

ADVANCED MACHINING

BETP 3584

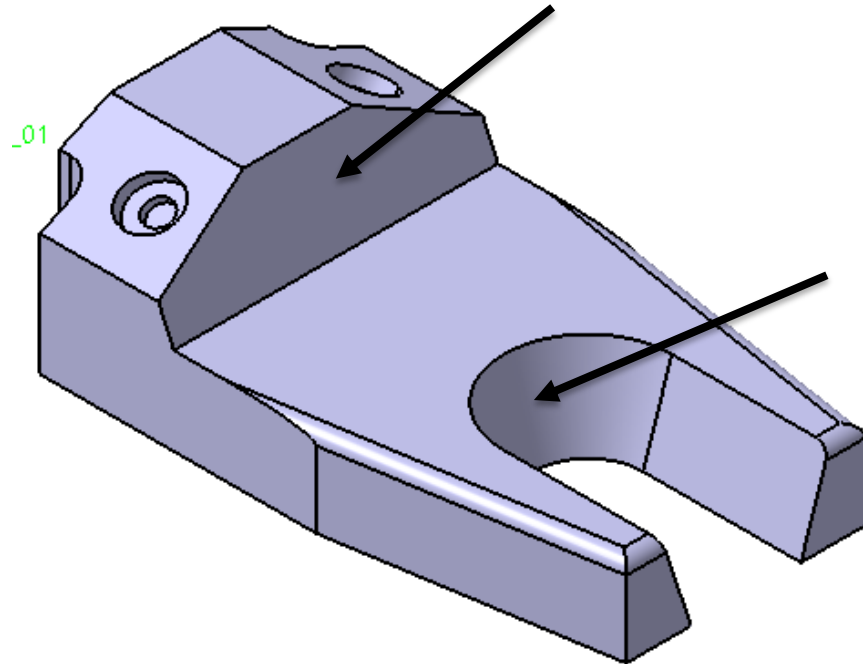
MULTI-AXIS FLANK CONTOURING OPERATION

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Multi-Axis Flank Contouring

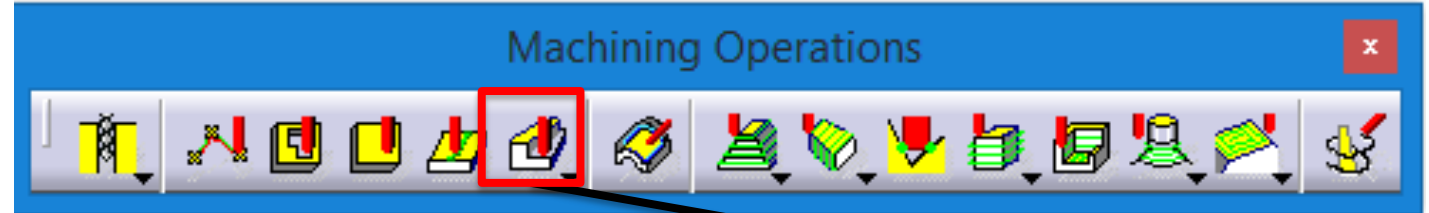
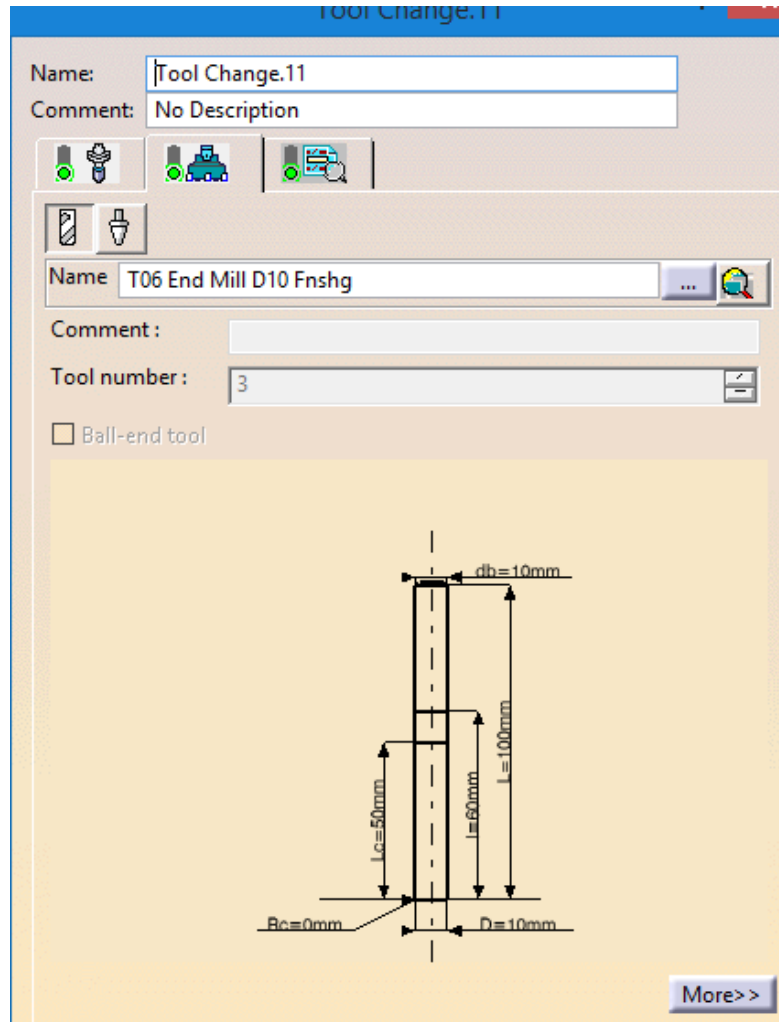
- ☐ Multi-Axis Flank Contouring is a machining process for machining slanted or wavy wall profiles.
- ☐ This operation utilizing the body of the cutting tool instead of the face which normally happened for the rest to the machining processes introduced before.
- ☐ With the introduction to this operation, tight slanted wall profiles are now possible to be machined.
- ☐ Ultimately, Multi-Axis Flank Contouring broaden the flexibility in preparing CAM program for Five-Axis Machining profiles.

Multi-Axis Flank Contouring



- ✓ From the given CAD Model, there are **TWO (2) areas** have been **identified** appropriate to perform **Multi-Axis Flank Contouring**.
- ✓ Although **one of the identified areas** has been performed with **Multi-Axis Profile Contouring**, in **some cases Multi-Axis Flank Contouring** is the **best machining operation** to be used.
- ✓ **Multi-Axis Flank Contouring** performing **smaller tilting angle** compared to **Multi-Axis Profile Contouring** which **affecting the rigidity of the cutting tool** whilst machining the respective area.

Multi-Axis Flank Contouring

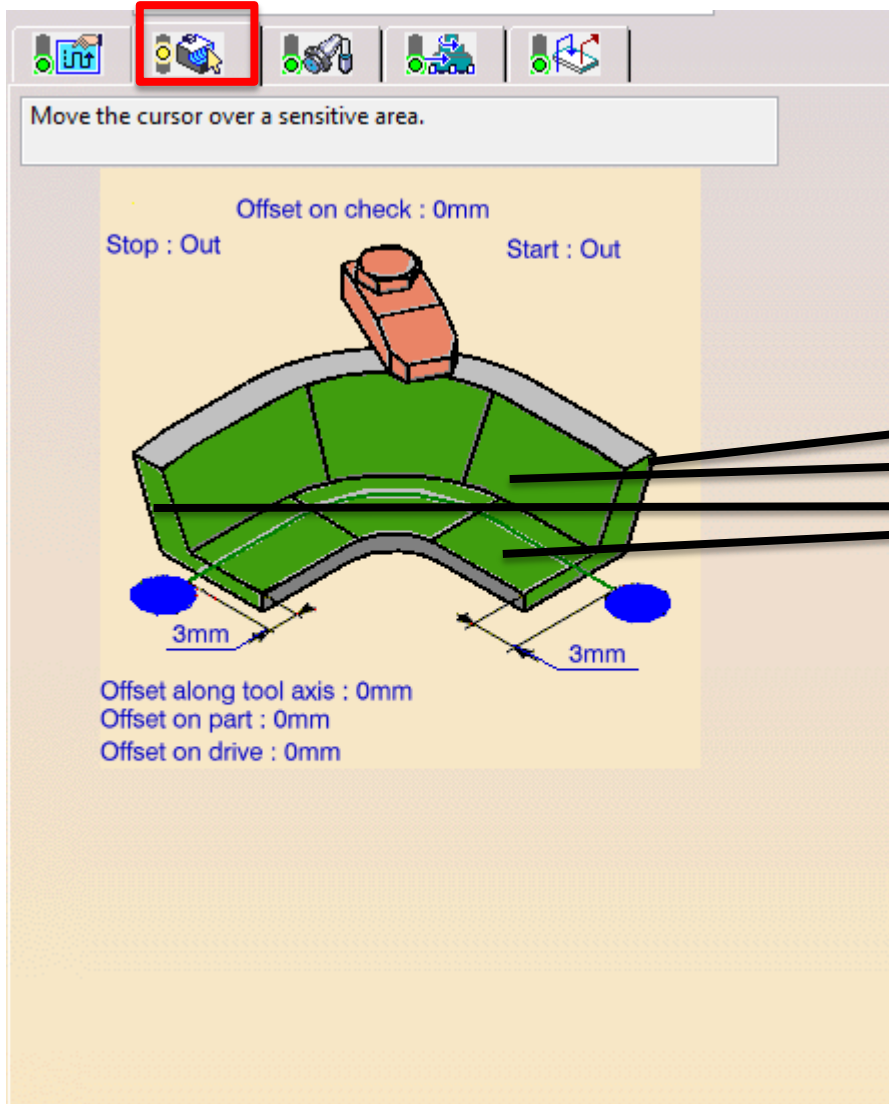


Multi-Axis Flank Contouring

- ✓ **Multi-Axis Flank Contouring Operation** icon is located inside the **Profile Contouring Operation** icon.
- ✓ Create and insert the desired Cutting Tool in the Resource List as well as in the Manufacturing Program
- ✓ Select the right **CUTTING TOOL– END MILL D10.0**

