ADVANCED MACHINING
BETP 3584
MULTI-AXIS POCKETING OPERATION IN 4/5 AXIS MACHINING

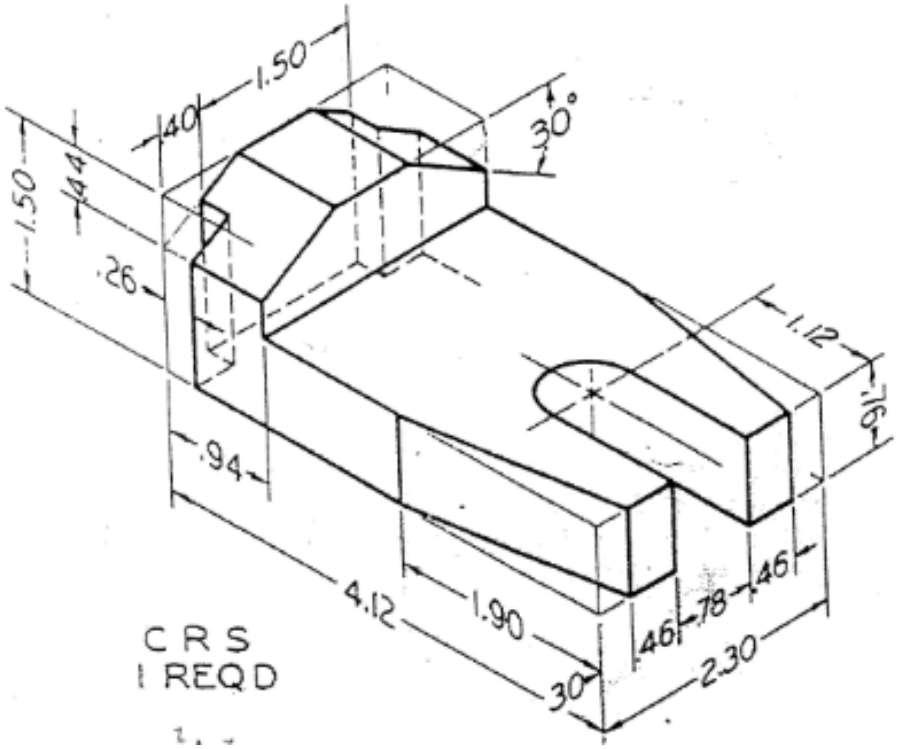
Syahrul Azwan bin Sundi @ Suandi
syahrul.azwan@utem.edu.my

Multi-Axis Pocketing Operation

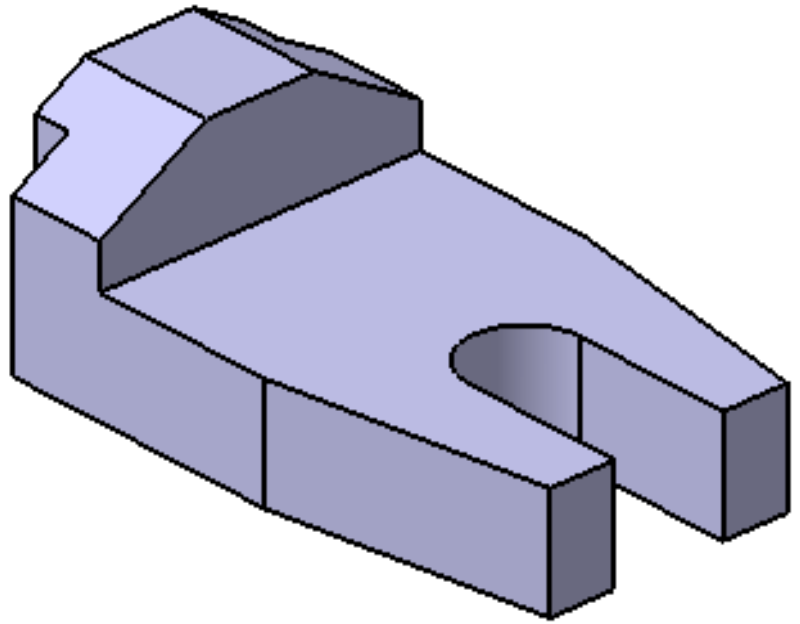
- Multi-Axis Pocketing is actually an advancement from Pocketing Operation in 3-Axis Machining.
- Despite performing pocketing process on the 3-Axis surfaces, Pocketing Operation can also be utilized to machine on slanted or angled surfaces which also known as 4/5 Axis surfaces.
- Multi-Axis Pocketing ONLY appropriate for 5-Axis Indexing program NOT simultaneous.
- Ultimately, Multi-Axis Pocketing offering broaden flexibility in preparing CAM program for any given CAD model.

Multi-Axis Pocketing Operation

EX.2- Finger Guide

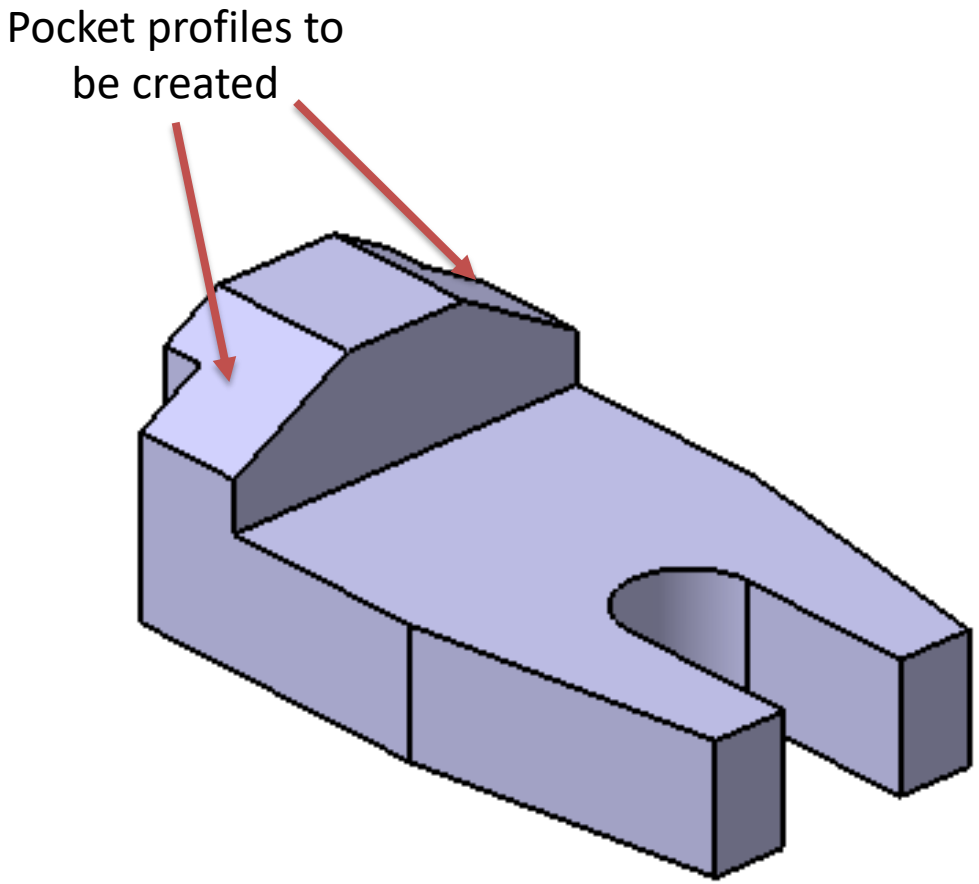


Isometric View of Drawing
Finger Guide



Isometric View of 3D CAD
Model
Finger Guide

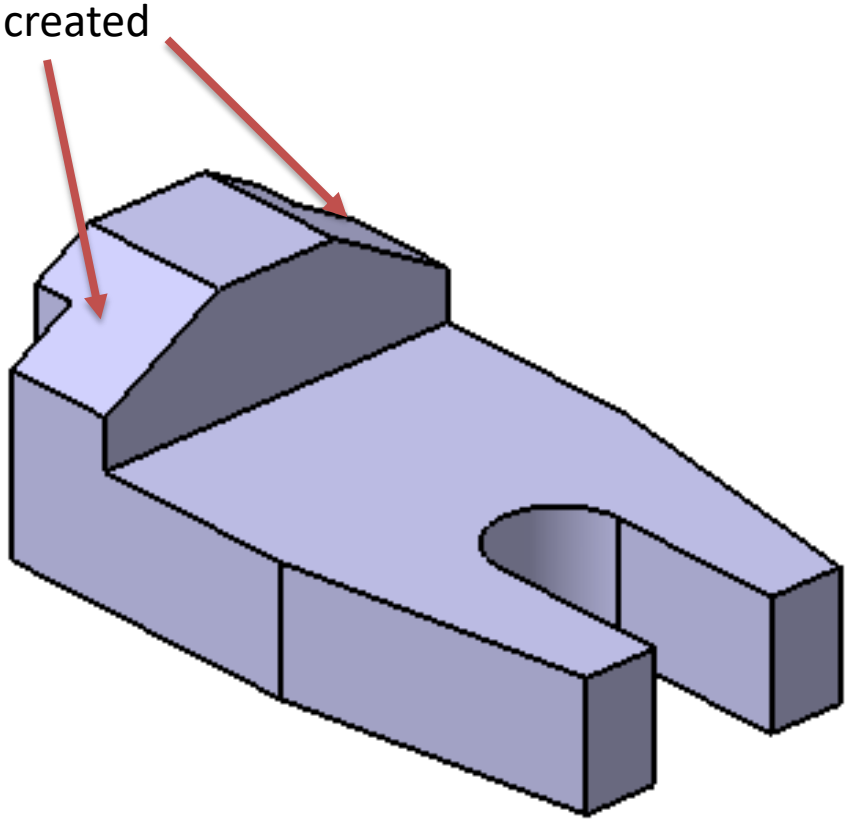
Multi-Axis Pocketing Operation

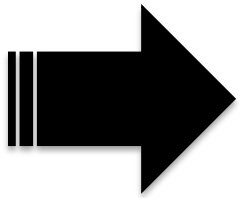


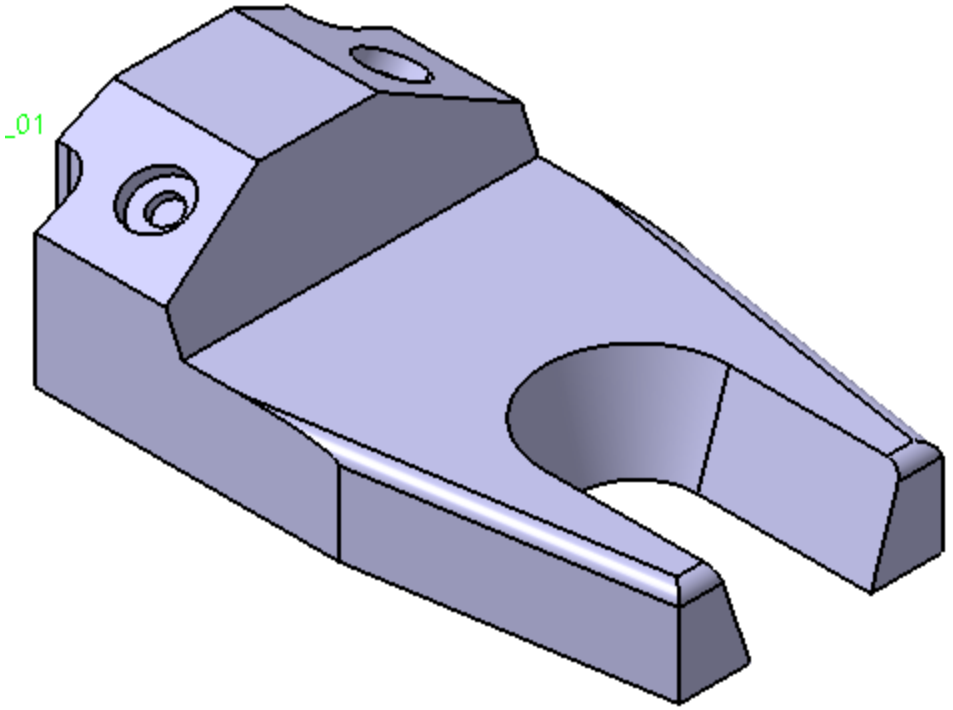
- From the completed Finger Guide CAD Model, there are **few modifications** need to be made to improve the CAD model.
- Pocket profiles are now going to be added as the main exercise for Multi-Axis Pocketing Machining.
- **Pocket profiles to be created on** the **chamfer or angle areas.**

