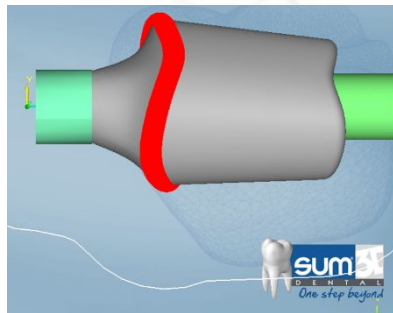
Option for the 4 axis
machining (lathe)

Machining Strategy



This machining operation allow to handle the finishes of some areas such as the separation between modeling and the emergency profile.

<EMx/y>

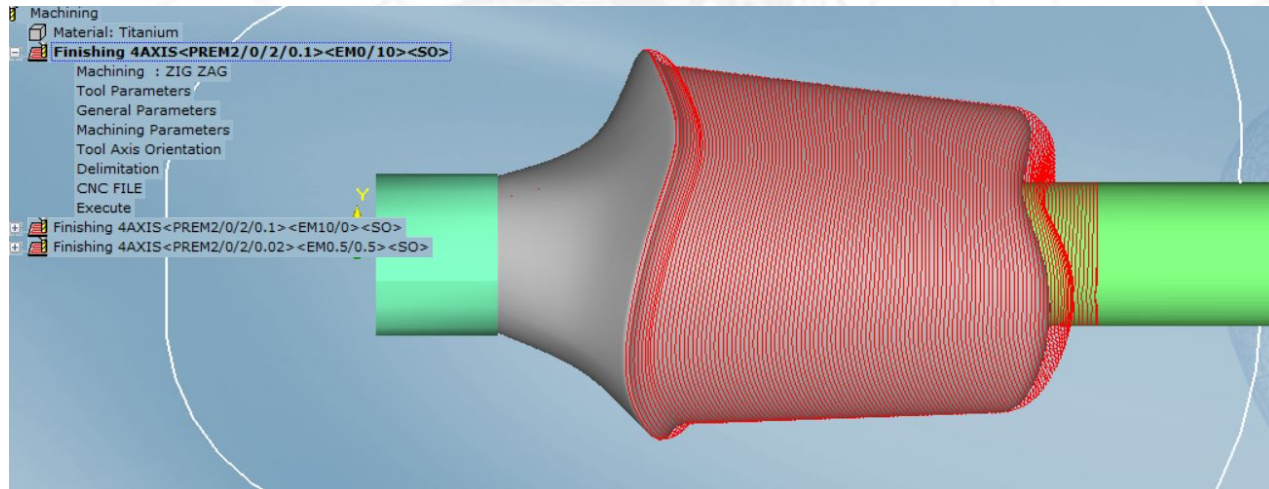


- x starting value
- y ending value

Machining Strategy

Ex. 1:

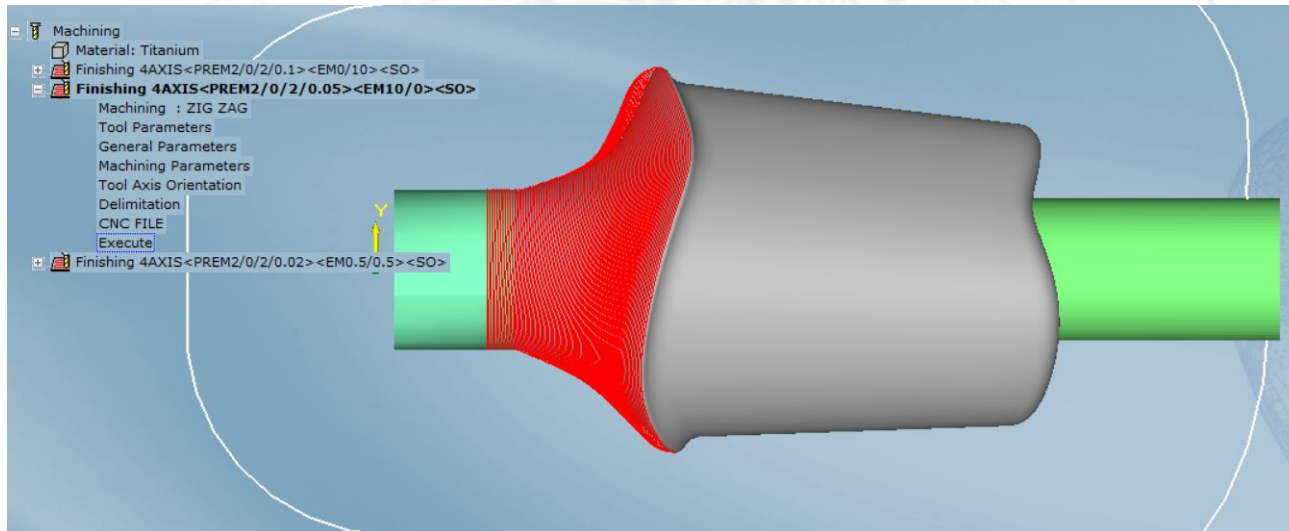
<EM0/10>



Machining Strategy

Ex. 2:

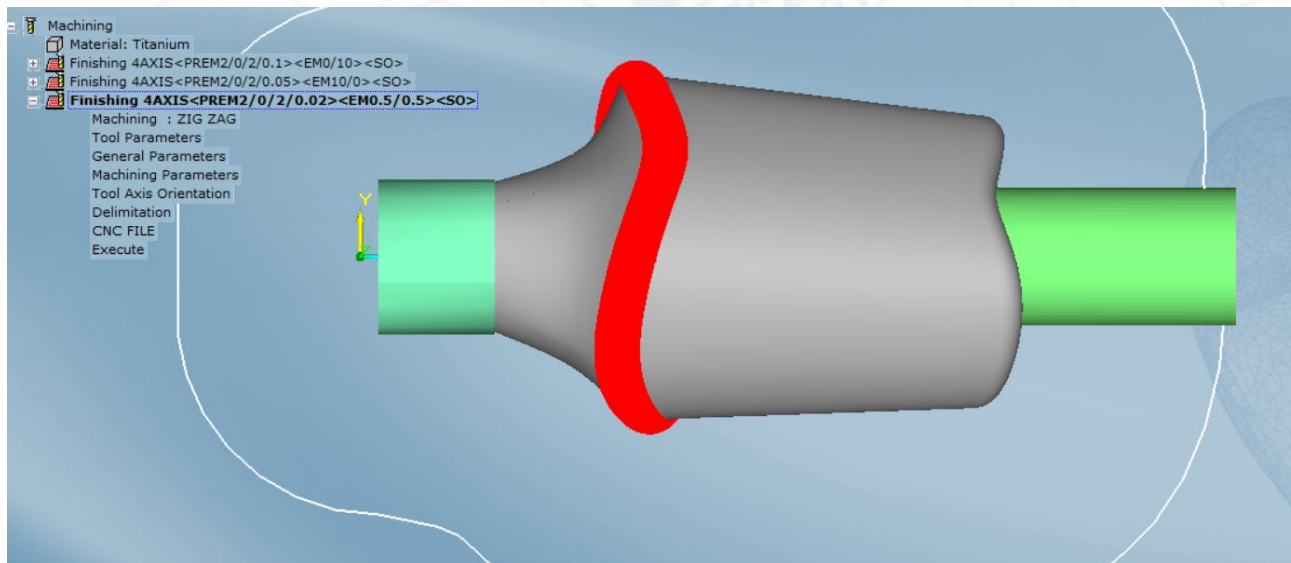
<EM10/0>



Machining Strategy

Ex. 3:

<EM0.5/0.5>

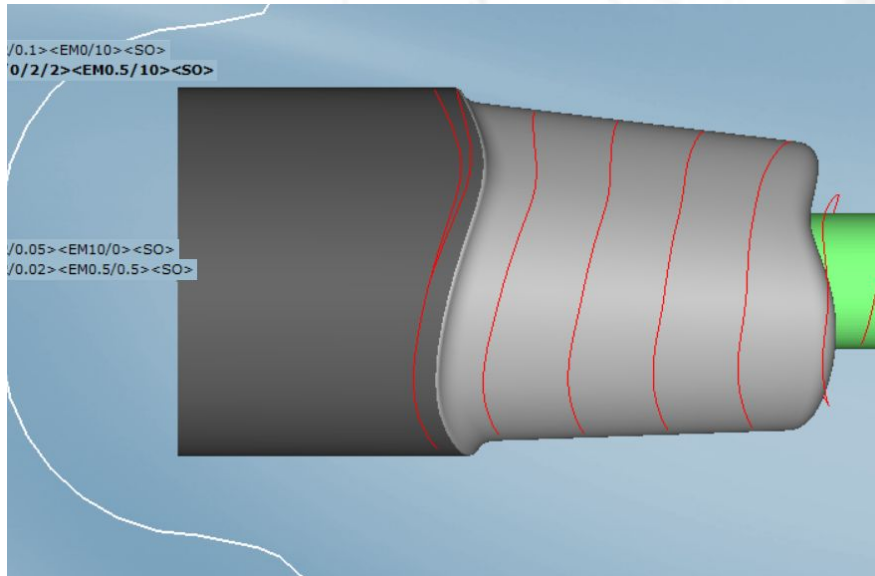


Machining Strategy

Ex. 4(Engraving case):