Multi-Axis Flank Contouring

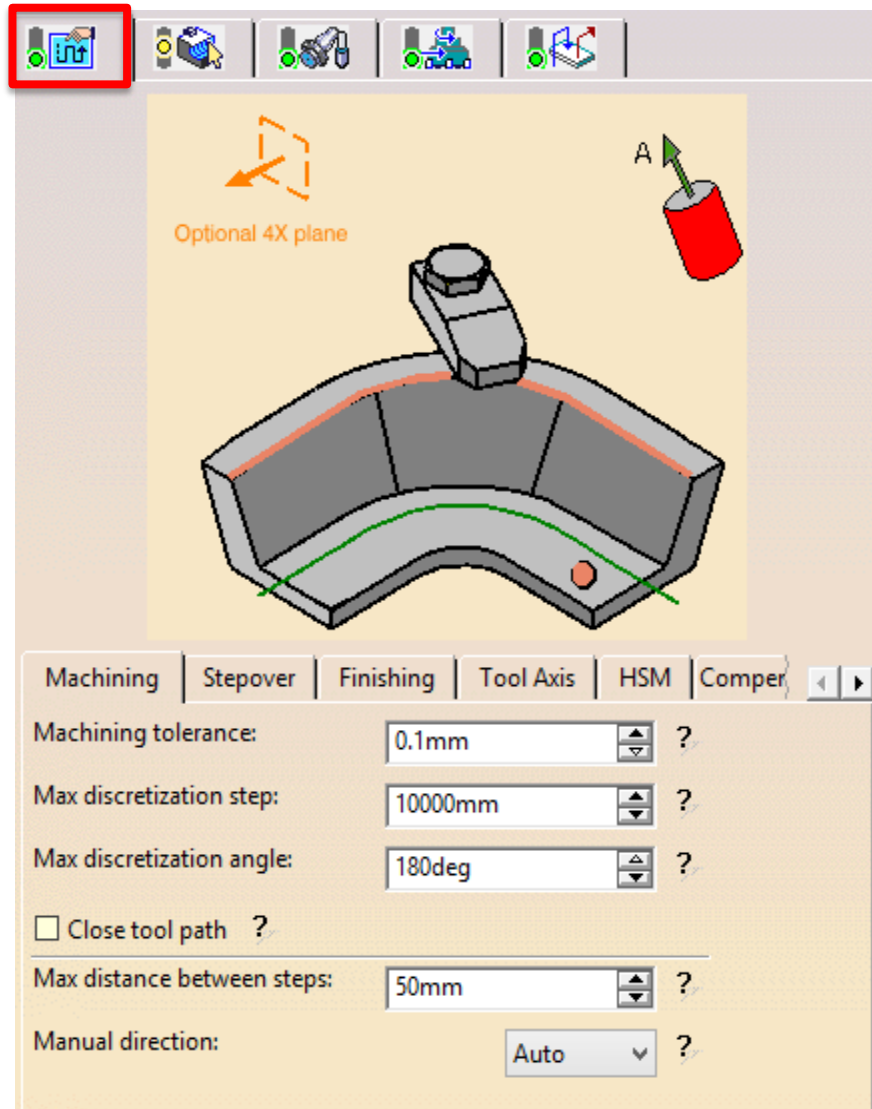
2



- ✓ In TAB – 2, there are **Four (4) geometries** that need to be defined namely **Part** (bottom), **Driving Element** (wall / surface to machine), **Start & End Elements**.
- ✓ **Driving Element** is very important because this surface will be the reference surface for the Tool Axis.
- ✓ **Start and End Elements** are two main important elements in determining the **Down Cut** or **Up Cut** machining strategy.
- ✓ In CATIA, the **term used for Down Cut** is **Climb** strategy whereas for **Up Cut** is **Conventional** strategy.

Multi-Axis Flank Contouring

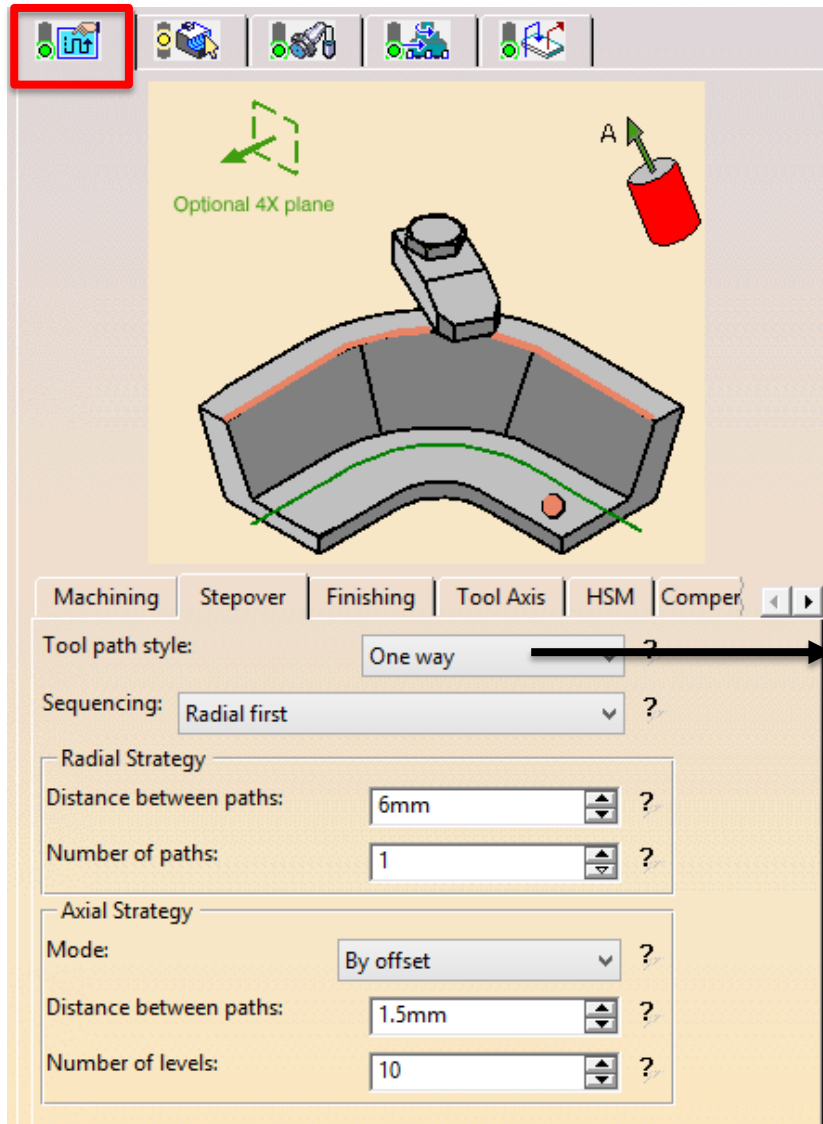
1



- ✓ In **TAB – 1**, there are nothing to be set as the default settings are good to proceed with the next step except for the **Machining Tolerance**.
- ✓ **Machining Tolerance** representing how fine one path to another or one point to another point.
- ✓ Realize or not in **Multi-Axis Flank Contouring** there is **NO** option for machining style or strategy namely as **Climb & Conventional**.
- ✓ This is because in **Multi-Axis Operations** users need to **define manually** since this operation is actually for Advanced Operations.
- ✓ Thus, users are **expected to be well-versed** in **basic machining operations**.

Multi-Axis Flank Contouring

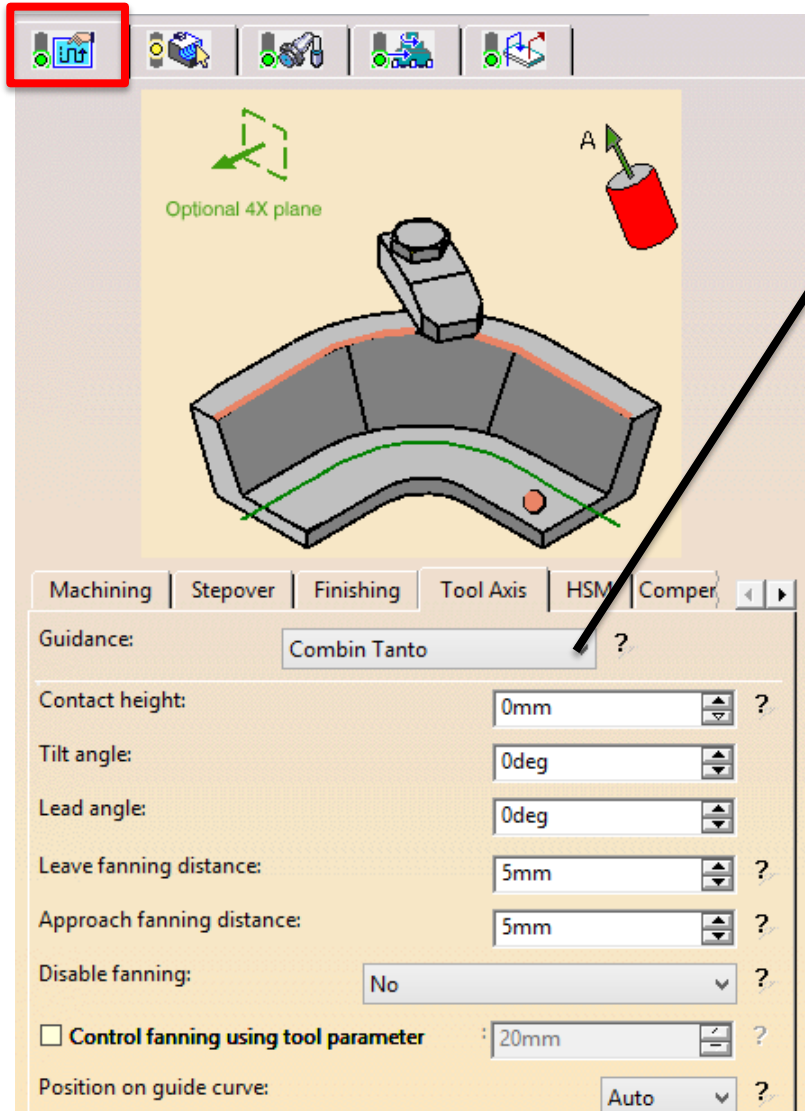
1



- ✓ Still in **TAB – 1**, STEPOVER – There are Tool Path Style options as well as Radial & Axial Strategy to be determined here.
- ✓ As mentioned earlier, there is **NO** options given for **Climb** and **Conventional** strategy **BUT** only for **One Way** and **Zig Zag** machining strategy.
- ✓ In most cases, **One Way strategy** is used to **preserve** the **cutting tool** and obtain **better surface finish** of machined part.
- ✓ On the other hand, users can choose the **sequence** of tool path calculation either **Radial** or **Axial first**.

Multi-Axis Flank Contouring

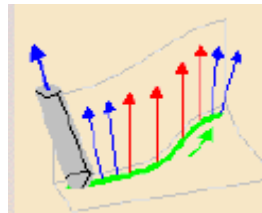
1



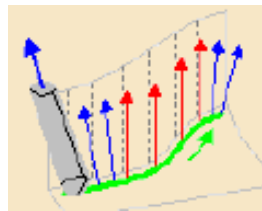
Tanto Fan
Combin Tanto
Combin Parelm
Mixed Combin
Fixed axis
Normal to part



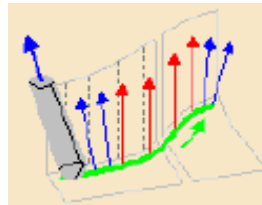
Tanto Fan



Combin Tanto



Combin Parelm



Mixed Combin

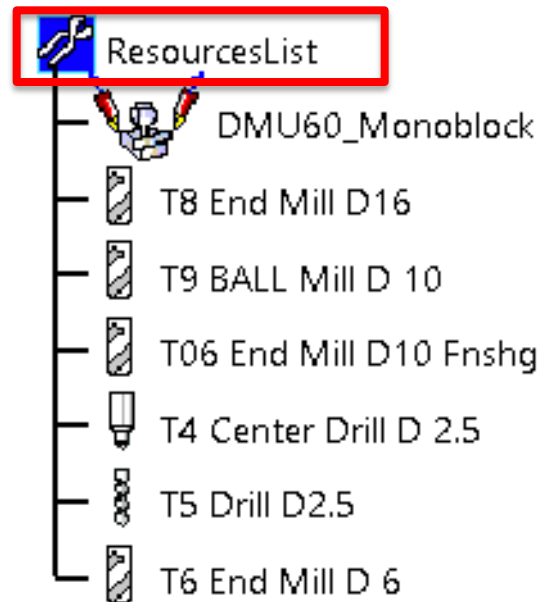
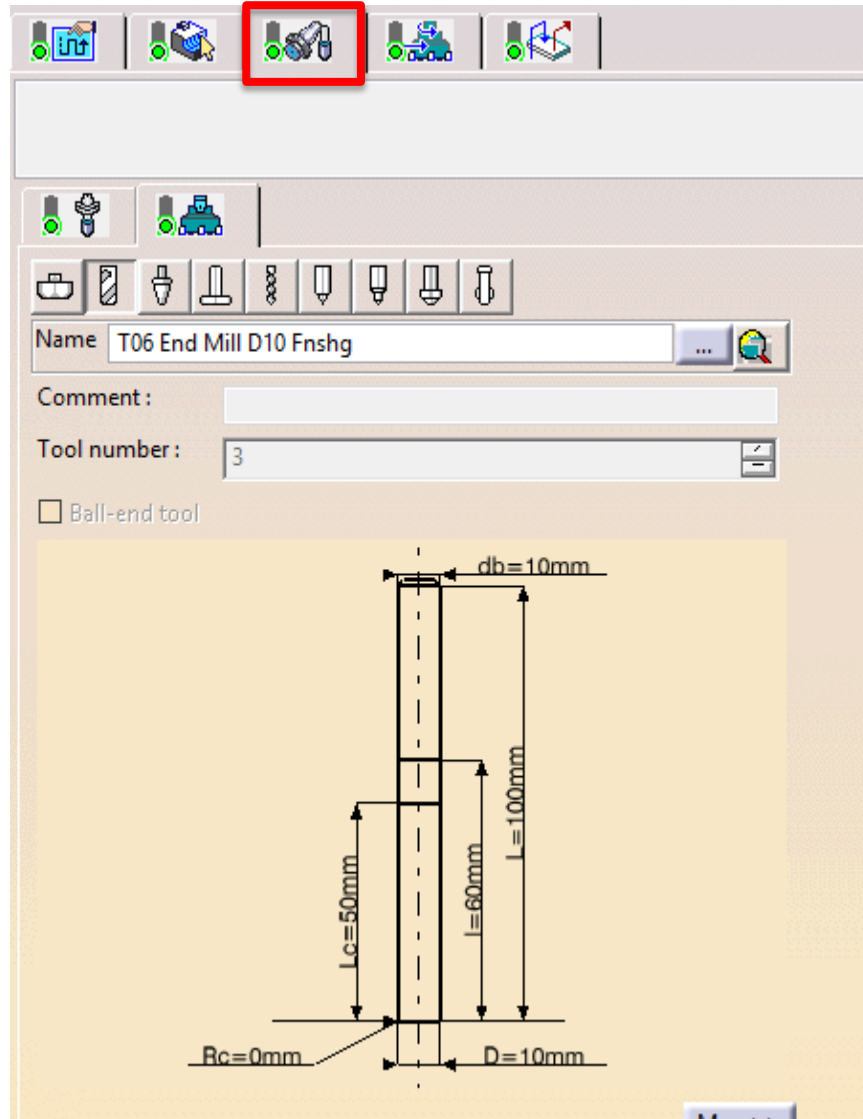
✓ Still in **TAB – 1**, **TOOL AXIS** – This is the **most important** setting to be defined in order to **differentiate 3-Axis & 5-Axis Machining**.