Multi-Axis Pocketing Operation

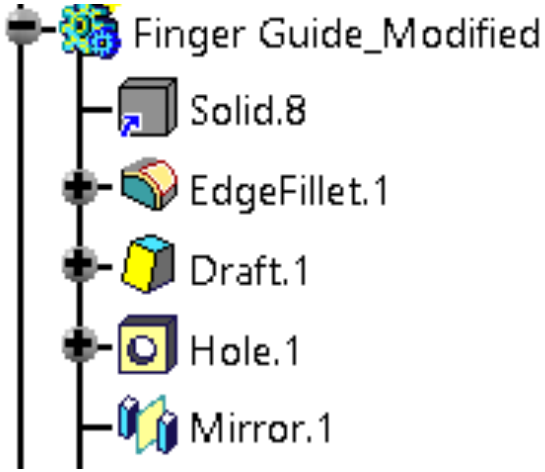
Pocket profiles to be created



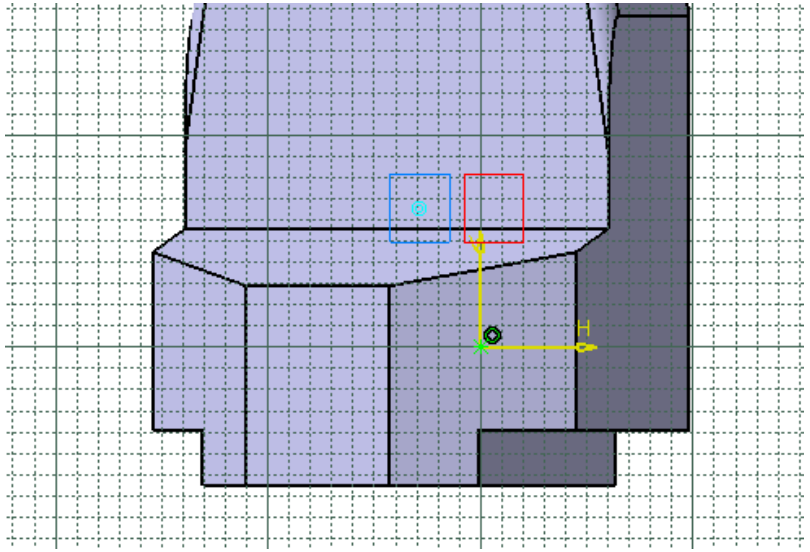


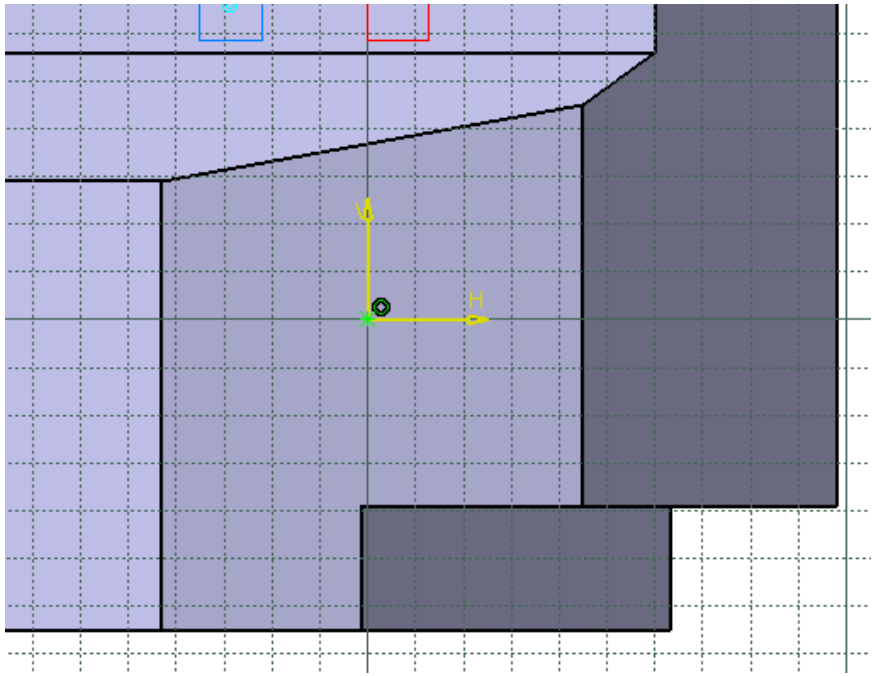


Multi-Axis Pocketing Operation



Specification TREE – Hole is added
– Mirror the hole to another side

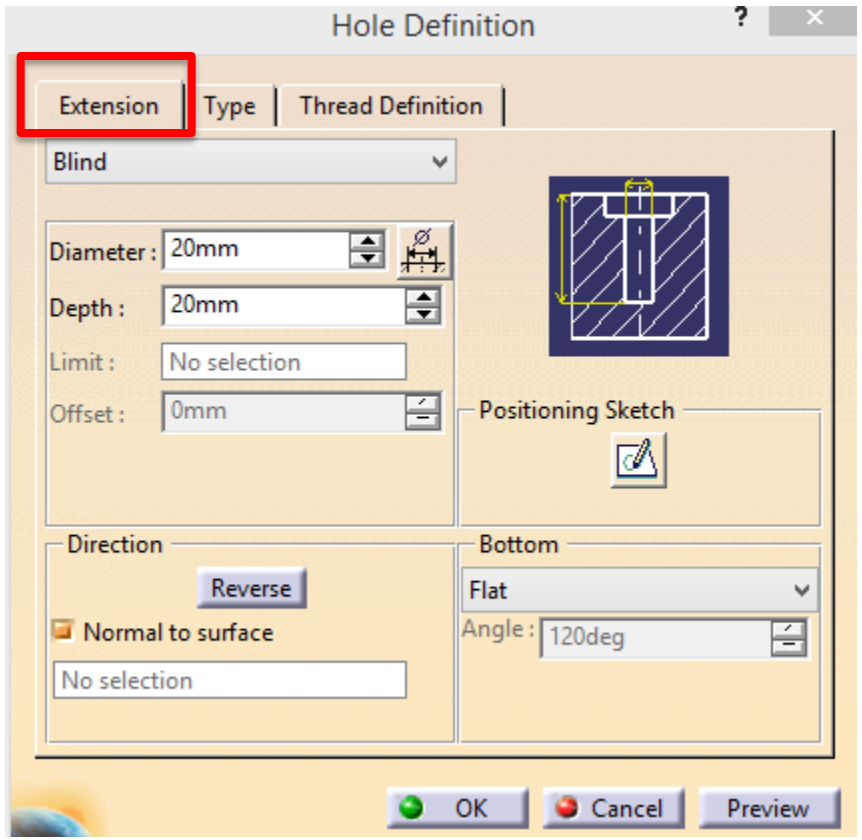




Create **one (1)** point in **Sketch Workbench**

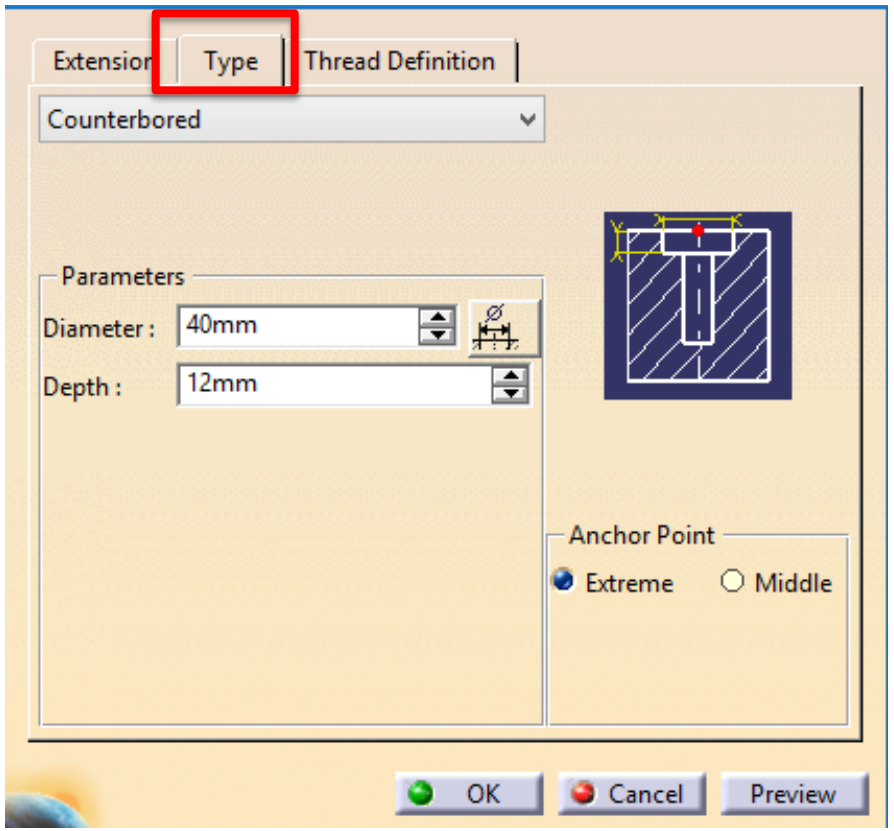
Multi-Axis Pocketing Operation

Hole Definition



1st TAB – Extension

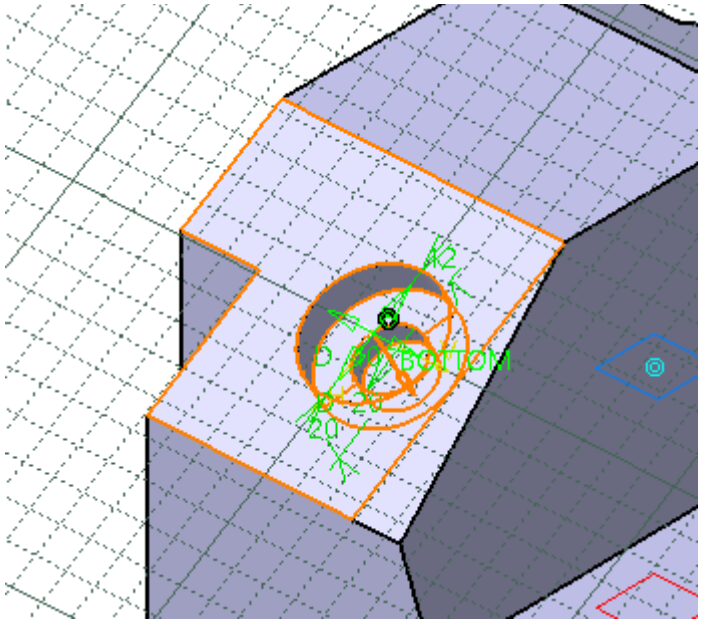
Enter Hole Diameter & Depth



2nd TAB – Type

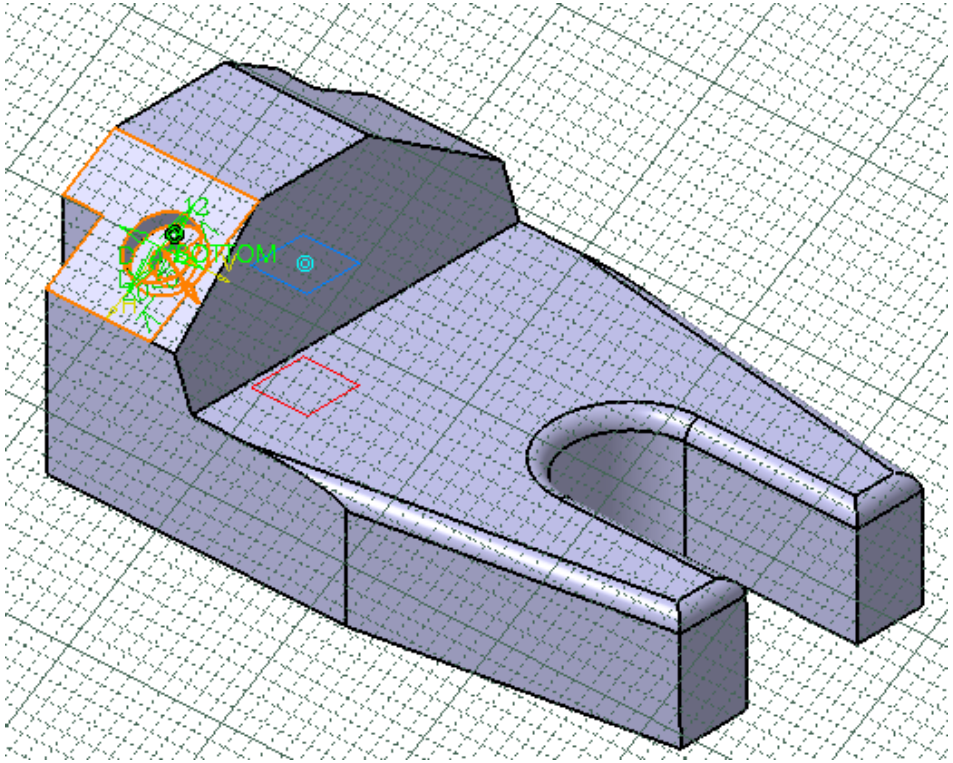
Choose Counterbored Type with specification