<EM0.5/10>

Enable the layer –DM-03



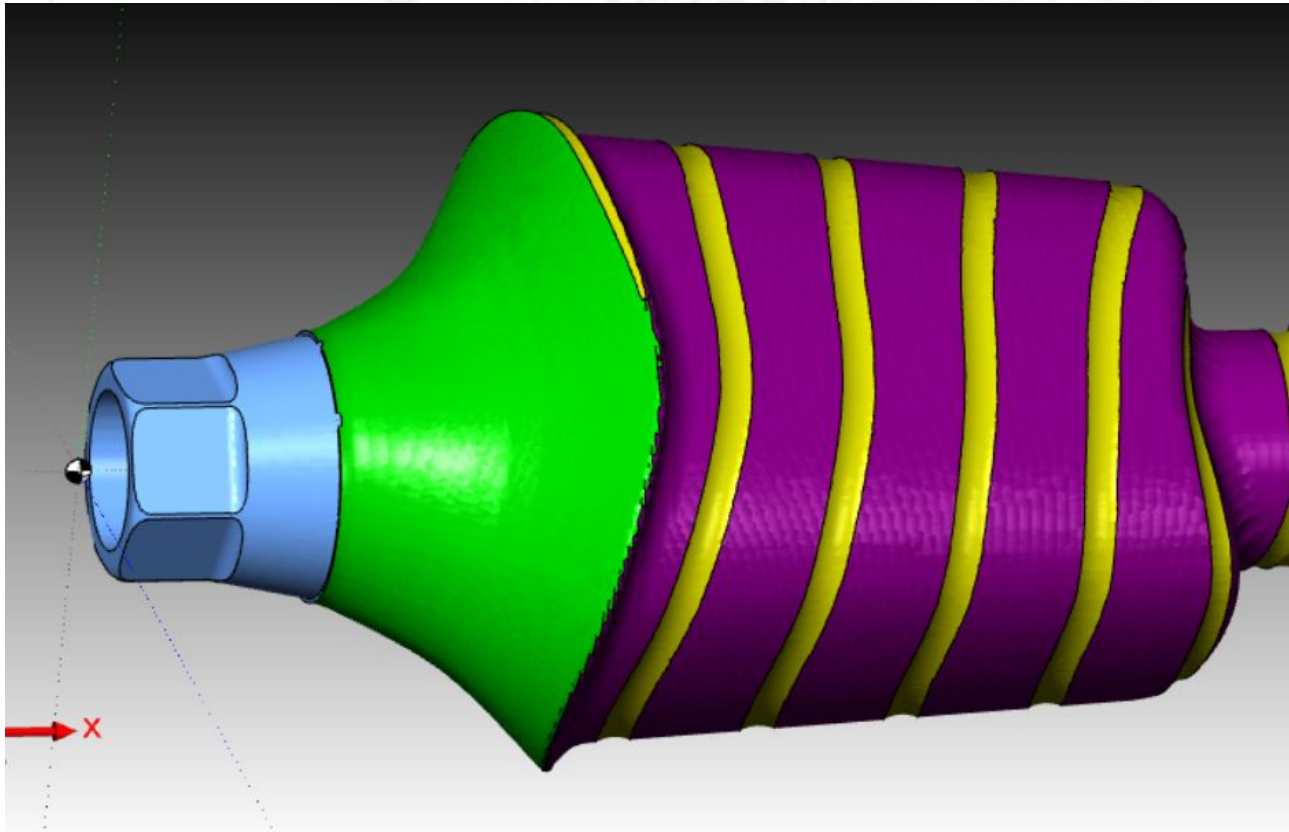
Layer Configuration

Name	Cur...	Visi...	Re...	Tra...	Color	Raw
Layer 0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
-DM-clamps	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
-DM-clamps-up	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
-DM-clamps-down	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
-DM-clamps-curves	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
-DM-labels	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
-DM-01	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
-DM-Y	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
-DM-rest	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
-DM=	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
-DM-Objects_main	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
-DM-X	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
-DM-P	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
-DM-T	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
-DM-G	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
-DM-D	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
-DM-03	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
-DM-W	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		

Machining Strategy

Ex. 4(Engraving case):

<EM0.5/10>



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