✓ There are **SIX (6)** options of **Tool Trajectory** given in **Tool Axis**. Each option comes with specific description.

✓ **First FOUR (4)** options are used in **5-Axis simultaneous**. Meanwhile, the **Fixed Axis** is for **3-Axis Machining** and finally **Normal to Part** is normally used for **4-Axis Machining** or **Indexing Motion**.

3

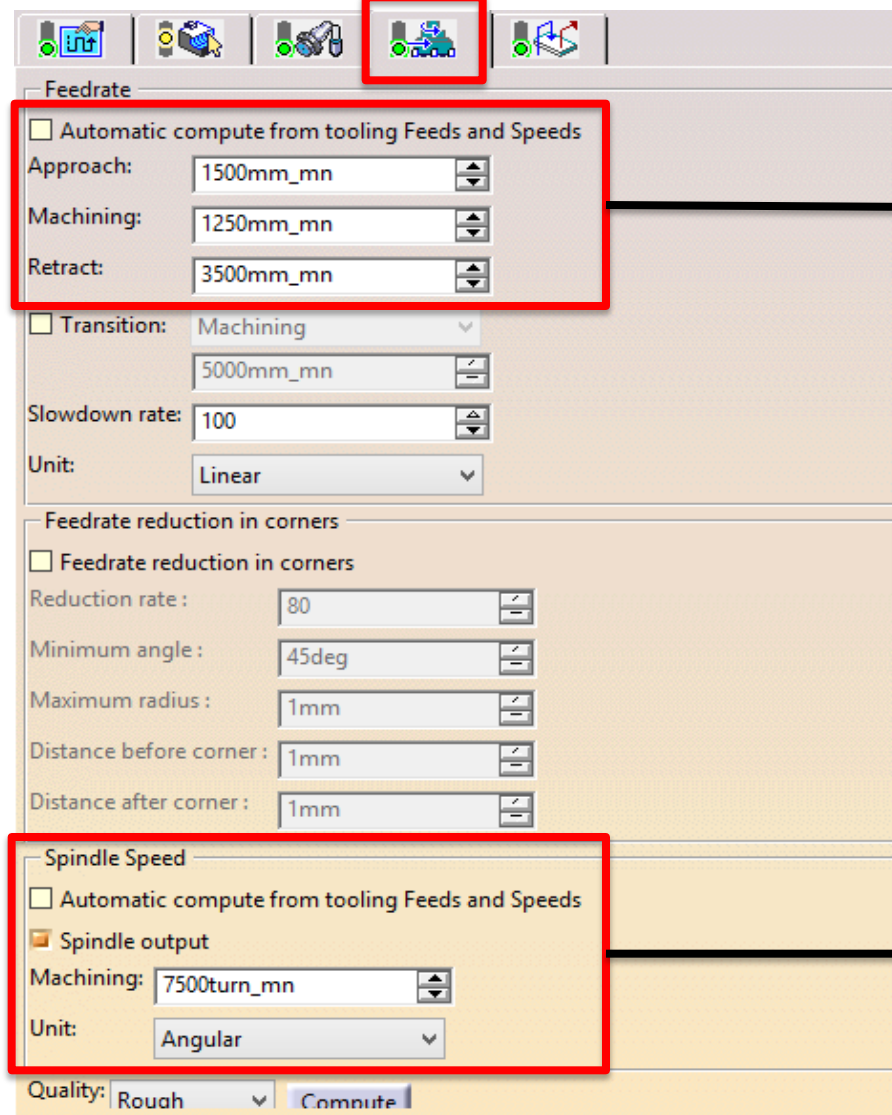
Multi-Axis Flank Contouring



- 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

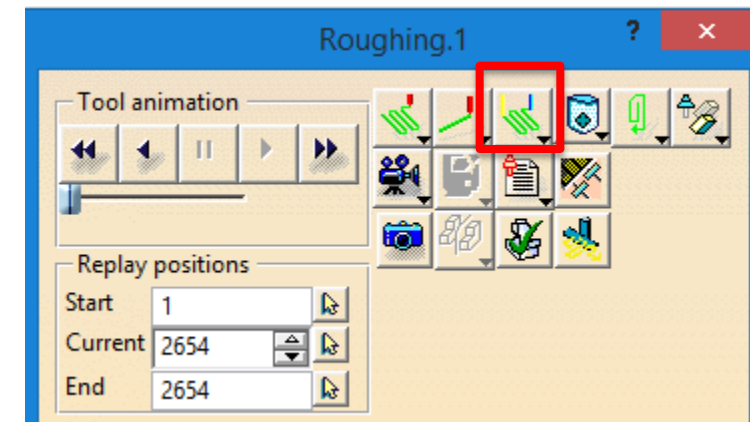
Multi-Axis Flank Contouring



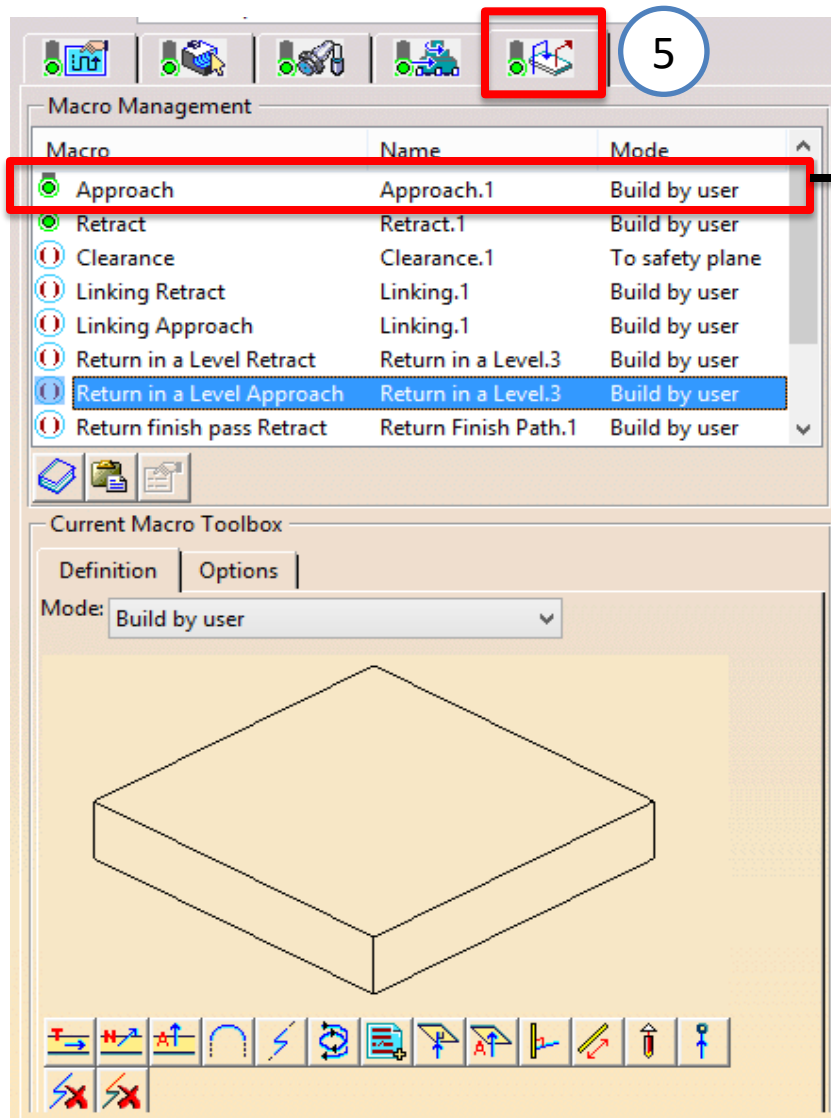
- There are **THREE (3)** types of **Feed Rates** which need to be defined namely **Approach, Machining & Retract**.
- **Color Coding** representing each Feed Rate are
 - **Approach = Yellow**
 - **Machining = Green**
 - **Retract = Blue**
- To view this, user needs to **change the setting** in **simulation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