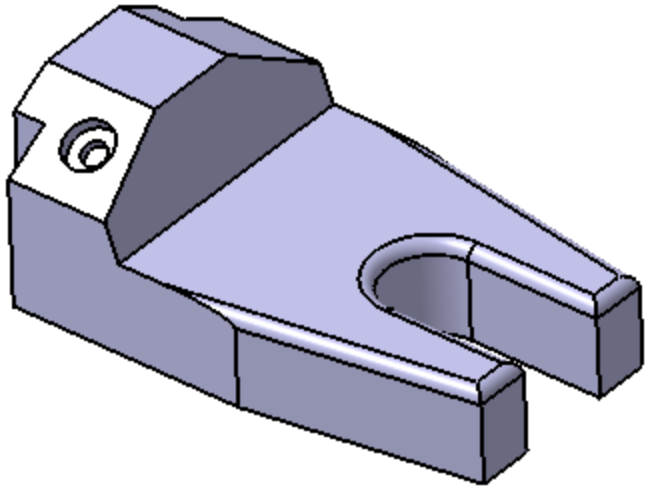
Multi-Axis Pocketing Operation



Close up of Hole Definition Created

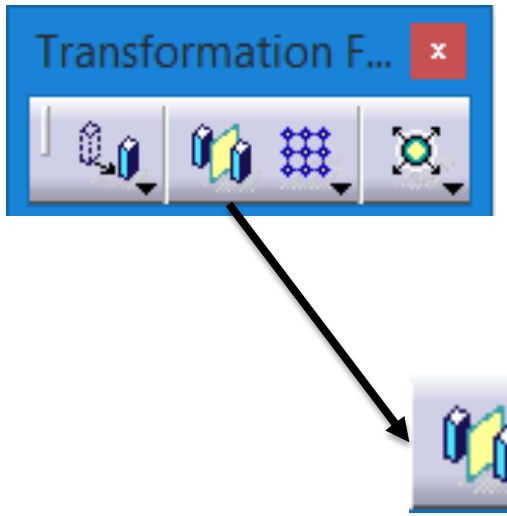
Preview of Hole Definition



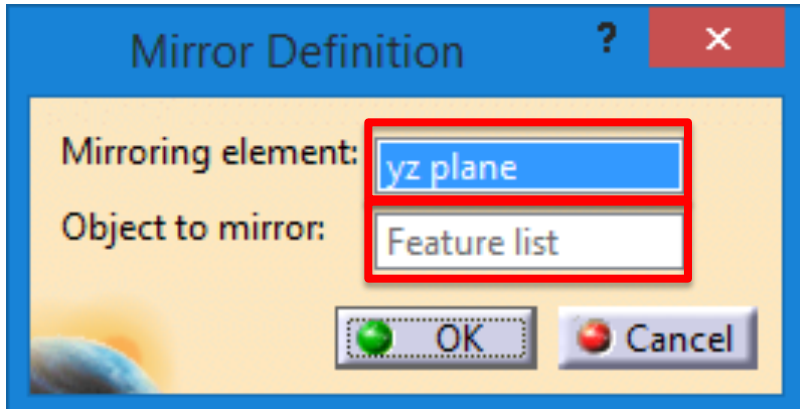


Hole created – completed on 1 side

Multi-Axis Pocketing Operation

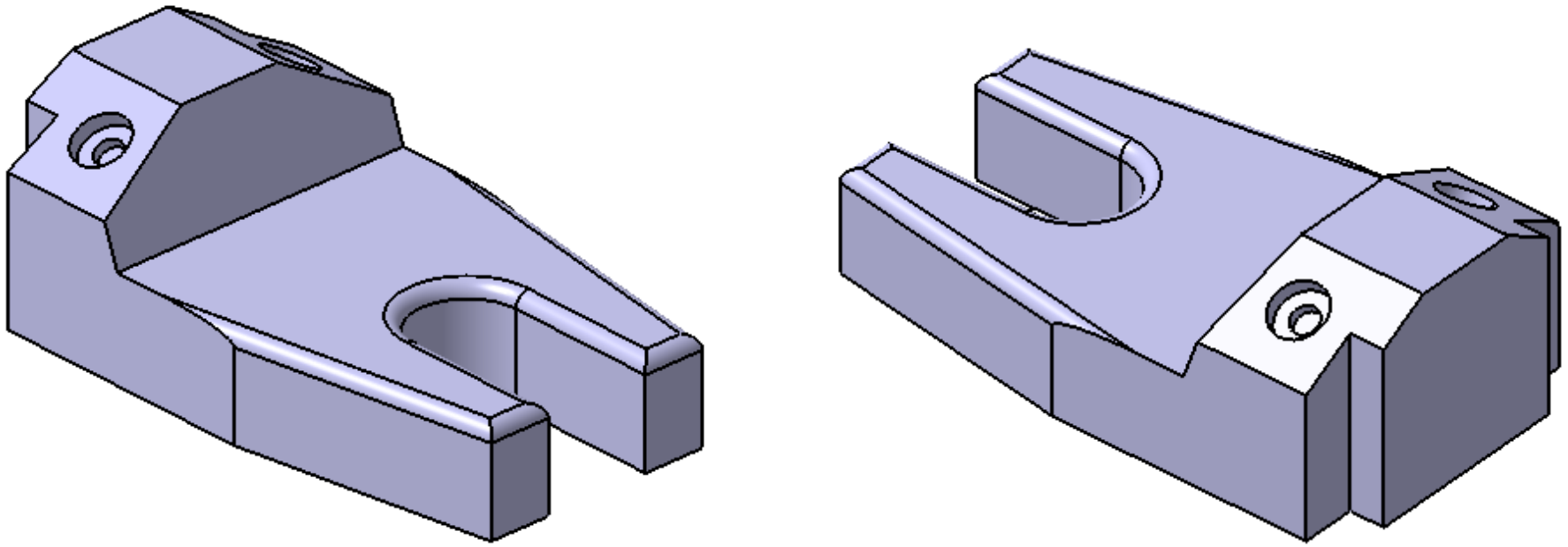


To create the same **Hole Definition** on the other side – use **MIROR Definition**



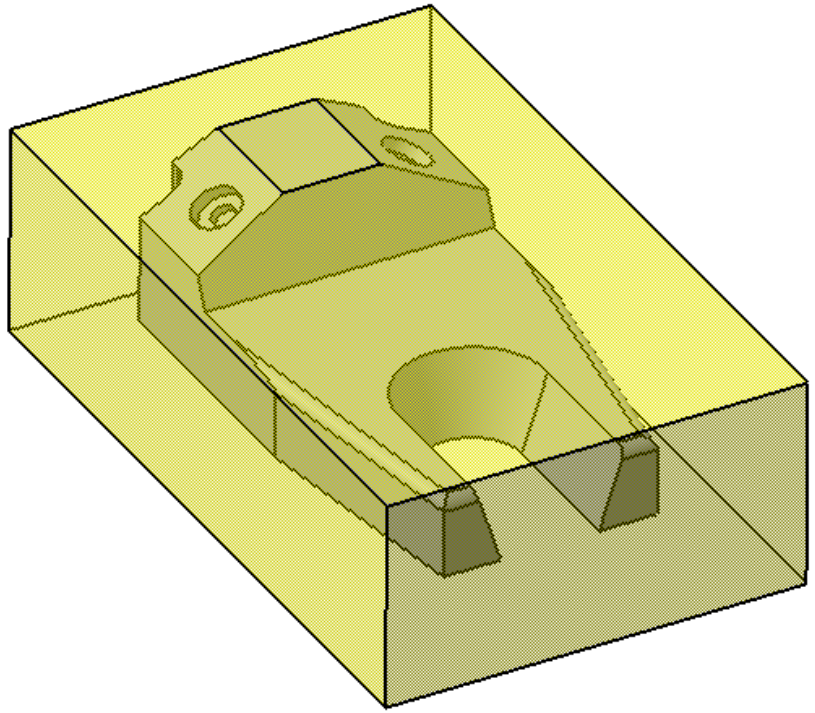
- 1st Thing to do is to **highlight the feature** to Mirror.
- In this case, **the Hole created** is the one which **needs to be highlighted.**
- 2nd element to have is the **Mirror Reference Object**
- This object **could be any parallel surfaces** or **newly created reference plane** or **initial reference plane XY , YZ & XZ.**

Multi-Axis Pocketing Operation

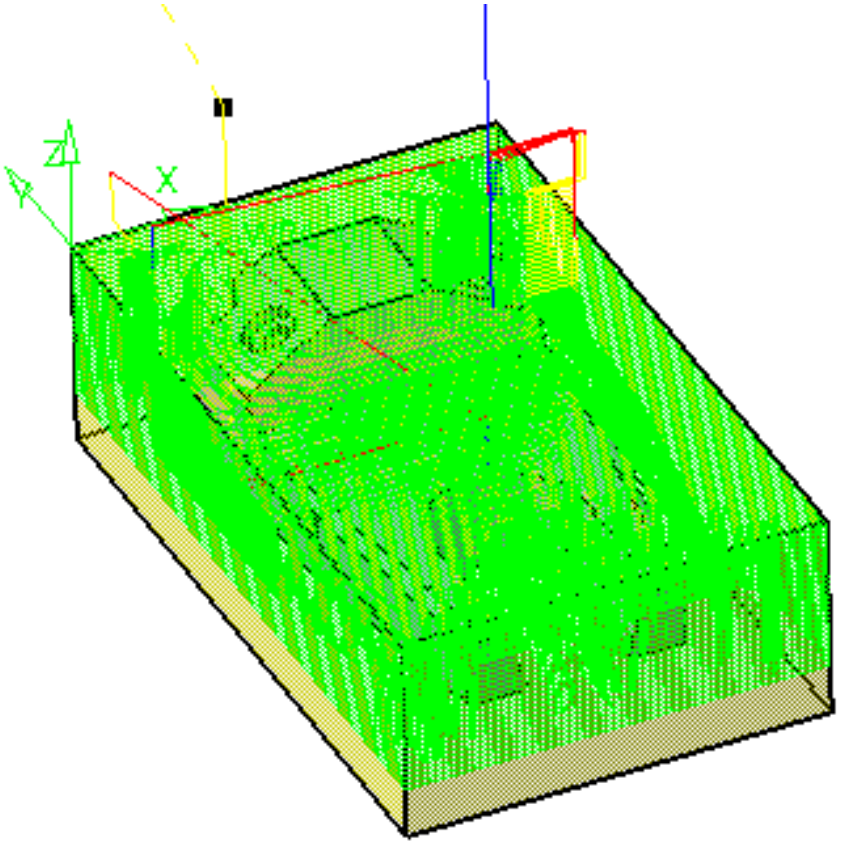


Final Result of new **HOLE Definition** created on **BOTH sides** – preparation for **Multi – Axis Pocketing Operation**

Multi-Axis Pocketing Operation

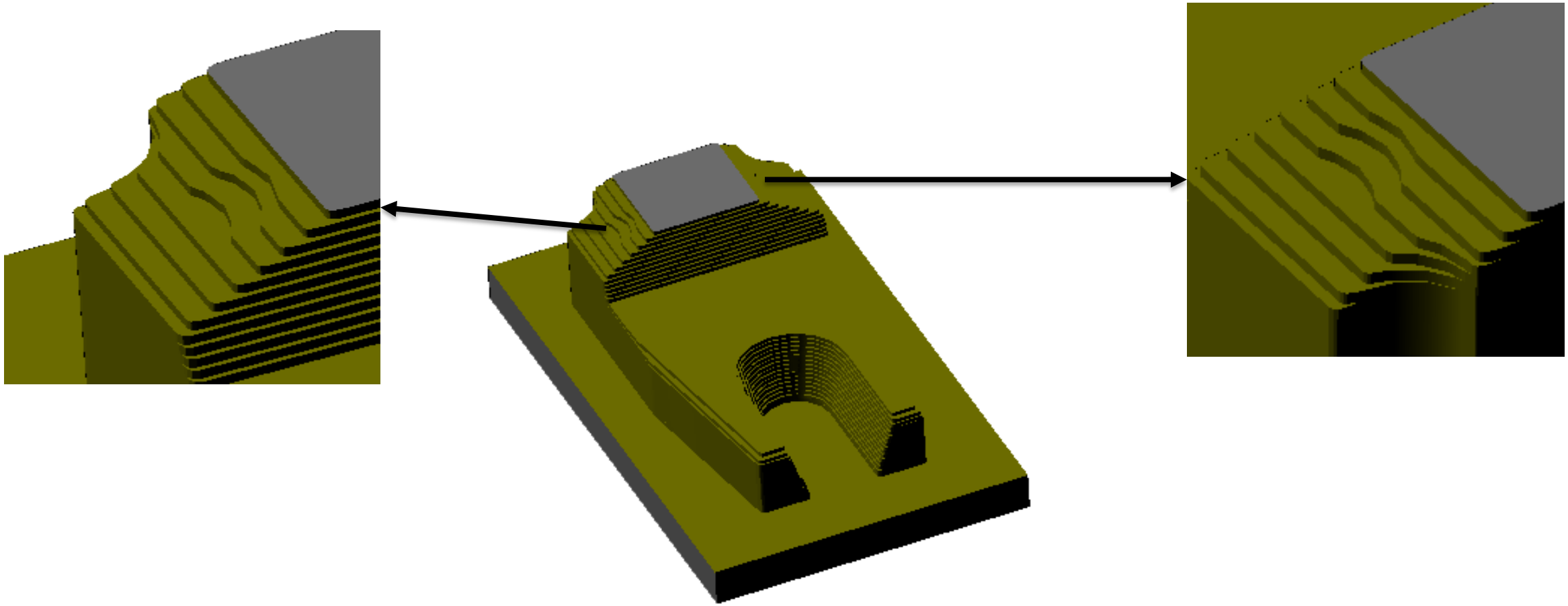


Part Model with Stock ready for CAM Program



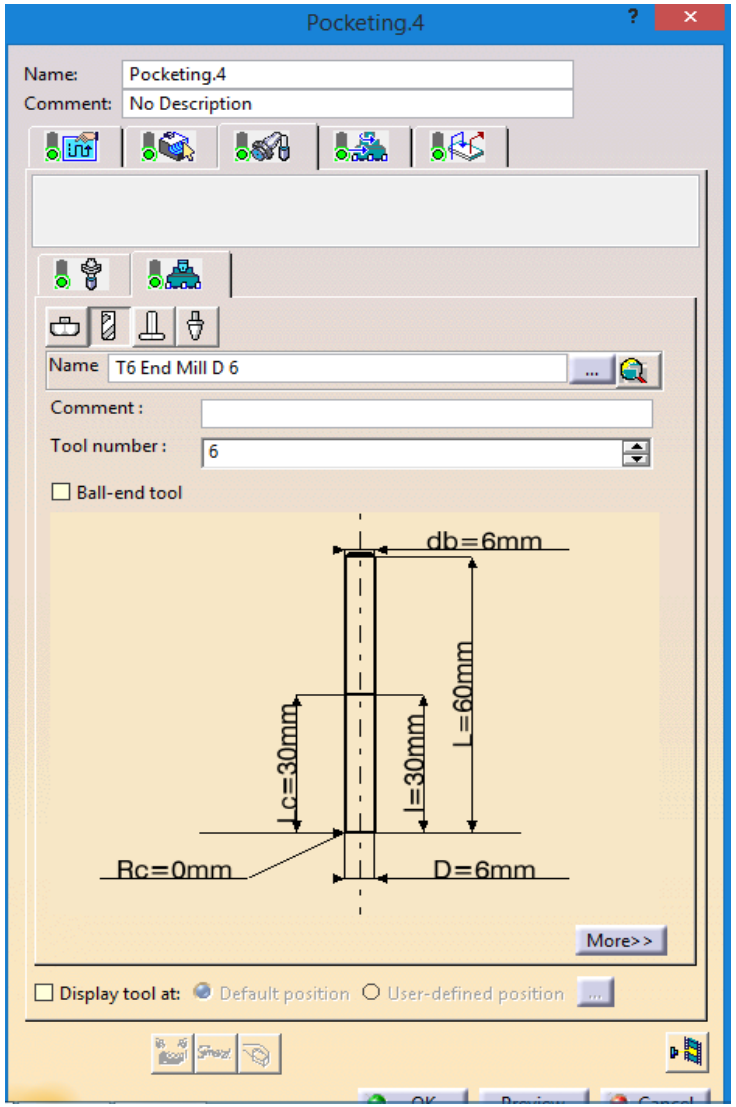
Calculation of Tool Paths after performing Roughing Operation