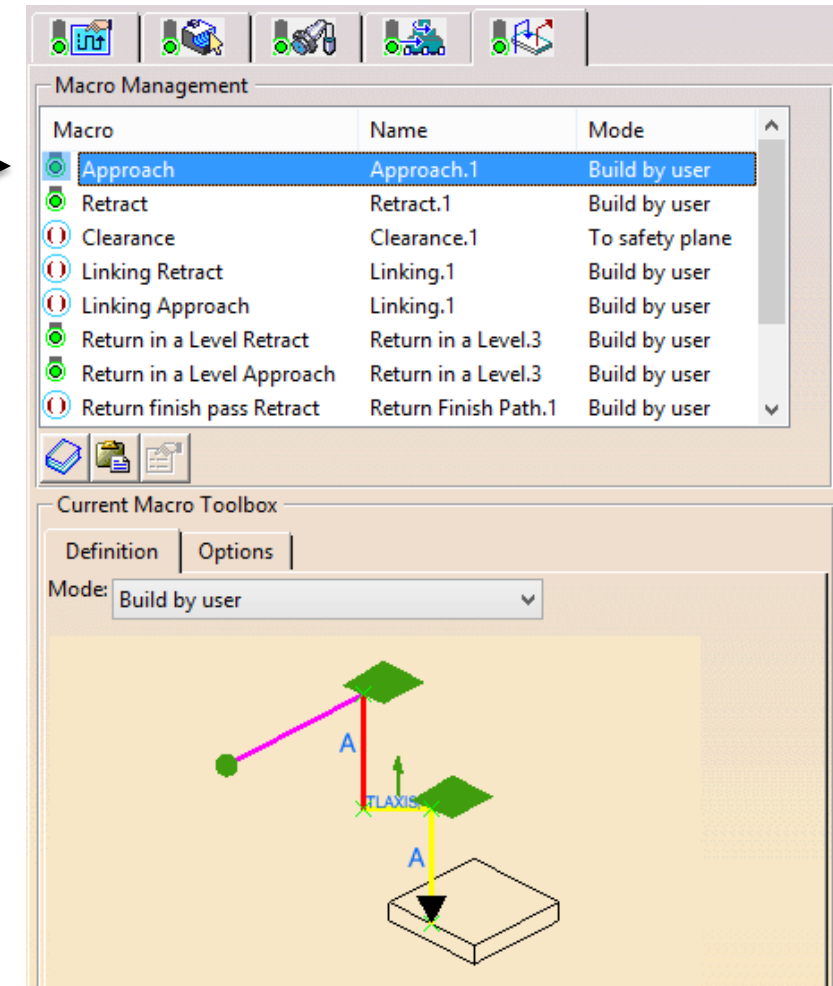


Multi-Axis Flank Contouring

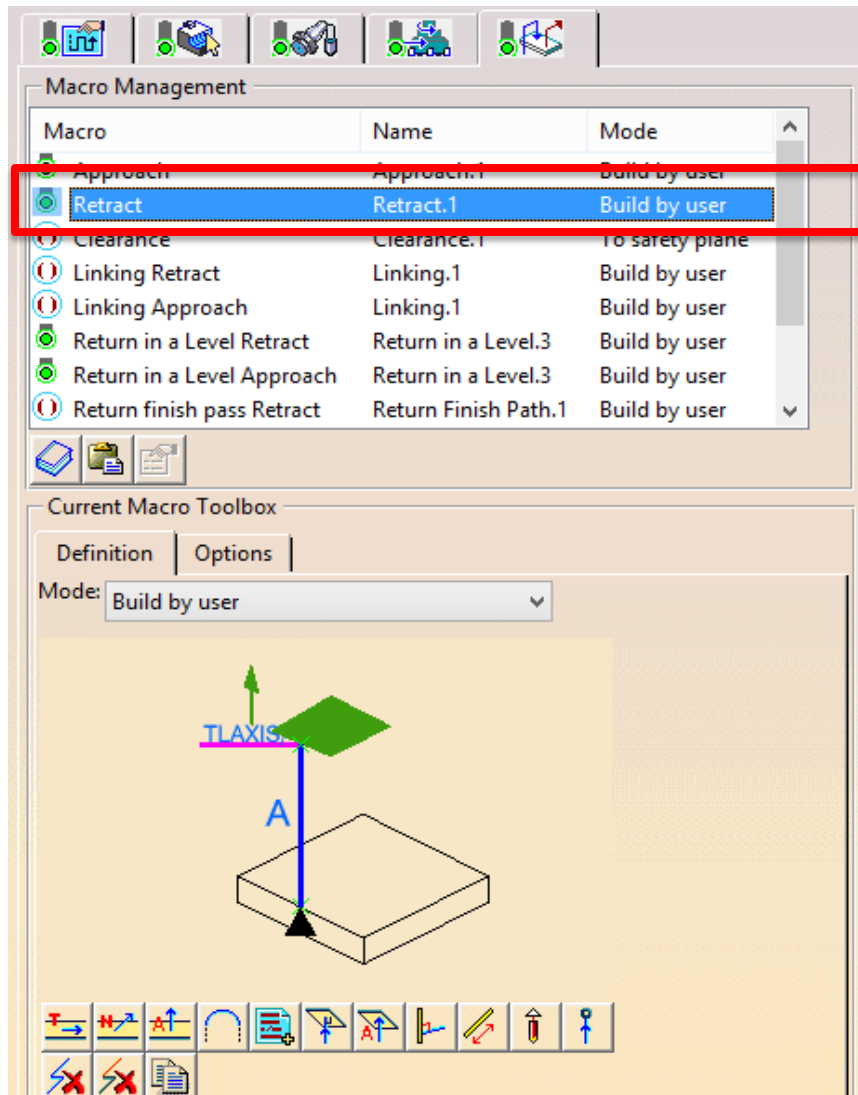


❑ Macro Setting for Approach consists of, Axial To Plane, Tool Axis, Axial To Plane and Motion to Point.

❑ Meanwhile, Macro Setting for Retract consists of Axial To Plane, Tool Axis and Axial To Plane.



Multi-Axis Flank Contouring



❑ Since **Multi-Axis Profile Contouring** is using for **4/5 Axis** position thus **Tool Axis** is very important to maintain the **cutting tool position 90 degree** before and after machining is done.

❑ **Tool Axis** is very useful to be used in **4/5 Axis** motion to **decrease possibility of collision**. Same goes to **Approach Macro Setting**.

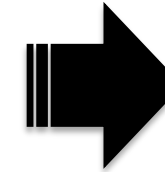
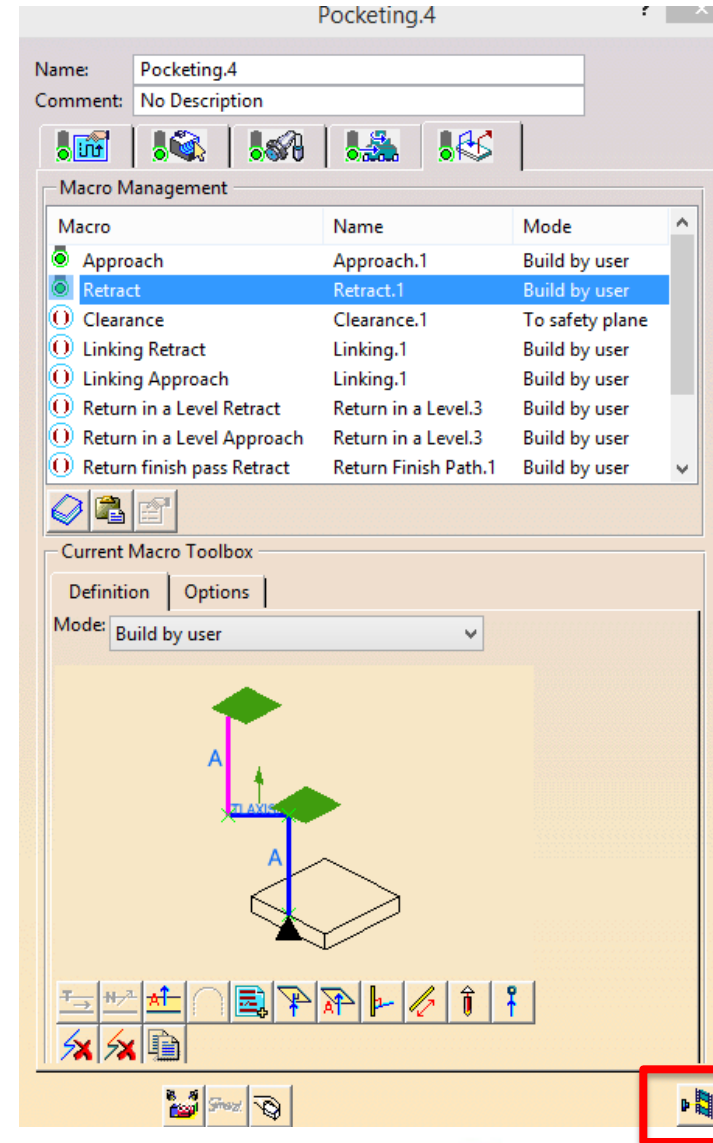
❑ Cutting tool will be **approaching and leaving the workpiece in 90 degree** – **3 Axis** motion before make **any tilting motion** towards the machining profile.



Macro Setting –
Tool Axis

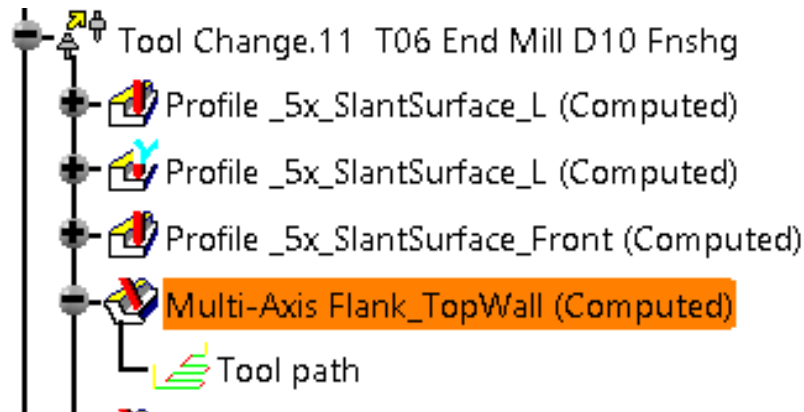
Multi-Axis Flank Contouring

- 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.

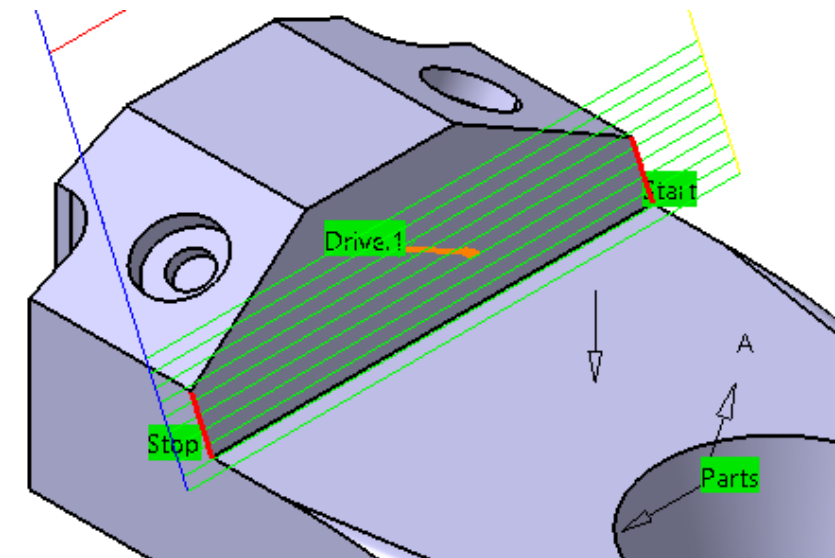
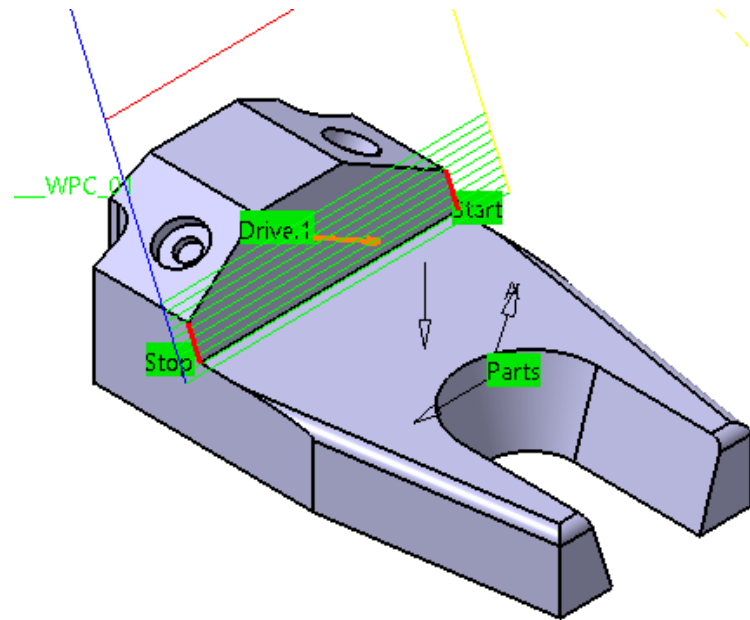


Tool Paths Reply

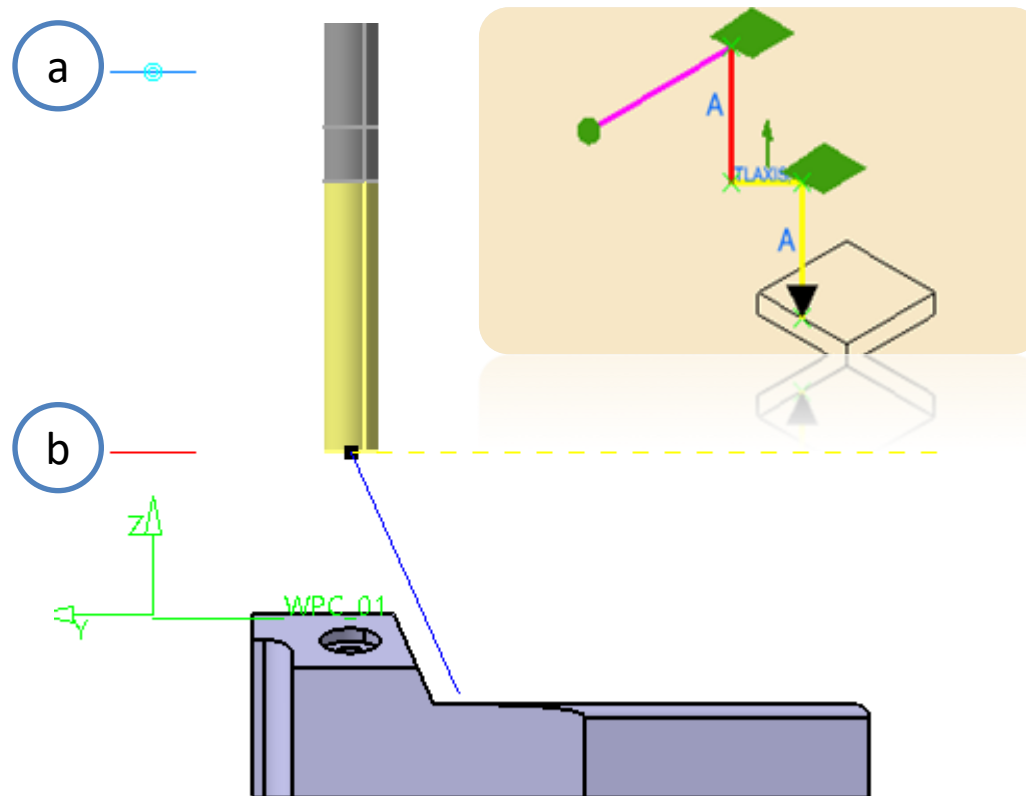
Multi-Axis Flank Contouring



☐ **Specification TREE** – Multi-Axis Flank Contouring – Slanted Top Surface

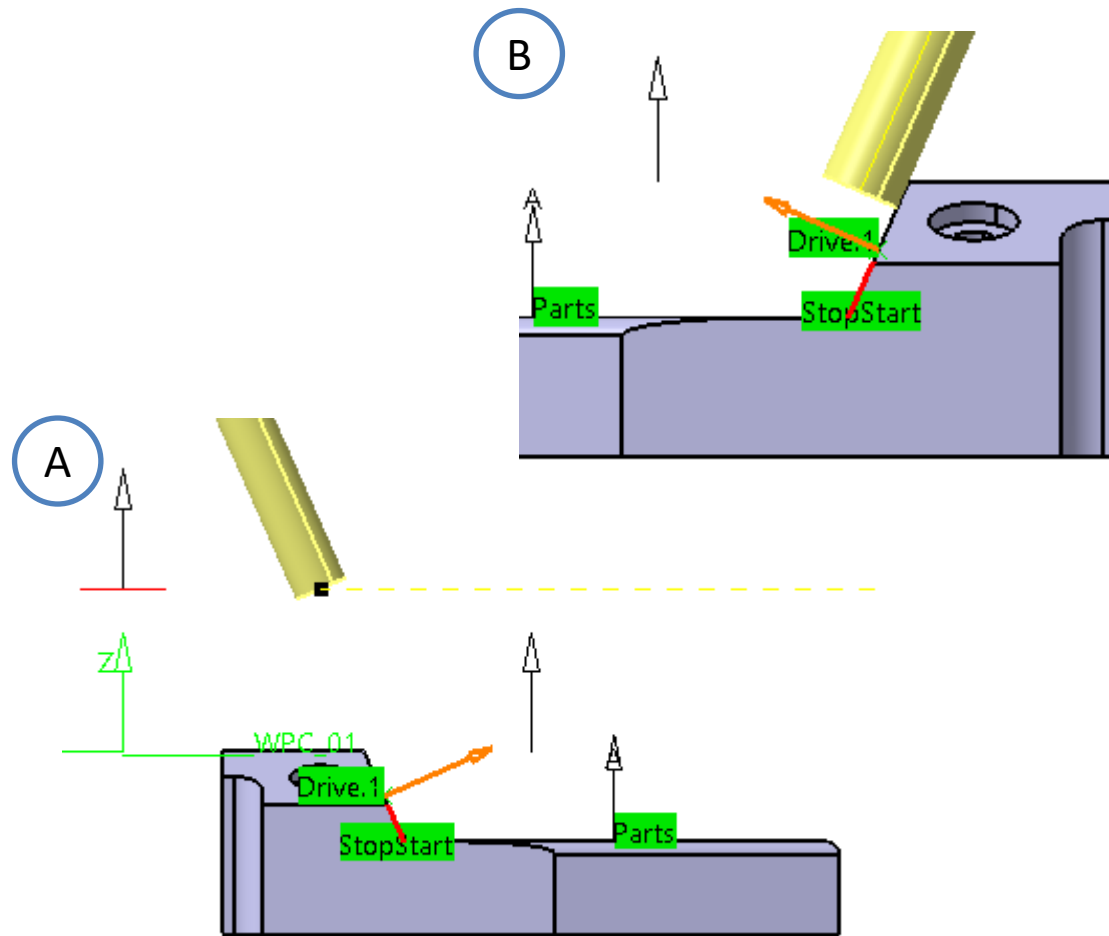


Multi-Axis Flank Contouring



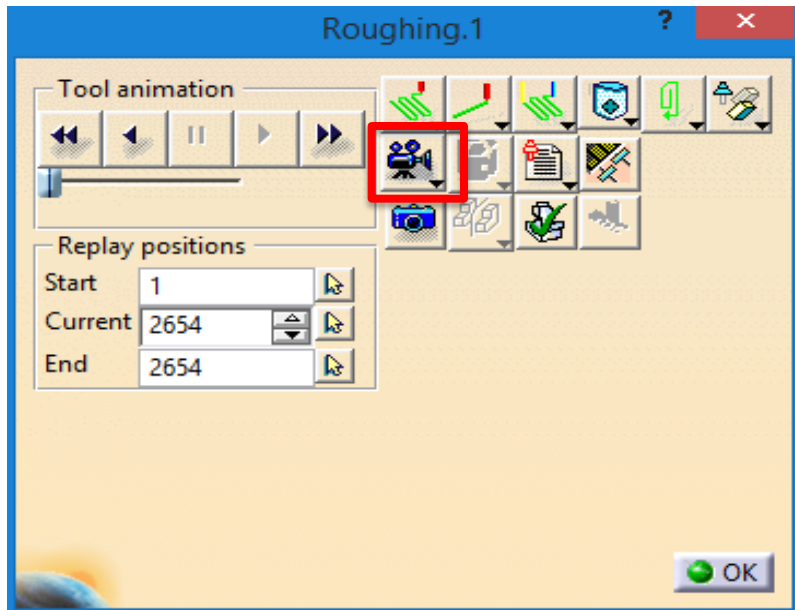
- From **Machining Tool Paths** calculation, it is **obviously** seen that the **cutting tool** is **approaching** the material in a **straight 90 degree motion** (from plane “a” – “b”)
- This is **due to the Approach Macro Setting** set which shows the function of **Tool Axis** motion.
- The **cutting tool** is **ONLY** allowed to tilt at certain height of the defined plane.

Multi-Axis Flank Contouring



- The cutting tool is started to tilt towards the machining surface illustrated by “A”
- Meanwhile, “B” exhibits the cutting tool **begins machining process** on the respected surface perpendicularly.
- Ultimately, **Macro Setting** is very useful in **directing the cutting tool motions** according to the **users specification** which on the same time **improving the flexibility** in preparing **CAM Program**.

Multi-Axis Flank Contouring



- There are THREE (3) options given by CATIA in viewing the full machining simulation. The description are as follows

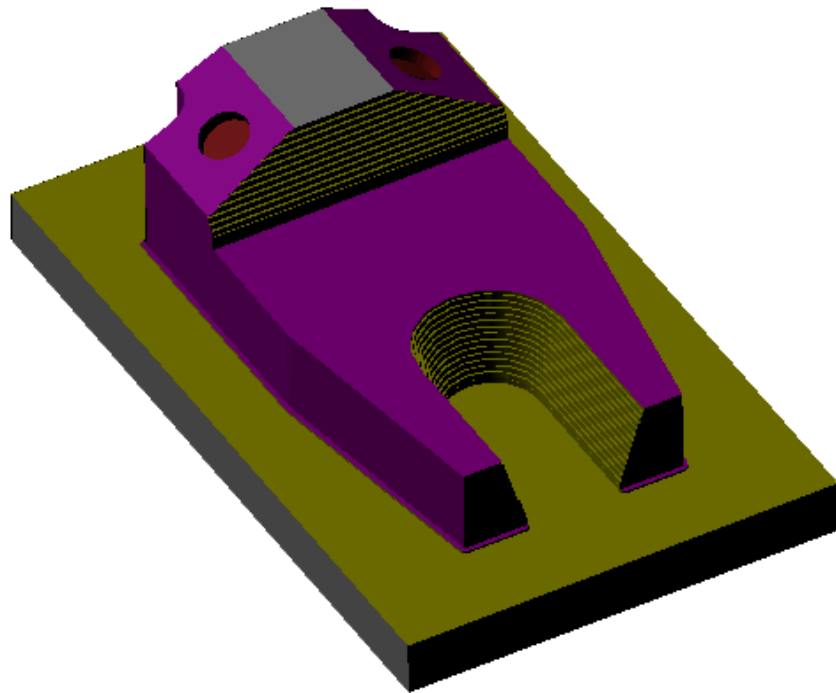
- 1 = Play video from last saved result
- 2 = Full Video
- 3 = Mixed Photo / Video

- Select 2nd icon to Play video from beginning.