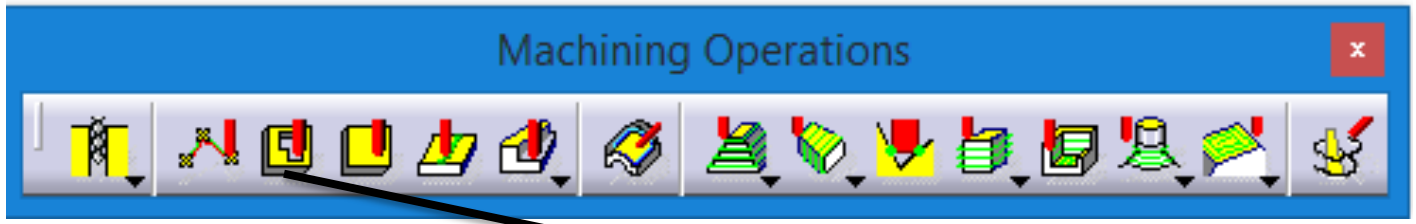
Multi-Axis Pocketing Operation



Result of Roughing Operation – End of Simulation

Multi-Axis Pocketing Operation



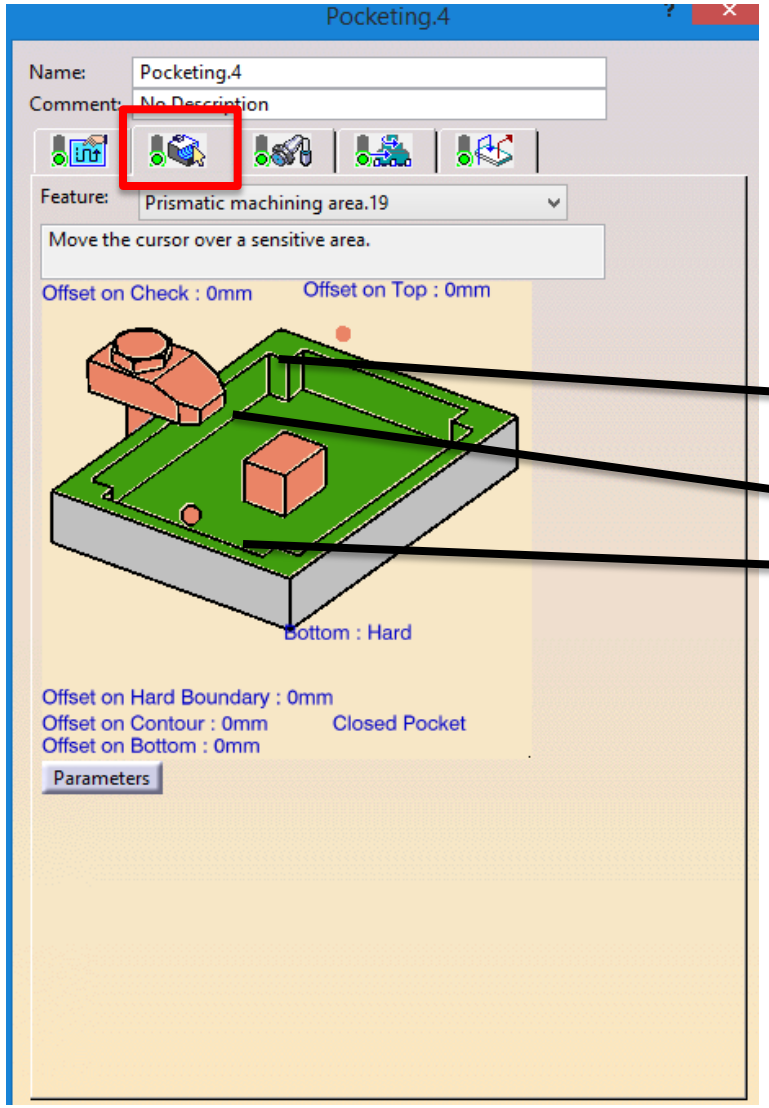


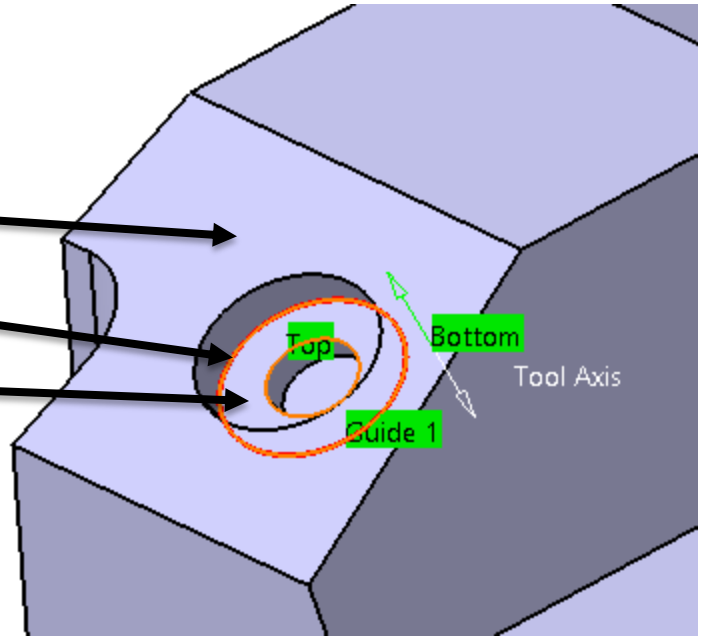
Pocketing Definition

- ✓ **Multi-Axis Pocketing** is actually using **Pocketing Definition** as the main operation
- ✓ Create and insert the desired Cutting Tool in the Resource List as well as in the Manufacturing Program
- ✓ Select the right **CUTTING TOOL – depending** on the **DIAMETER** of the **Hole created – END MILL D6.0**

Multi-Axis Pocketing Operation

2

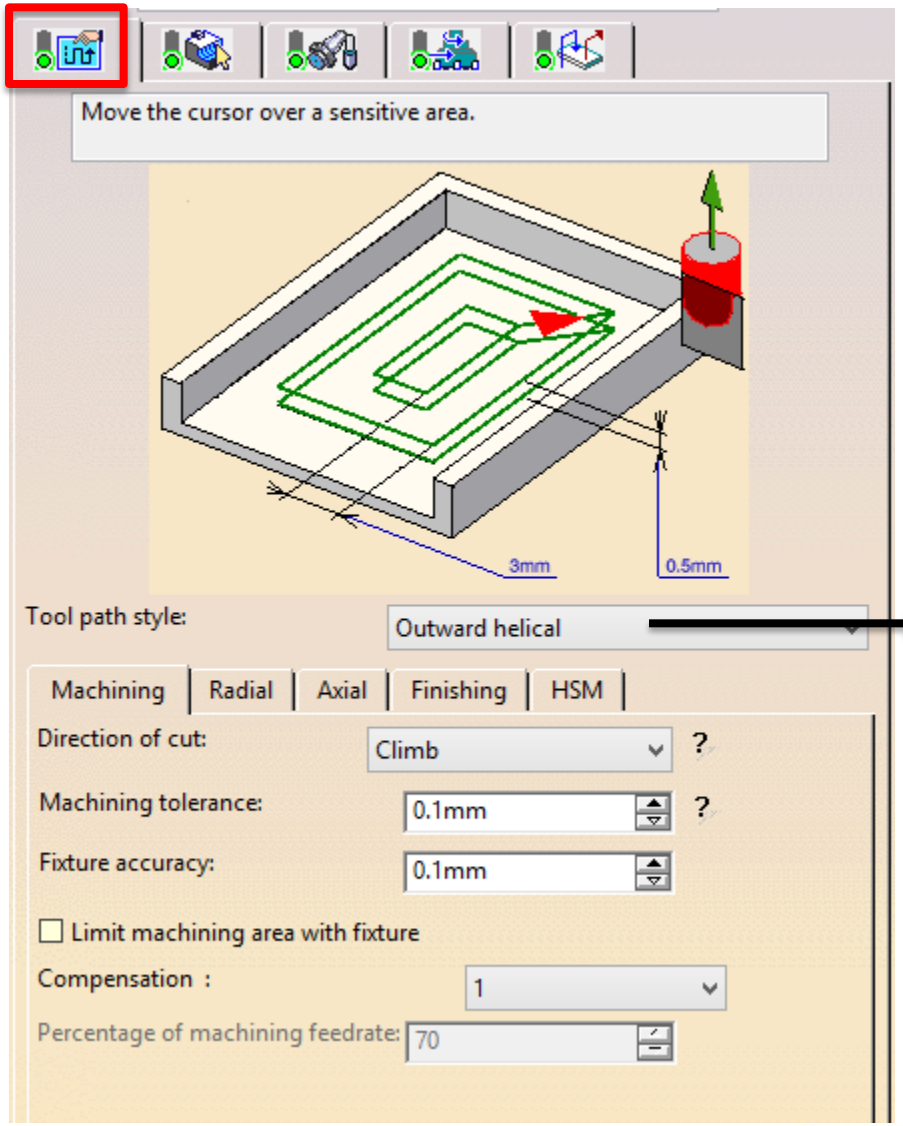


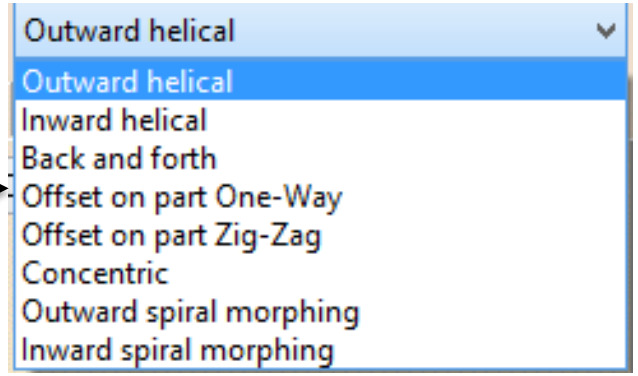


- ✓ In TAB – 2, there are **Three (3) geometries** that need to be defined namely **Bottom Surface**, **Guiding Element** (Machining Guide) and **Top Surface** (for depth of cut auto-calculation)
- ✓ **Bottom Surface** is **very important** because this surface will be the **reference surface for the Tool Axis**.
- ✓ In **Multi-Axis Pocketing** there is no **Tool Axis options**.
- ✓ **Tool Axis** will be **automatically change perpendicular** to the chosen **Bottom Surface**.