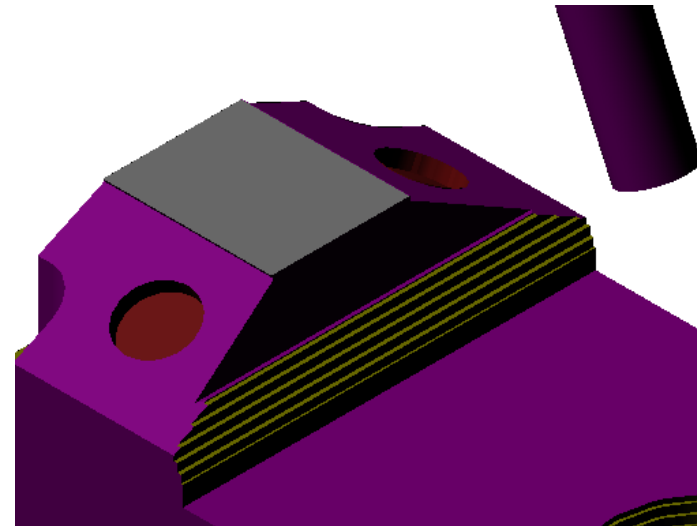


- Once satisfied with full machining simulation then just click OK to return back to previous window

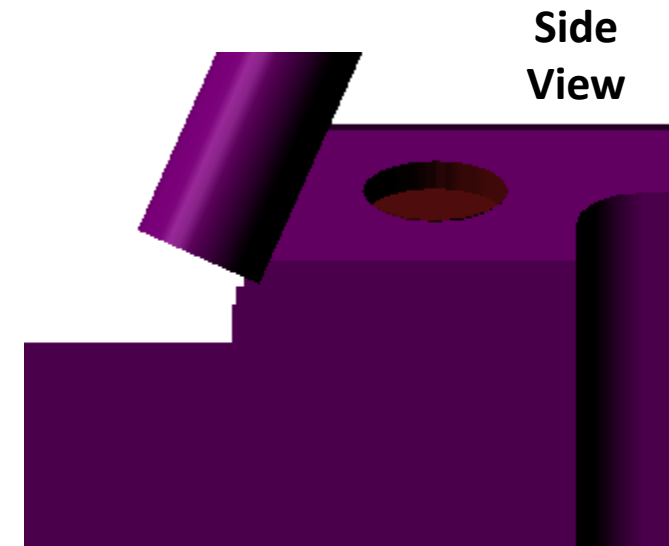
Multi-Axis Flank Contouring



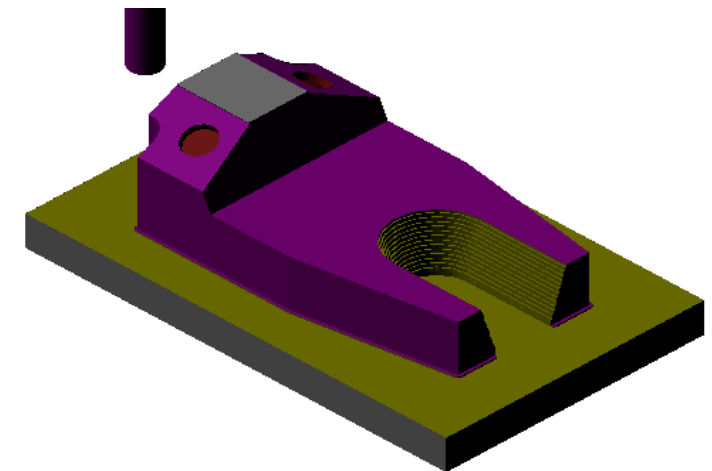
End Simulation of Roughing Operation +
Finishing Profile Contouring Operation +
Multi-Axis Pocketing Operation



Multi-Axis Flank
Contouring– in progress

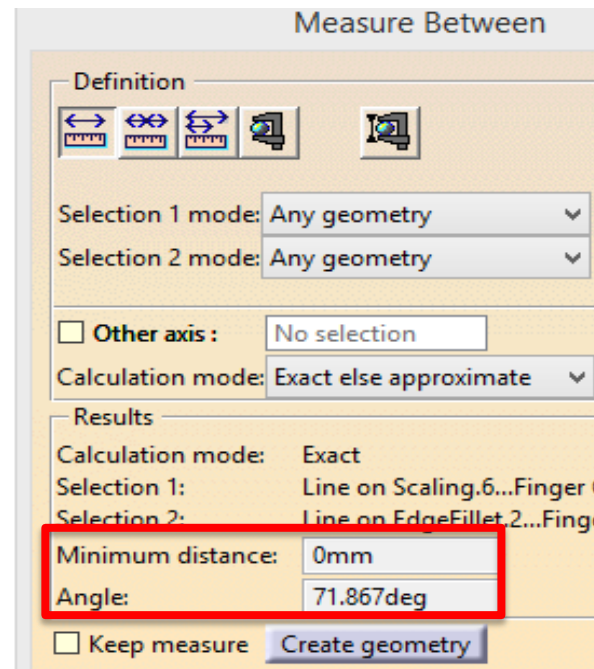
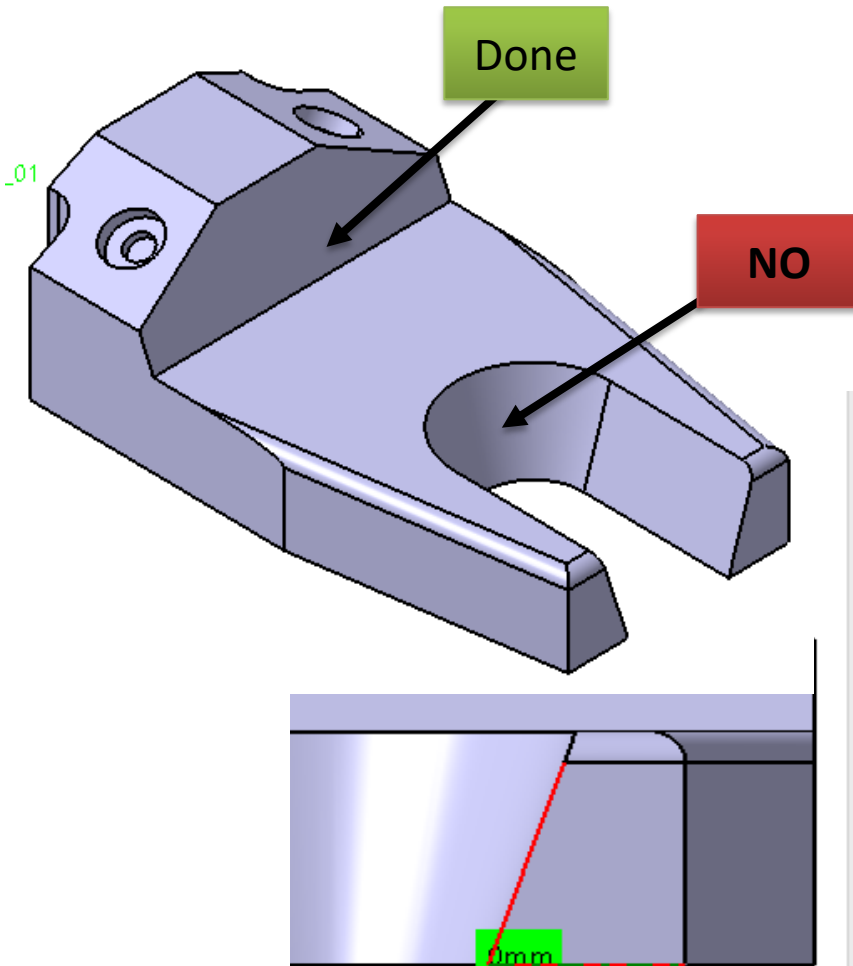


Side
View



Multi-Axis Flank Contouring -
Completed

Multi-Axis Flank Contouring



- From the given **CAD model**, one (1) area **has been successfully machined** and **left another area** which looks like U shape.
- This U shape is not straight or 90 degree due to the draft angle after analyzed the CAD model.
- The **following steps** shall **guide** on **how to perform Multi-Axis Flank Contouring Operation** on that particular area.

Move the cursor over a sensitive area.

Offset on check : 0mm

Stop : Out

Start : Out

Offset along tool axis : 0mm

Offset on part : 0mm

Offset on drive : 0mm

3mm

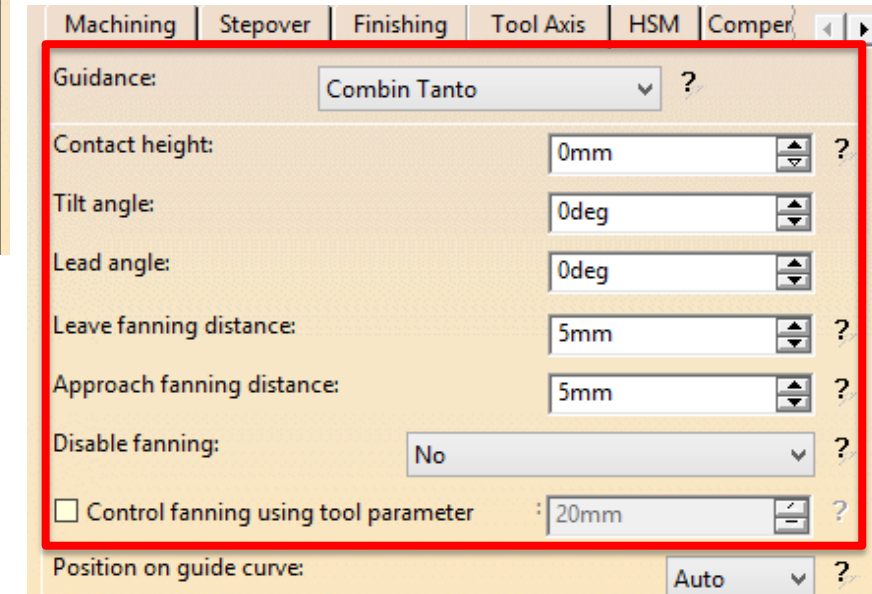
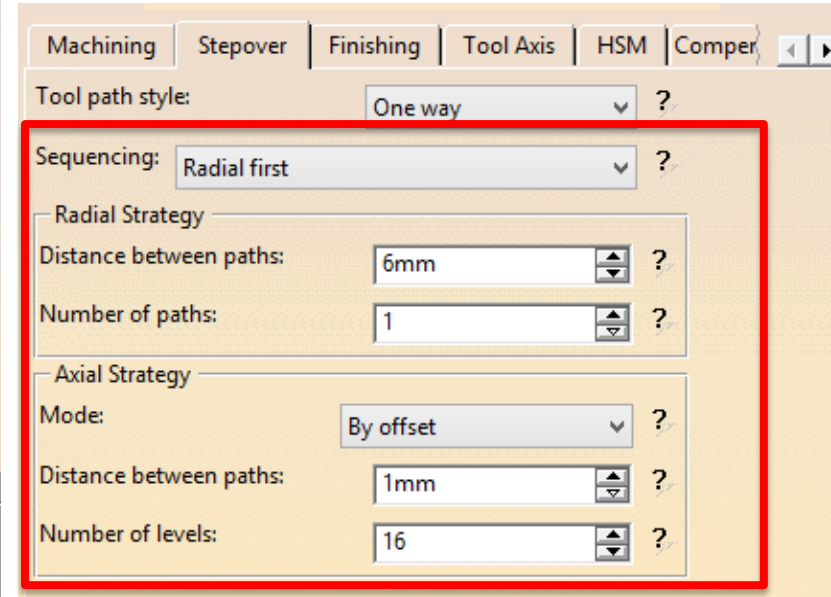
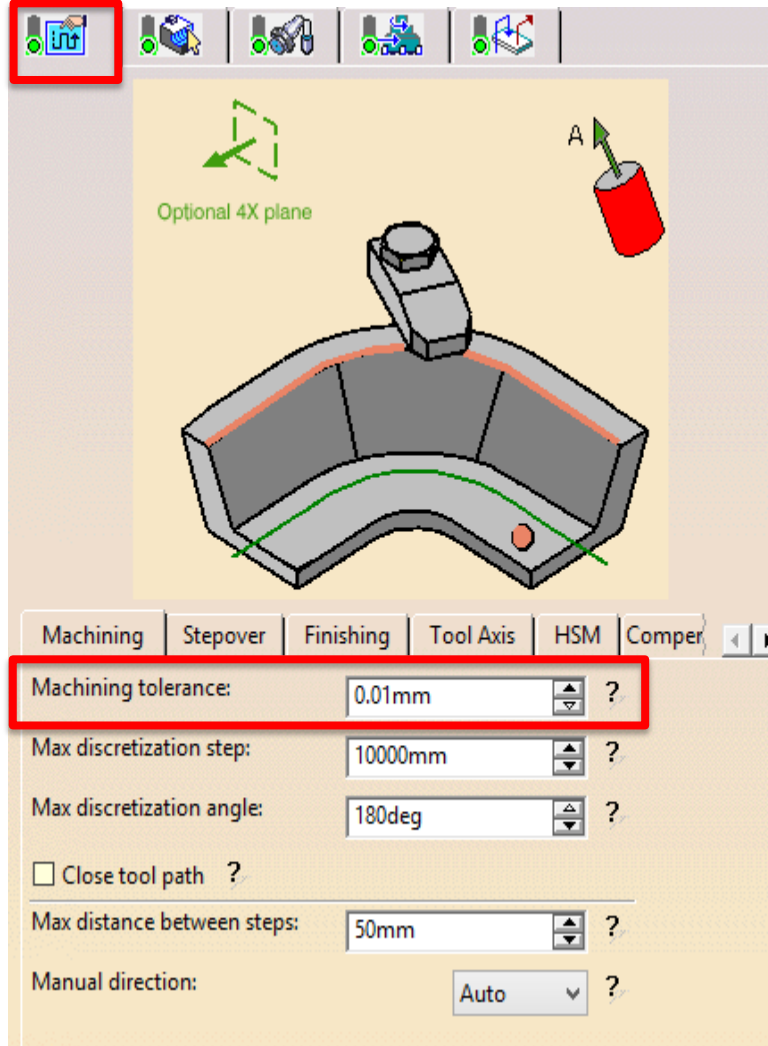
3mm

The diagram shows a 3D model of a quarter-circle part with a red tool positioned on top. The part is green and has a grey base. Two blue circles on the base indicate a 3mm offset. The text 'Offset on check : 0mm' is at the top. 'Stop : Out' and 'Start : Out' are on the left and right respectively. 'Offset along tool axis : 0mm', 'Offset on part : 0mm', and 'Offset on drive : 0mm' are at the bottom. The 3mm dimensions are labeled at the bottom left and right.

- 

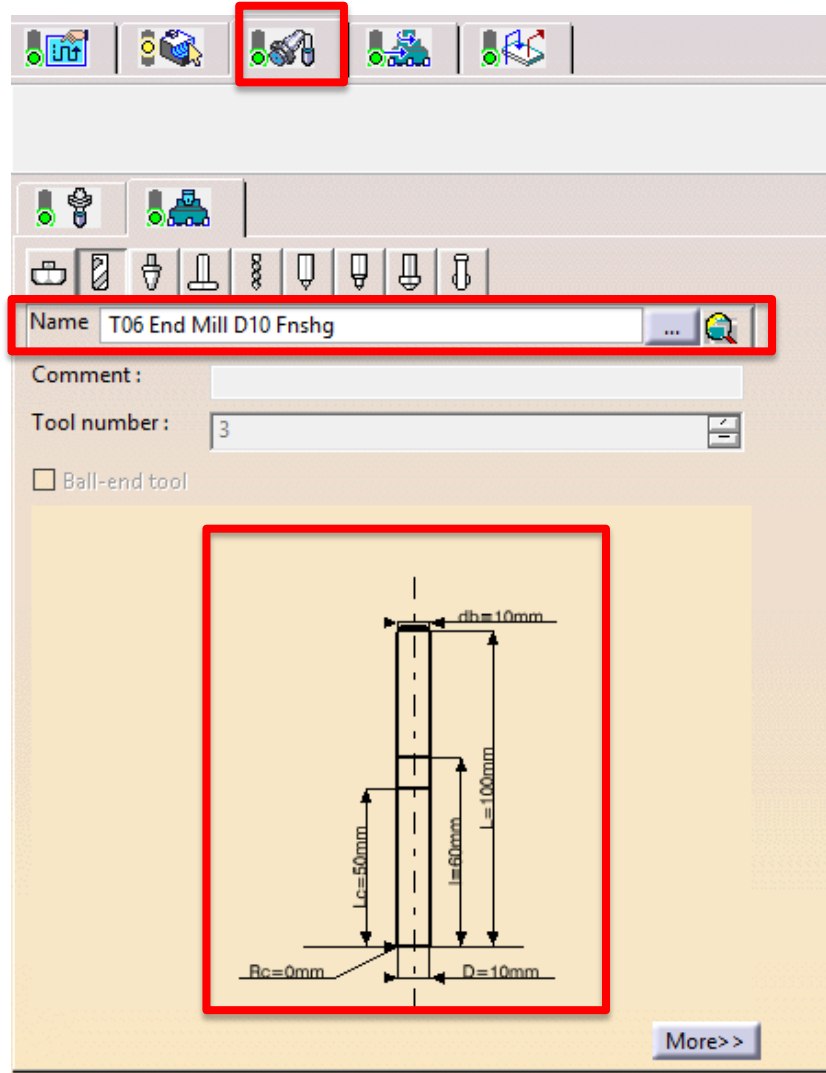
Multi-Axis Flank Contouring

1

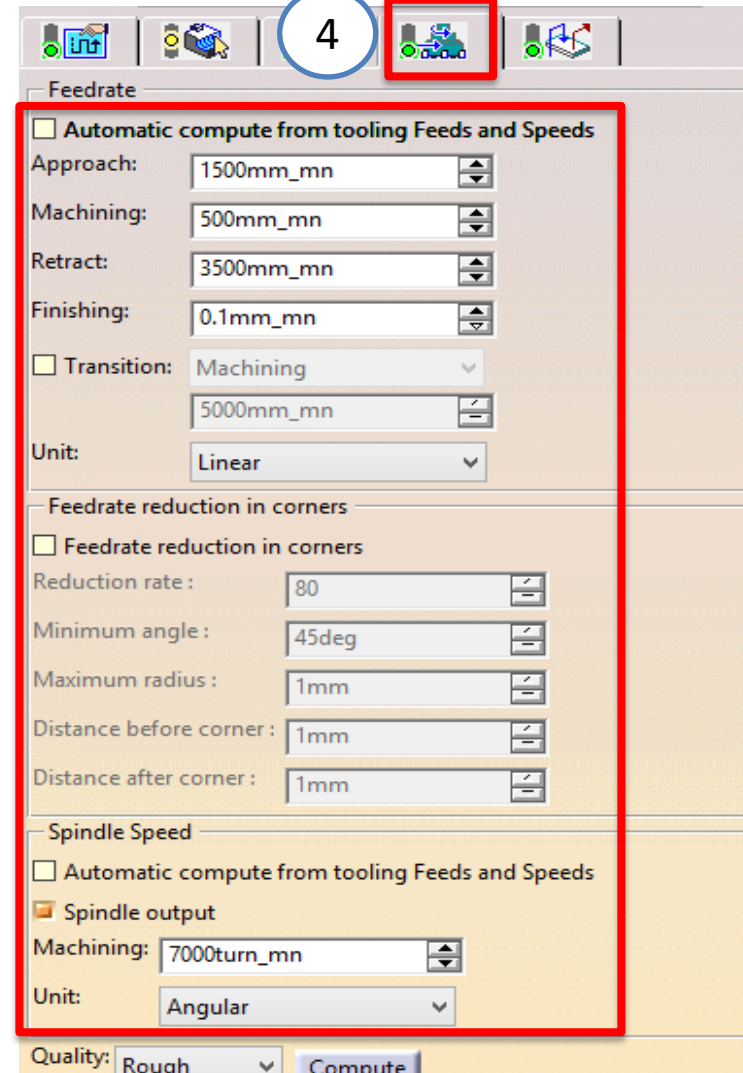


Multi-Axis Flank Contouring

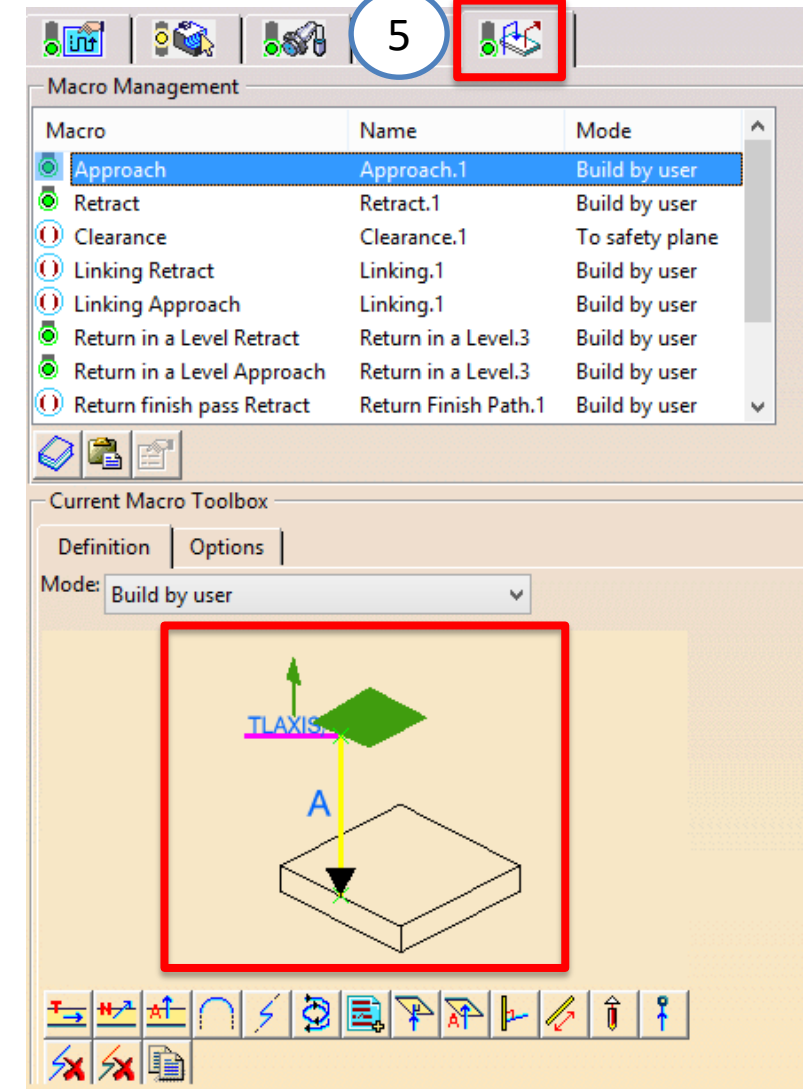
3



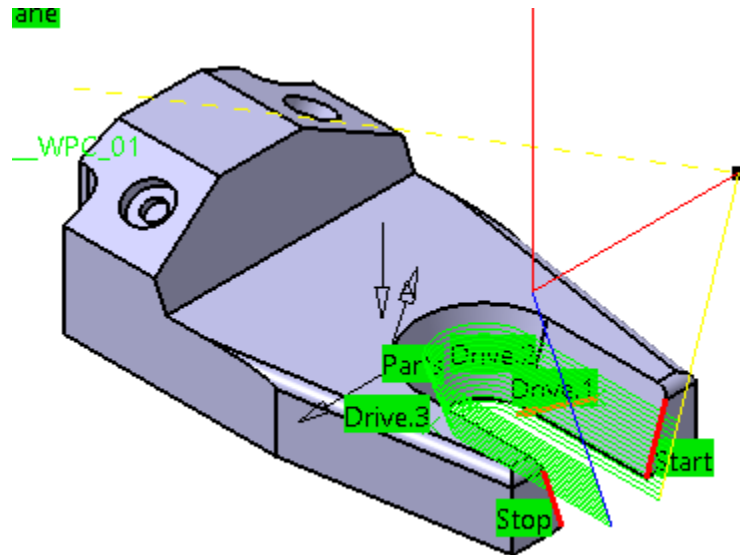
4



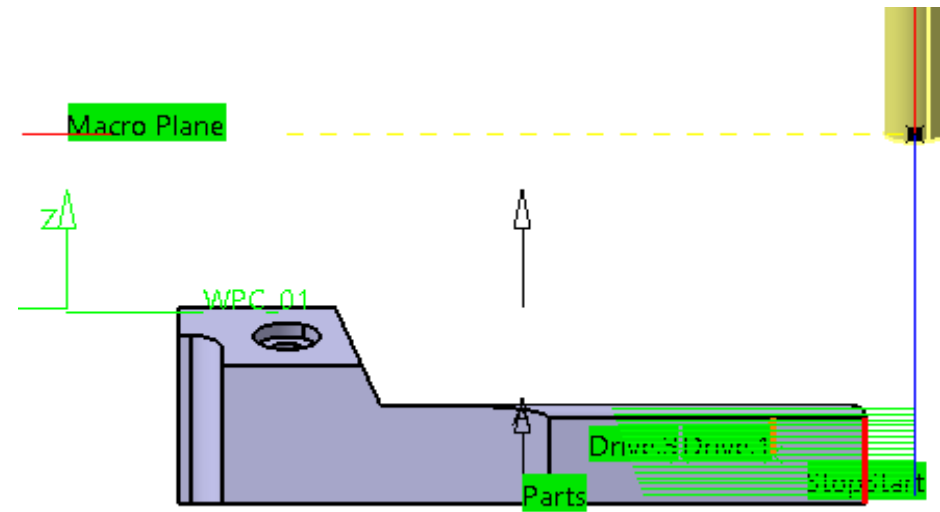
5



Multi-Axis Flank Contouring

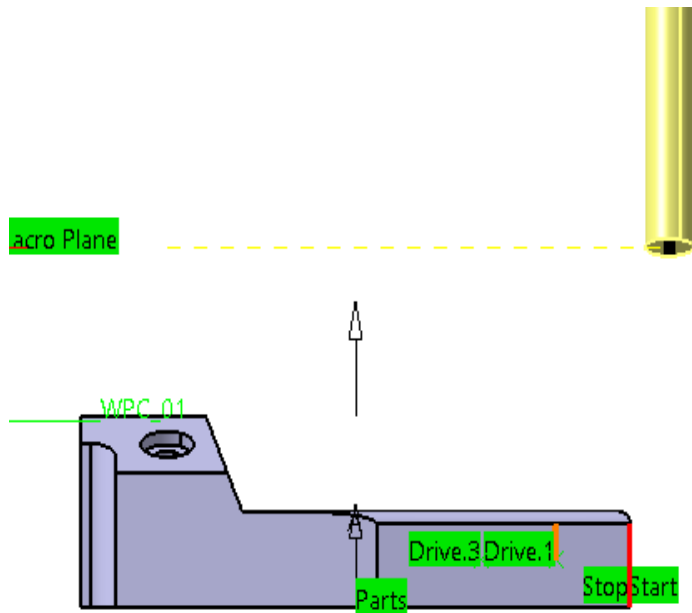


- Tool Paths calculation for slanted front surface
 - Multi-Axis Flank Contouring
 - **ISOMETRIC VIEW**

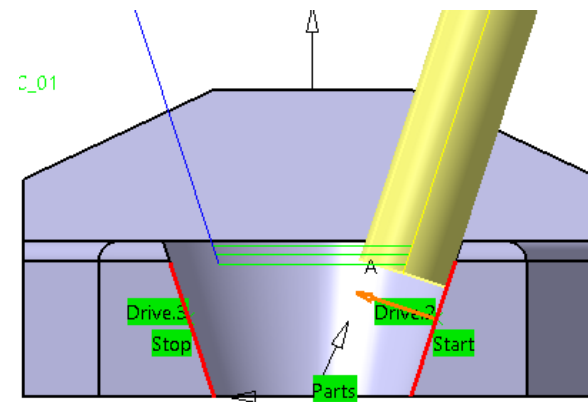


- Tool Paths calculation for slanted front surface
 - Multi-Axis Flank Contouring
 - **SIDE VIEW**