Multi-Axis Pocketing Operation

1



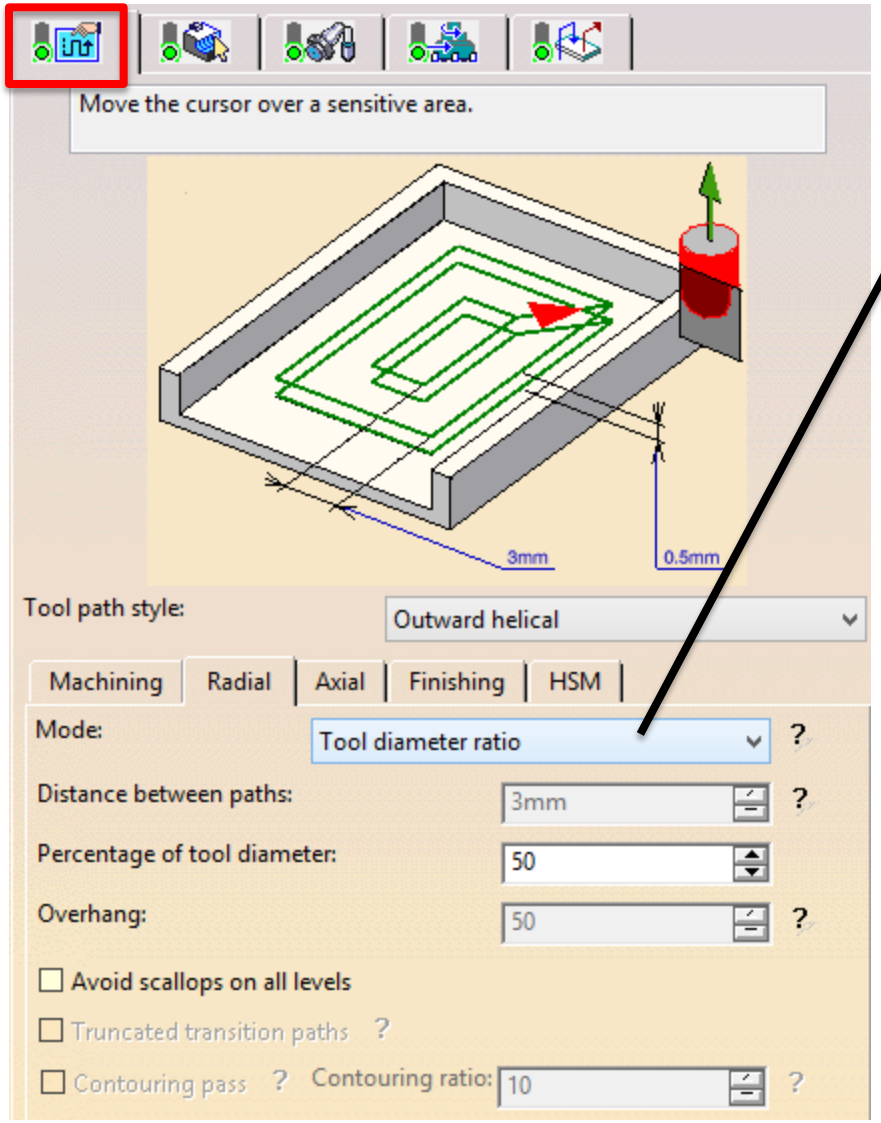


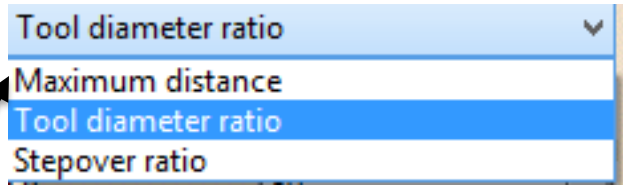
Tool Path Style Options

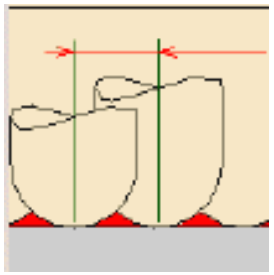
- ✓ In **TAB – 1**, there are **Tool Path Style** or **Machining Strategy** can be determined.
- ✓ Common strategy that being used are **Outward Helical** and **Inward Helical**.
- ✓ On the other hand, **Machining Tolerance** representing **how fine one path to another or one point to another point.**
- ✓ **The smaller the number** is in Machining Tolerance will **give better result in dimensional.**

Multi-Axis Pocketing

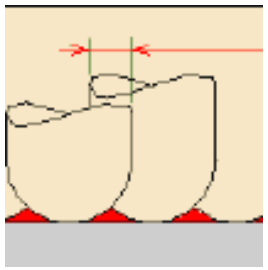
1



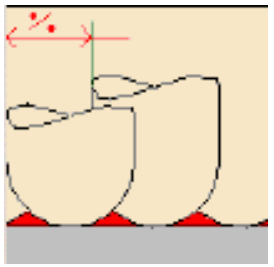




Maximum Distance



Tool Diameter Ratio

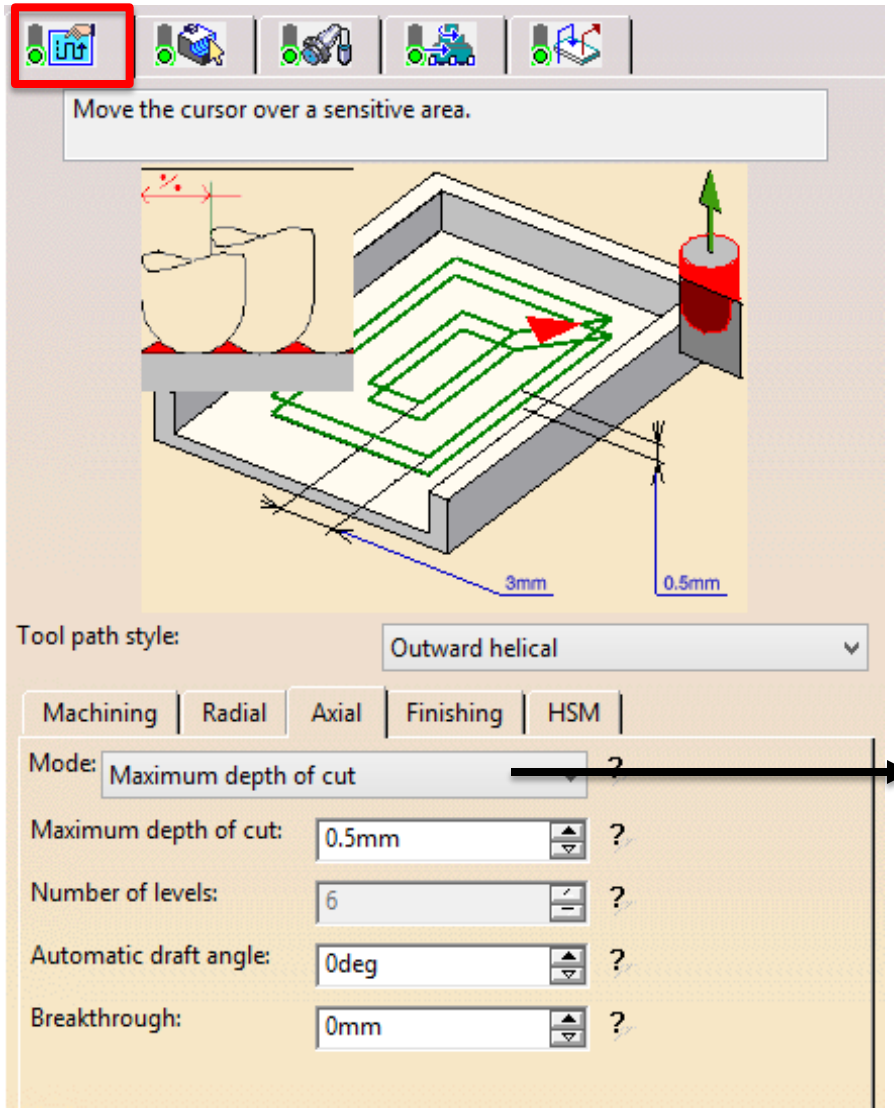


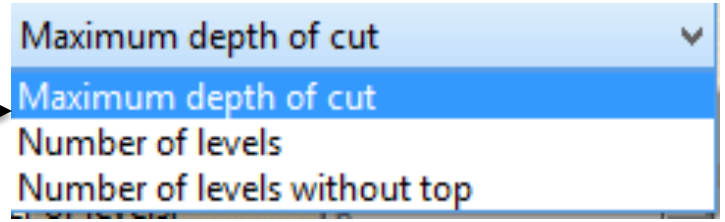
Stepover Ratio

- ✓ Still in **TAB – 1**, Radial – Options to the users on determining the MODE of **STEPOVER** or **calculation of distance one path to another**.
- ✓ There are **THREE (3) options** of **MODE** given namely **Maximum Distance, Tool Diameter Ratio and Stepover Ratio.**
- ✓ **Tool Diameter** is the most **common MODE** being used since it is much easier to control by the cutting tool diameter

Multi-Axis Pocketing Operation

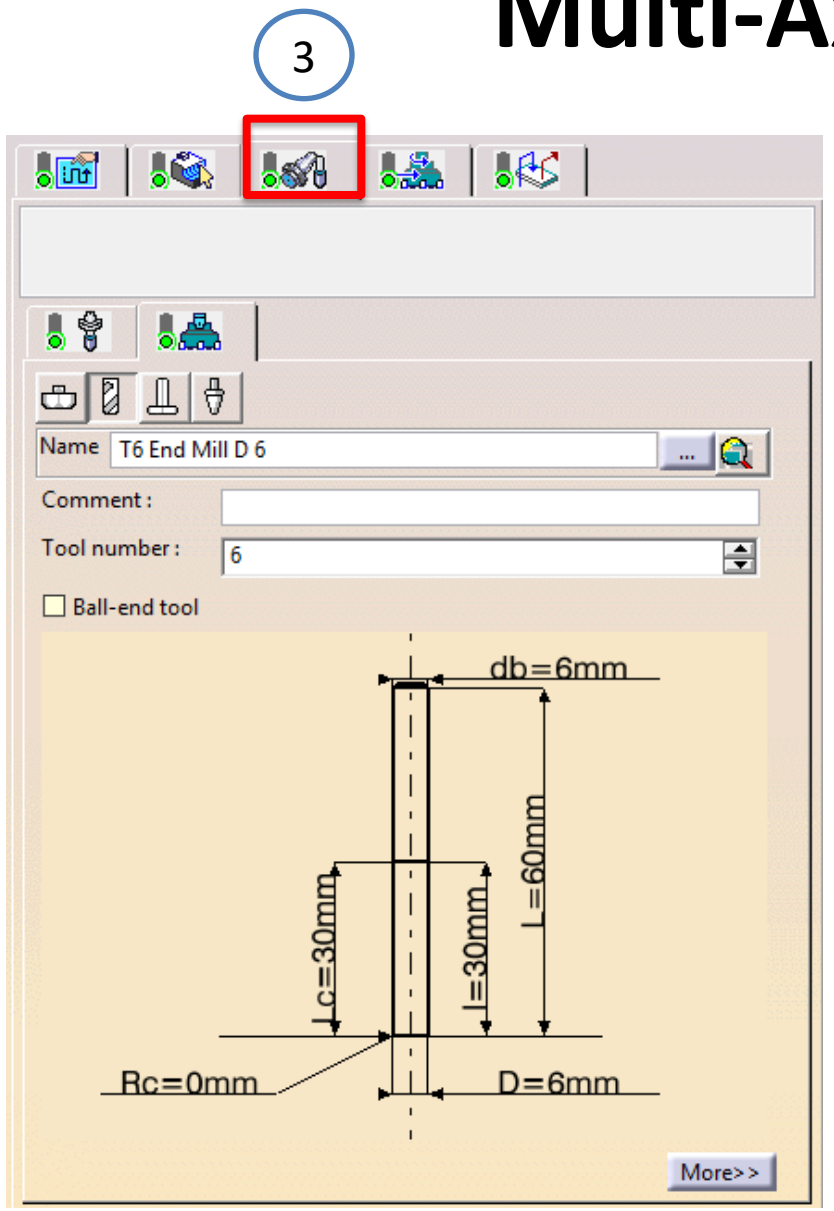
1

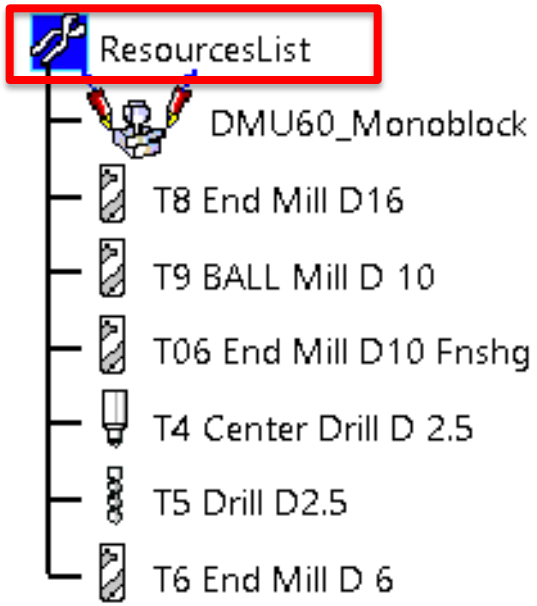




- ✓ Still in **TAB – 1**, Axial Strategy– This setting **determine the way of depth of cut is calculated.**
- ✓ Options of **Maximum Depth of Cut** and **Number of Levels** can **ONLY** be used **IF Top Surface** is **defined**.
- ✓ **IF NO Top Surface defined** user **can ONLY** choose **Number of Levels Without TOP** and determine manually.

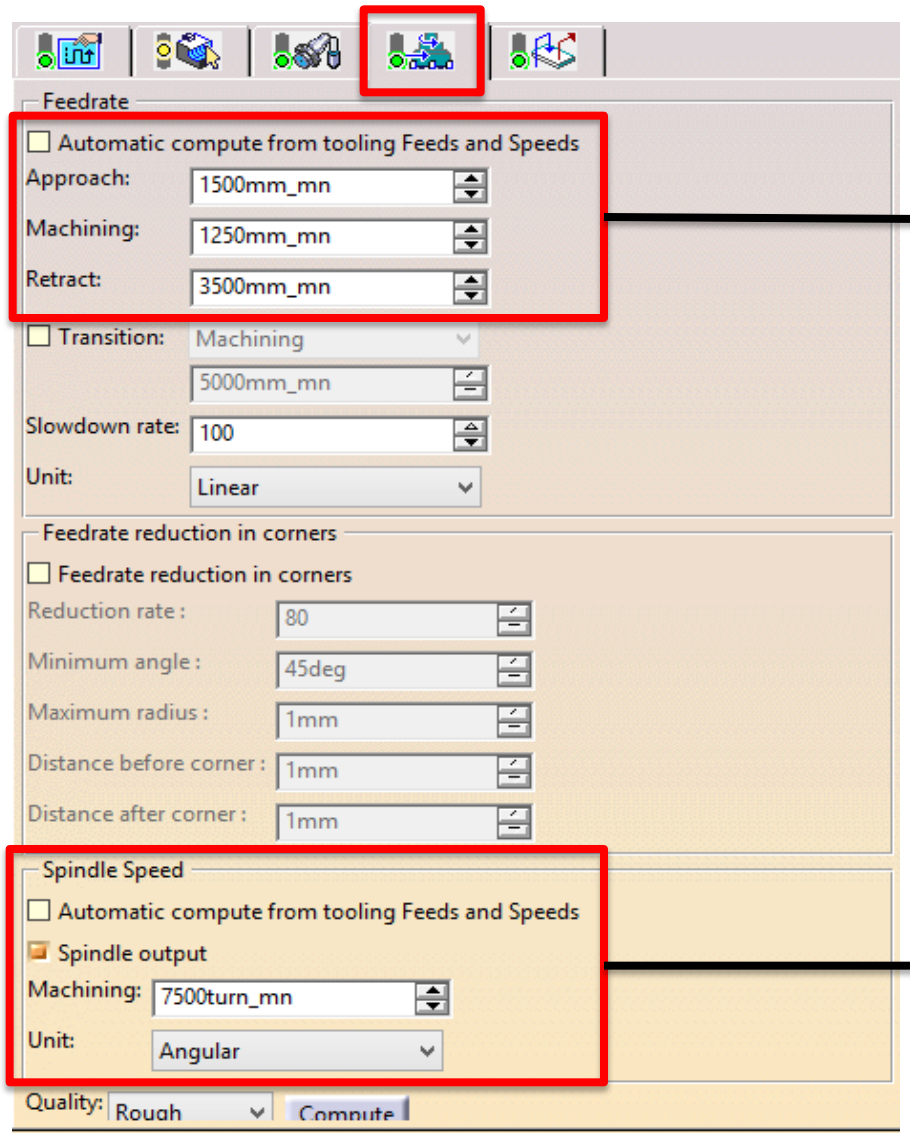
Multi-Axis Pocketing Operation



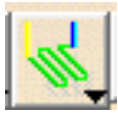


- On the TAB-3, user **need to check cutting tool specification** is correct according to the machining process to be used.
- This is very important **to ensure the right machining simulation is calculated**.
- **No changes is allowed** to be done here.
- If there is **any modification needs to be made**, user need to go back to the **Resources List** and make necessary changes there.

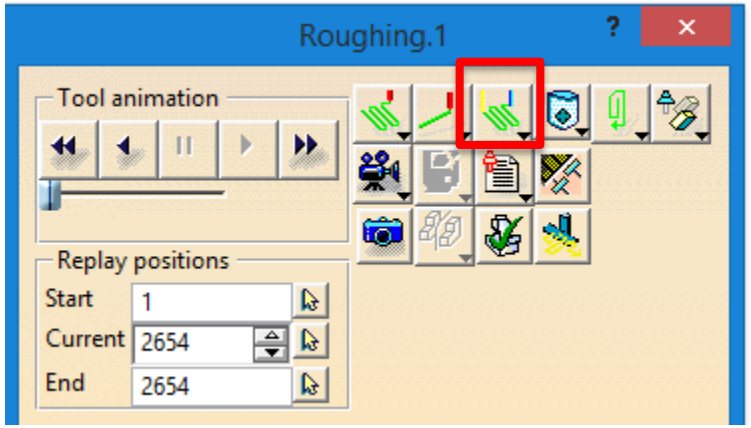
4 Multi-Axis Pocketing Operation



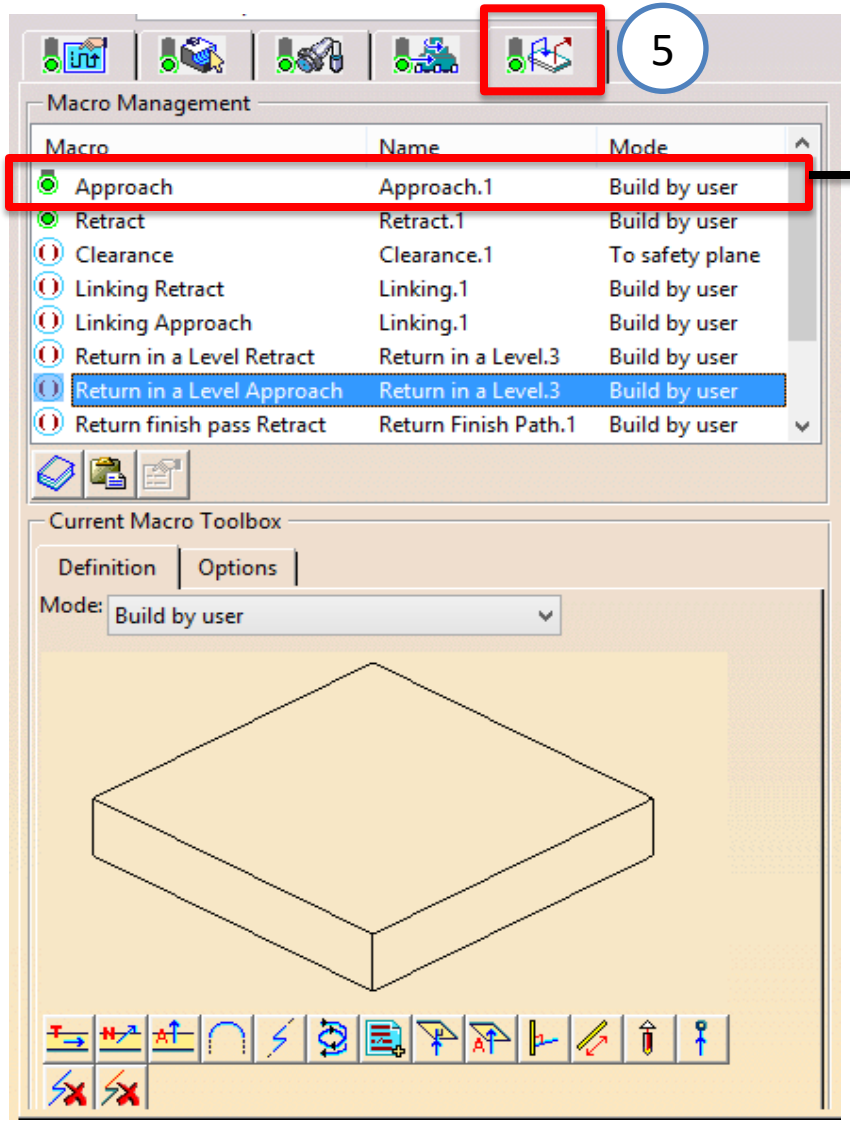
- There are **THREE (3) types** of **Feed Rates** which need to be defined namely **Approach, Machining & Retract.**
- **Color Coding** representing each Feed Rate are
  - **Approach = Yellow**
  - **Machining = Green**
  - **Retract = Blue**
- To view this, user needs to **change the setting** in **simulation TAB** into **Color Mode**.



❑ **Another Setting** that needs to be defined is **Spindle Speed** which **relying on the size, type & material** of the **cutting tool** as well as the **workpiece**.

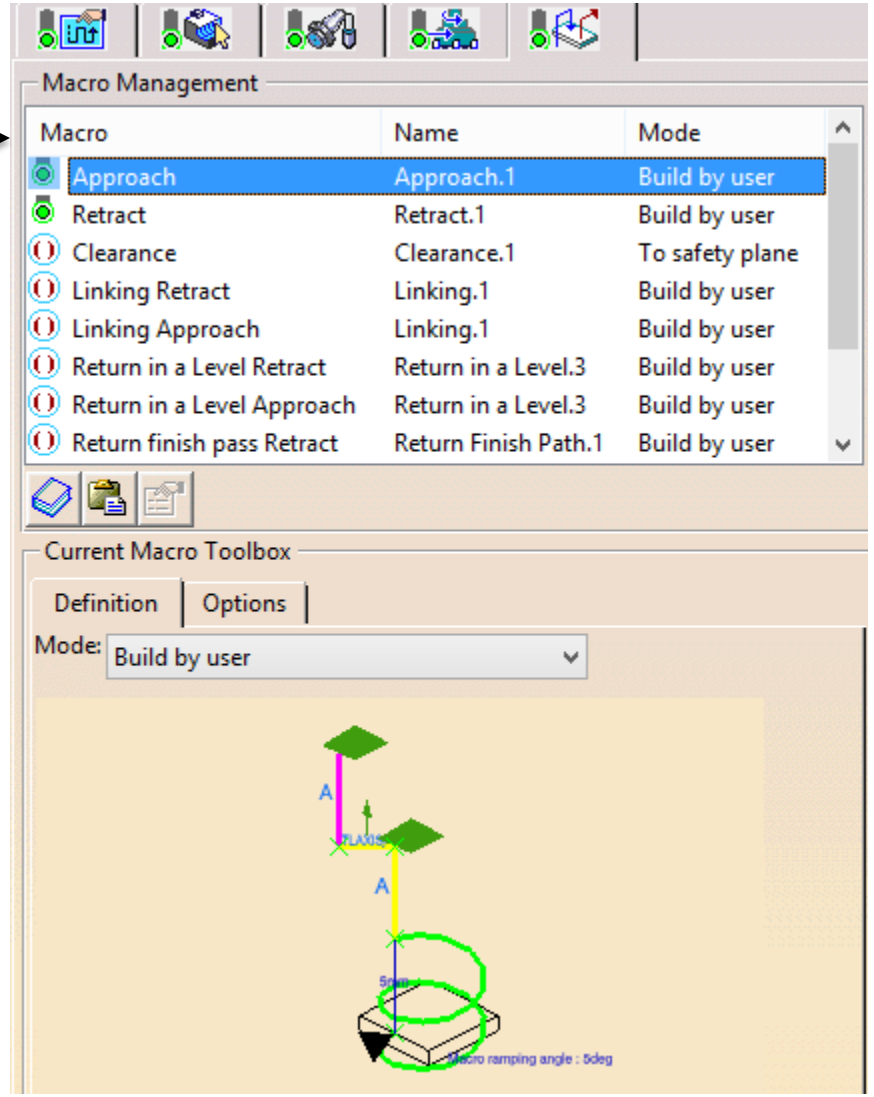


Multi-Axis Pocketing Operation

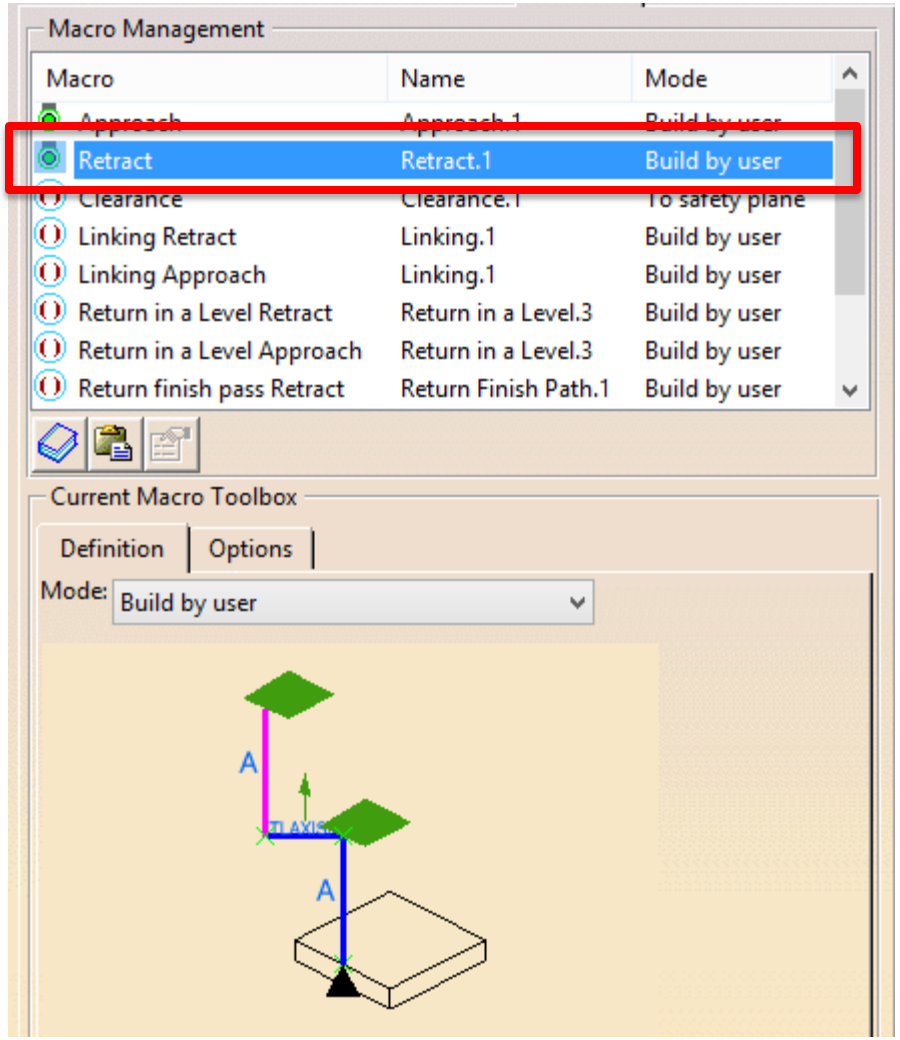


- **Macro Setting** for **Approach** consists of **Ramping Motion, Axial To Plane, Tool Axis and Axial To Plane**.

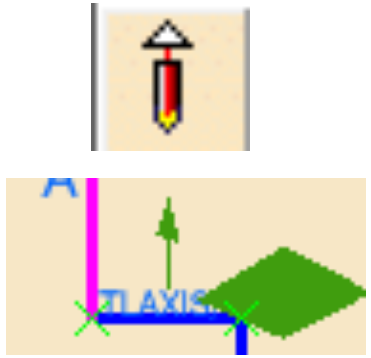
- Since **Pocketing Operation straight away approaching** the **material, Ramping Motion** is **highly suggested to avoid high cutting force** on the first cut.



Multi-Axis Pocketing Operation



- **Macro Setting** for **Retract** consists of **Axial To Plane, Tool Axis and Axial To Plane**.
- **Tool Axis** is **very useful** to be used in **4/5 Axis motion** to **decrease possibility of collision**. Same goes to **Approach Macro Setting**.
- **Cutting tool** will be **approaching and leaving** the **workpiece** in **90 degree – 3 Axis** motion before make **any tilting motion** towards the machining profile.

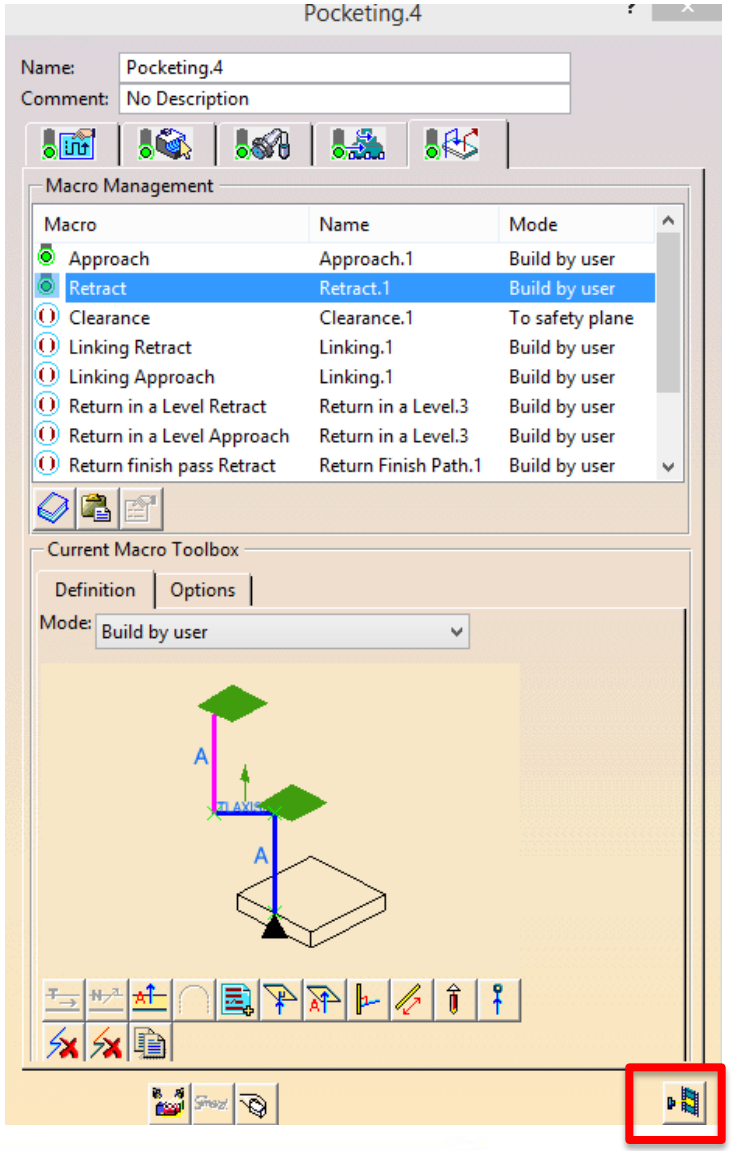


Macro Setting – Tool Axis

Multi-Axis Pocketing Operation

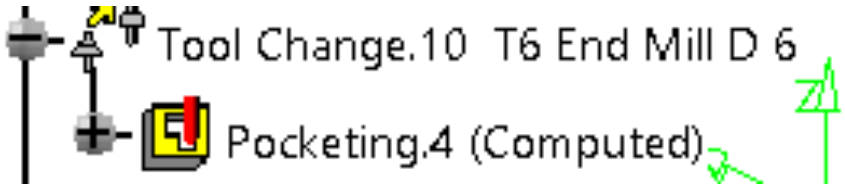
- Once ALL settings from **TAB 1 – TAB 5** are **done**, **machining tool paths** is now can be calculated by hitting the icon **Tool Paths Reply**.

- This icon located at the bottom right of every TAB and appears the same on every machining operation offered.

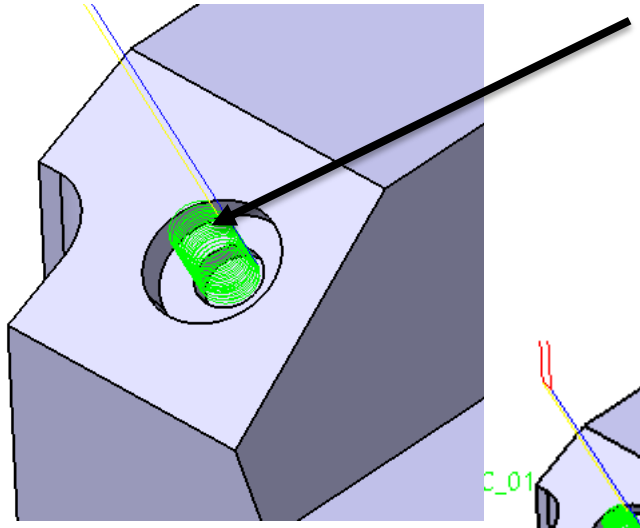


Tool Paths Reply

Multi-Axis Pocketing Operation

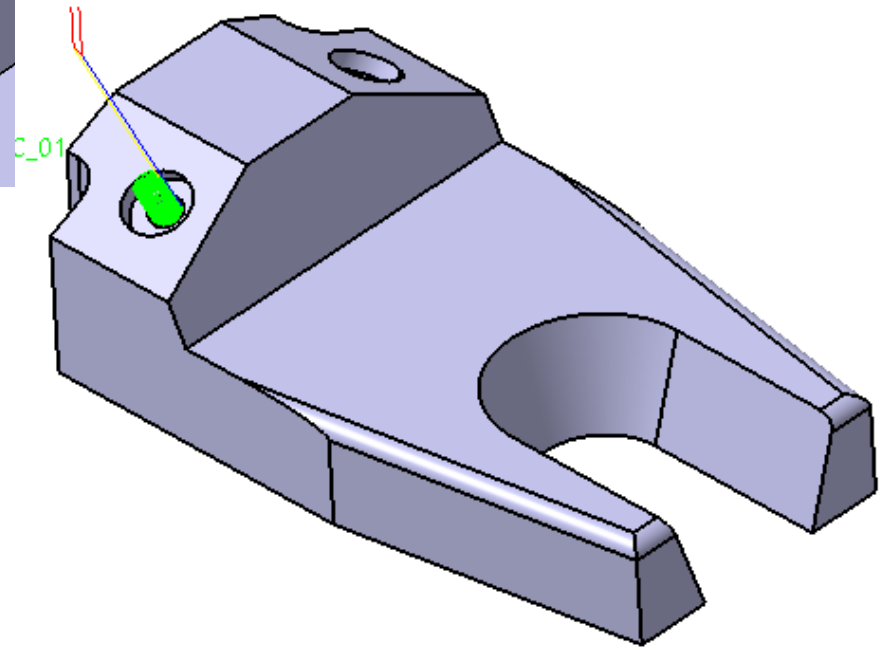


- **Specification TREE** – Pocketing Operation – 1st Hole.

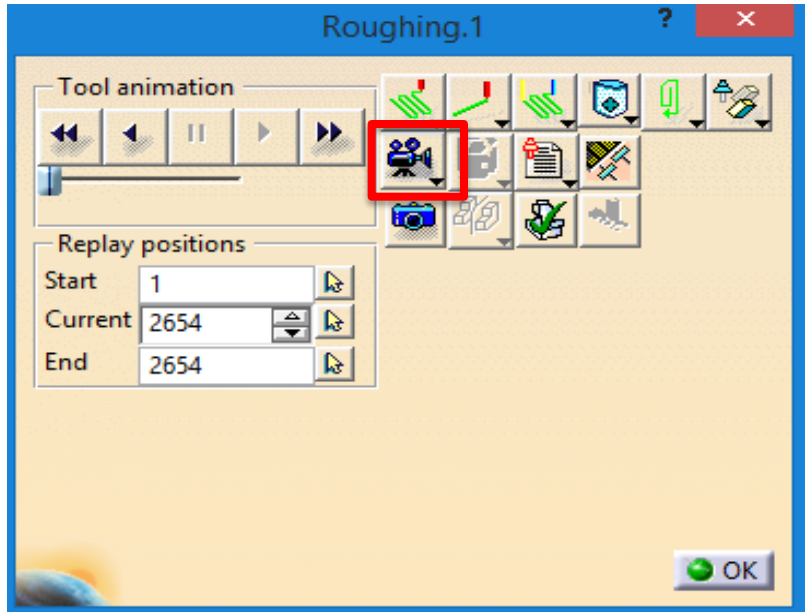


Tool Paths with Ramping Motion of Macro Setting activated

Tool Paths Calculation

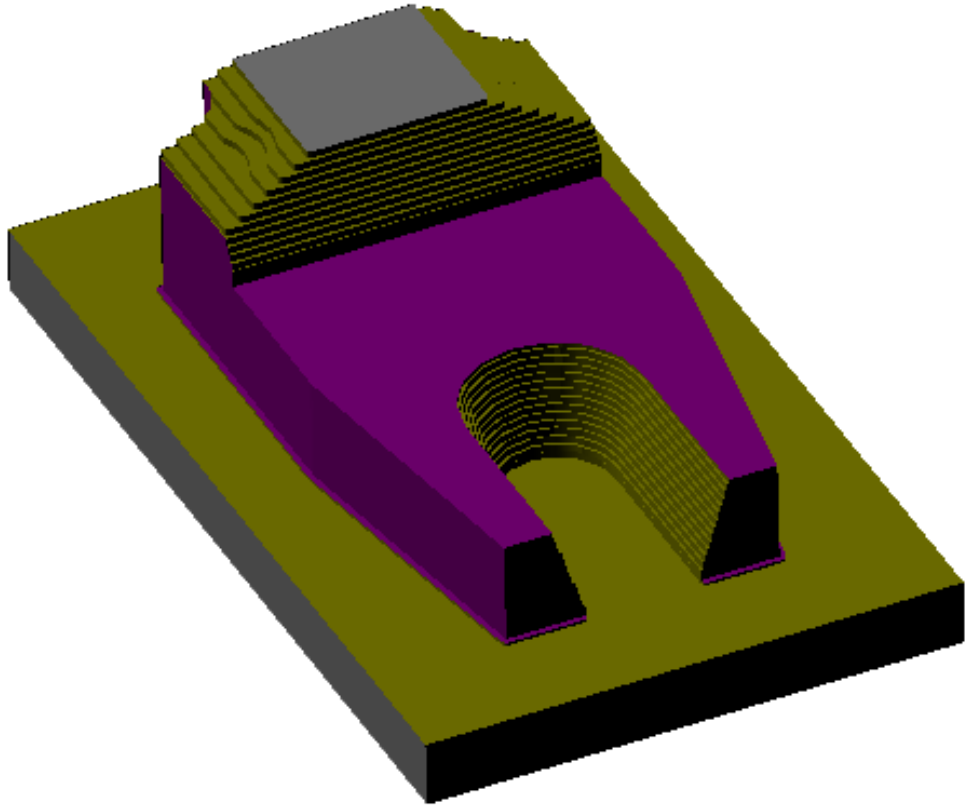


Multi-Axis Pocketing Operation

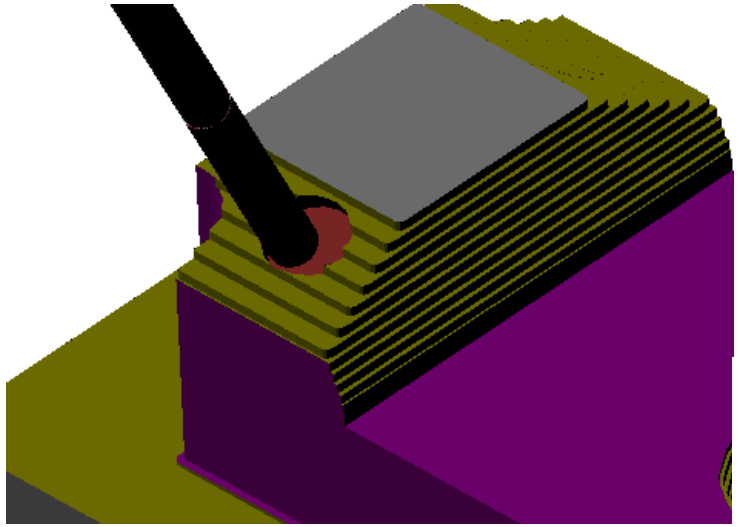


- There are THREE (3) options given by CATIA in viewing the full machining simulation. The description are as follows
  - 1 = Play video from last saved result
  - 2 = Full Video
  - 3 = Mixed Photo / Video
- Select 2nd icon to Play video from beginning. 
- Once satisfied with full machining simulation then just click OK to return back to previous window

Multi-Axis Pocketing Operation

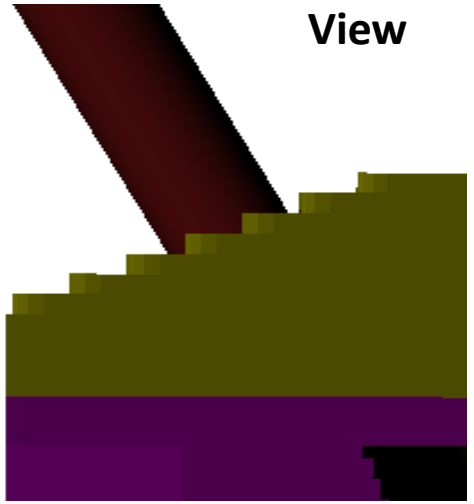


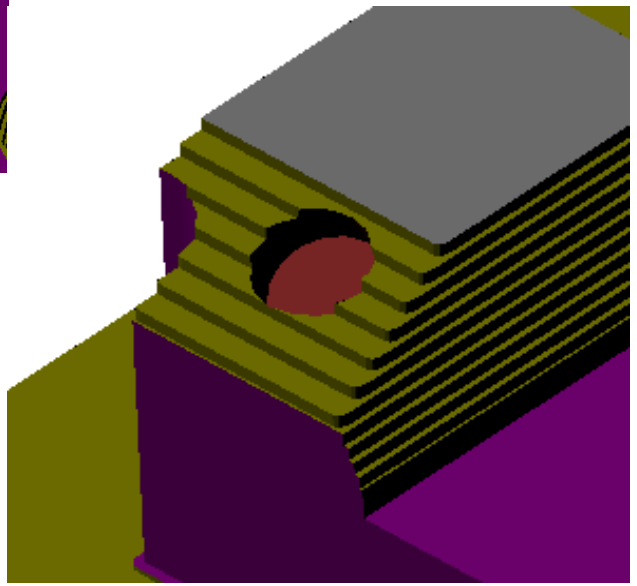
End Simulation of Roughing Operation &
Finishing Profile Contouring Operation



Multi-Axis Pocketing –
in progress

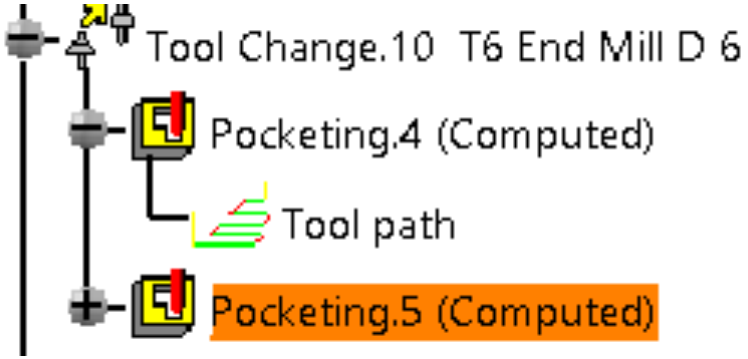
Front
View



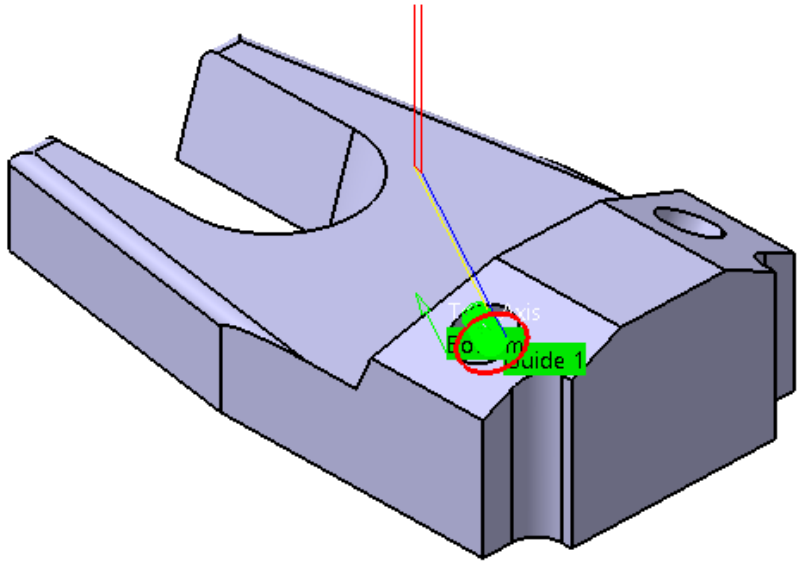


Multi-Axis Pocketing - Completed

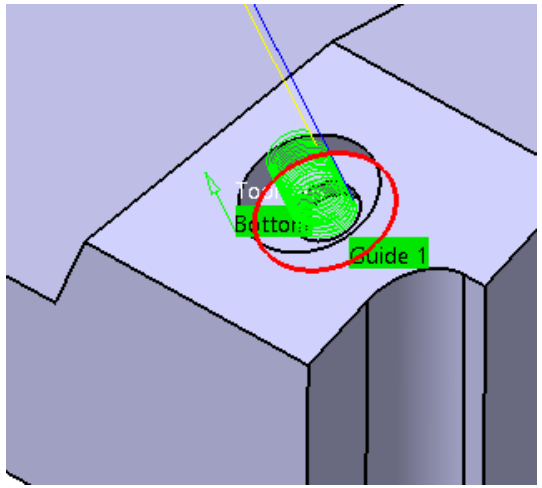
Multi-Axis Pocketing



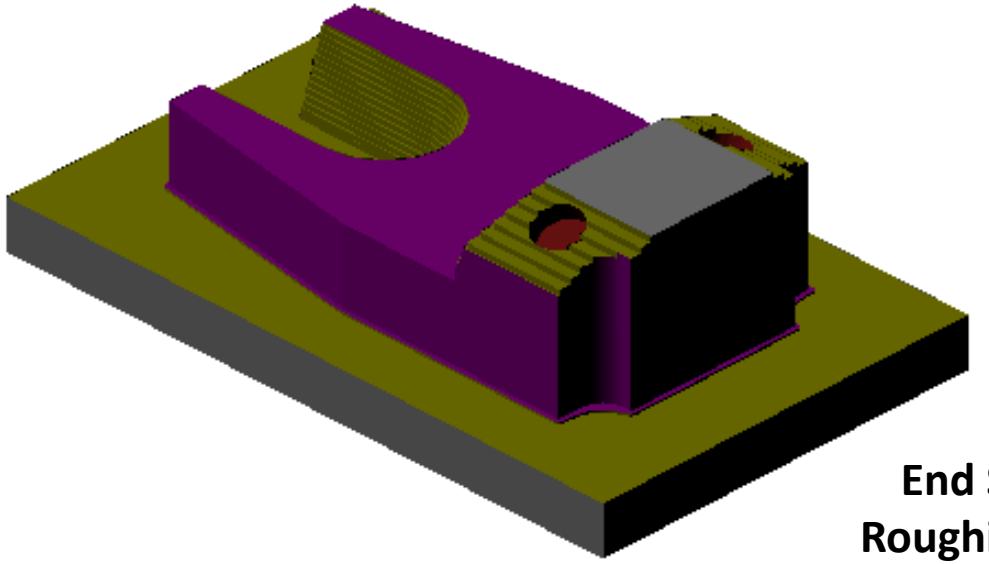
- **Specification TREE** – Pocketing Operation – 1st Hole.
- Once complete, COPY & PASTE the same operation for the 2nd Hole.
- ONLY change TAB 2- Geometry – Bottom, Guide Element & Top Surface

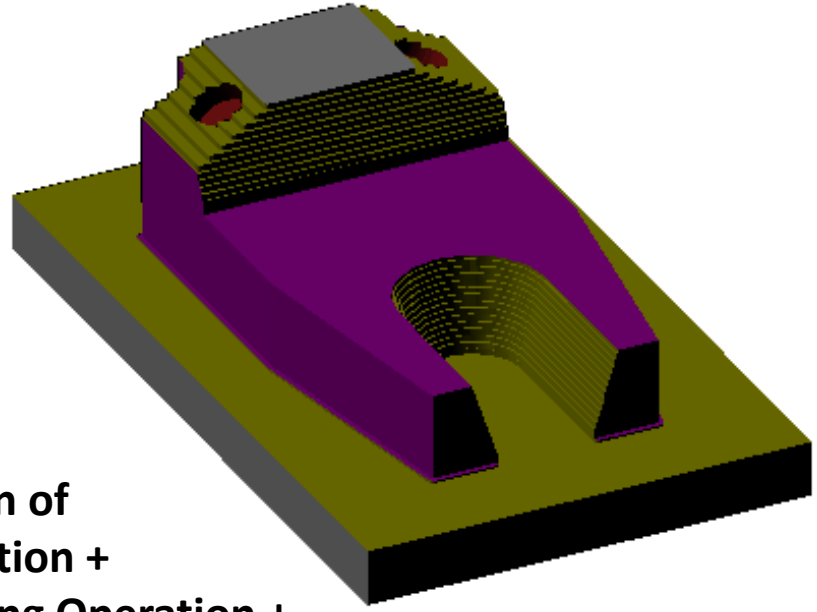


Tool Paths Calculation on another Hole



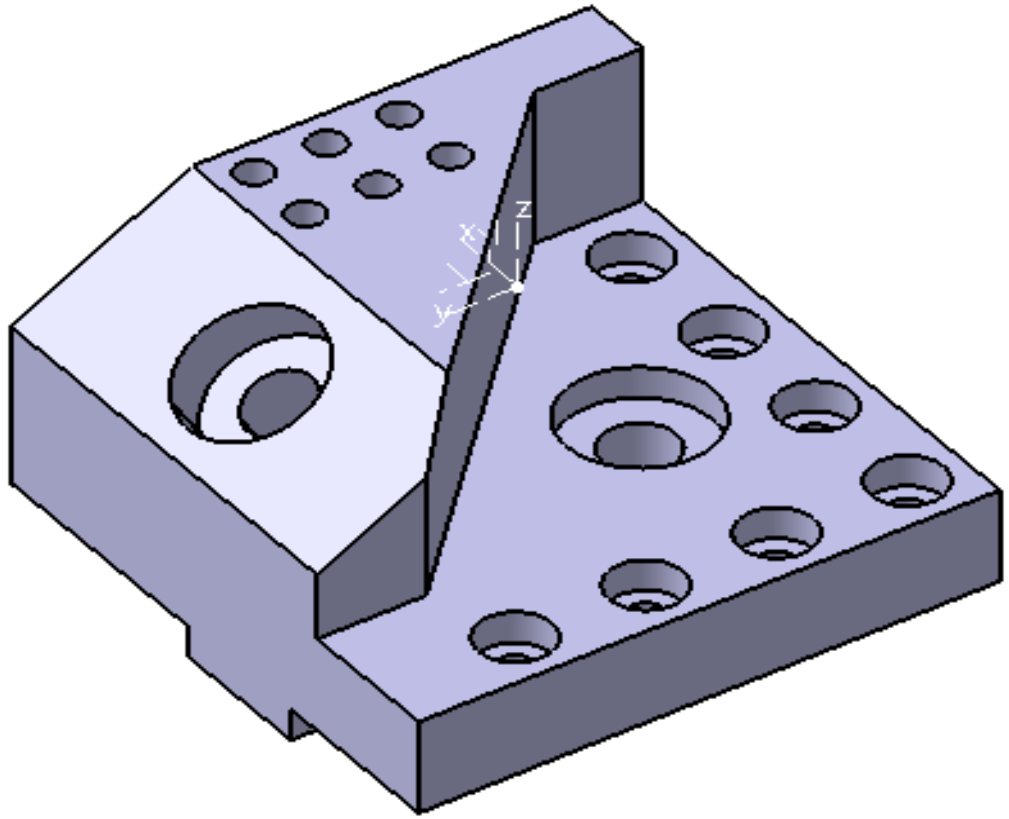
Multi-Axis Pocketing Operation





End Simulation of
Roughing Operation +
Finishing Profile Contouring Operation +
Multi-Axis Pocketing Operation

Multi-Axis Pocketing Operation

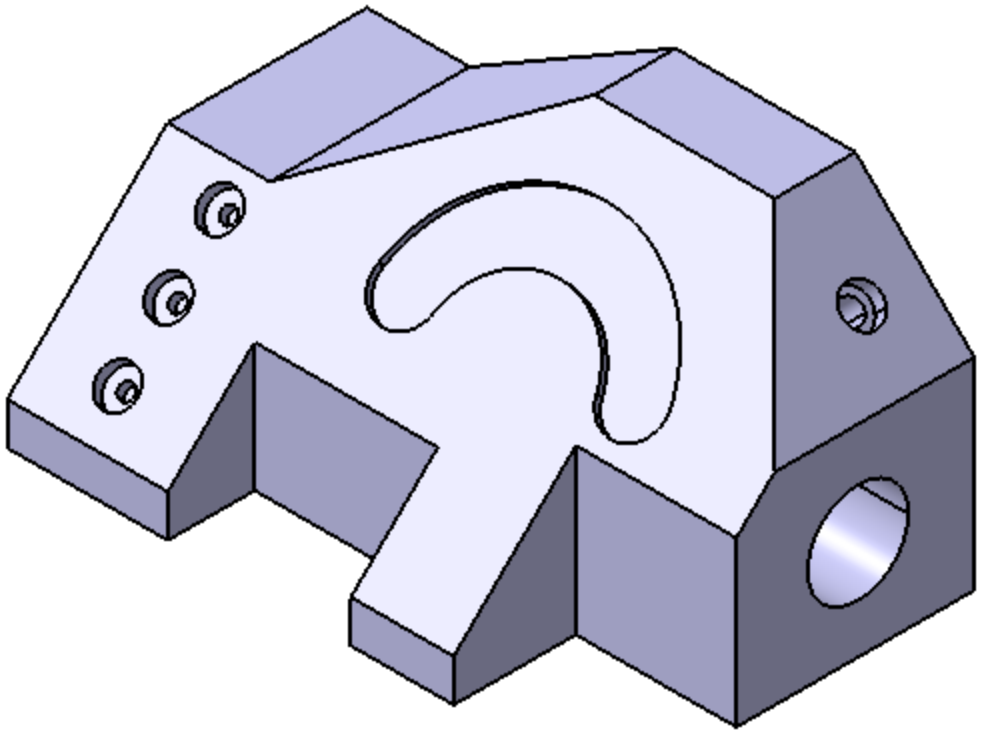


Exercise 1

Please prepare the CAM Programming following the instructions below:

- *Perform Multi-Axis Pocketing on the shown location.*
- *Please ensure the best practice of Macro Setting is used.*

Multi-Axis Pocketing



Exercise 1

Please prepare the CAM Programming following the instructions below:

- *Perform Multi-Axis Pocketing.*
- *Please ensure the best practice of Macro Setting is used.*

Multi-Axis Pocketing Operation

ALL THE BEST

THANK YOU