 - **Cutting Tool Position – 90 Degree**

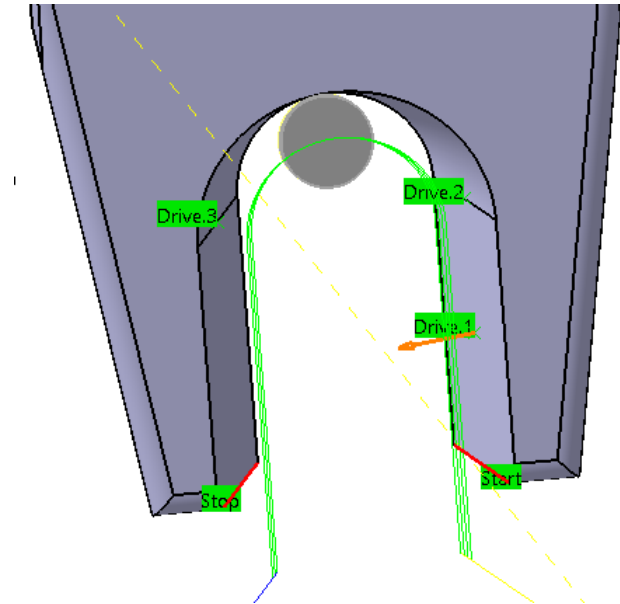
Multi-Axis Flank Contouring



- Cutting Tool started to tilt on certain degree perpendicularly to the selected surface

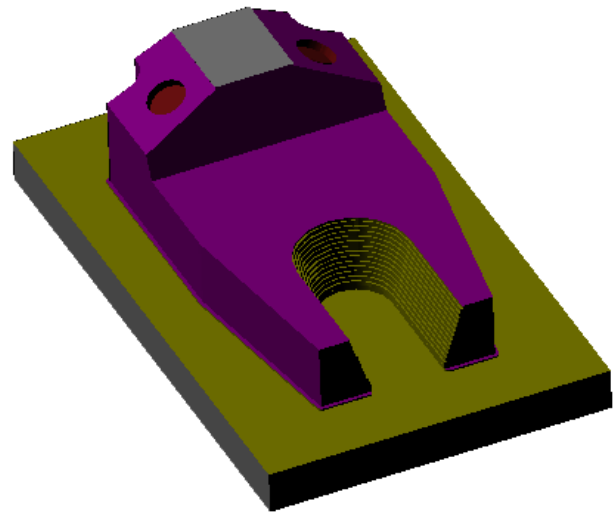


- Cutting Tool begin machining process in tilting position as per defined surface

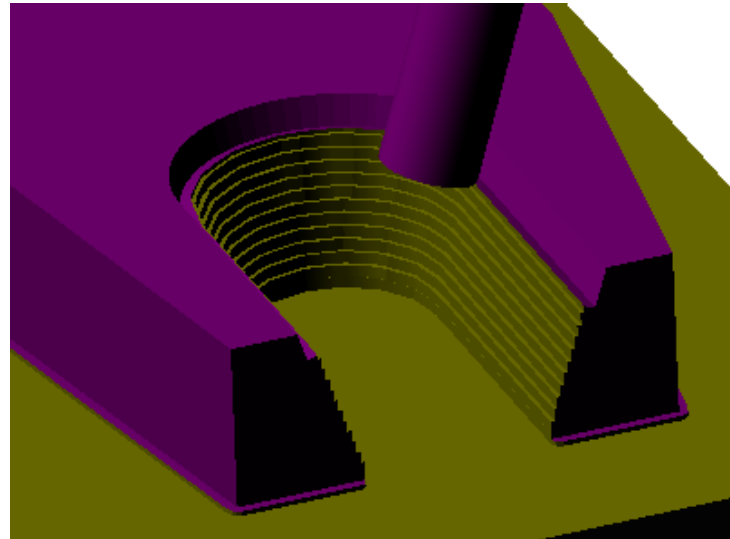


- Cutting Tool **EXACTLY** leaning on the machined surface

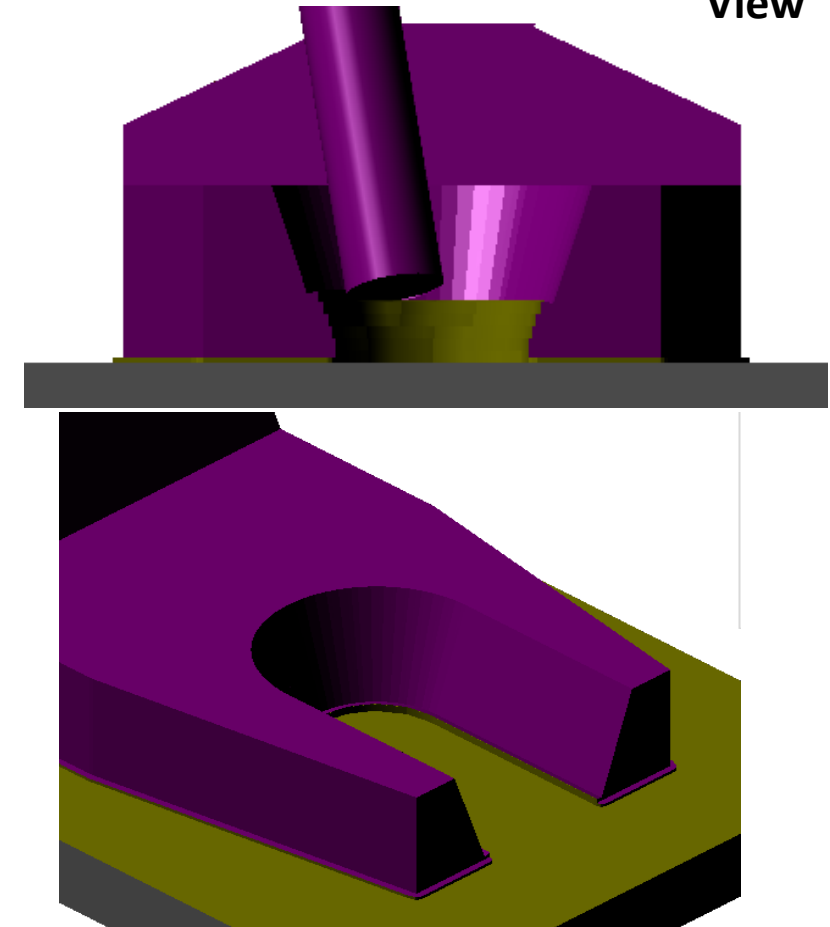
Multi-Axis Flank Contouring



From Previous Simulation Result

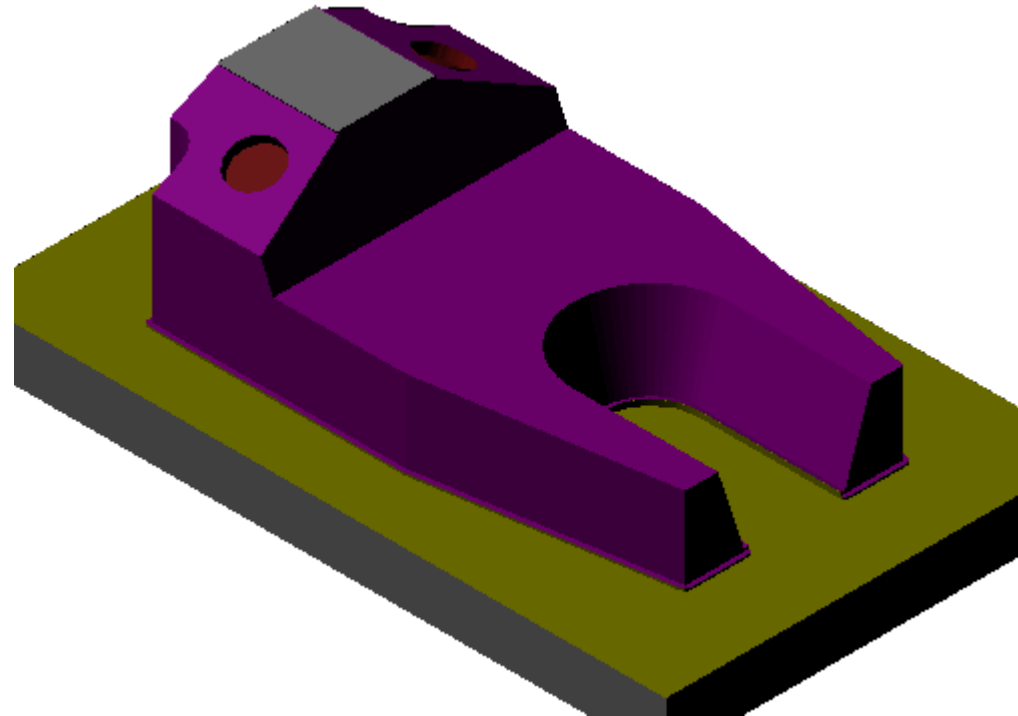


Multi-Axis Flank Contouring in progress



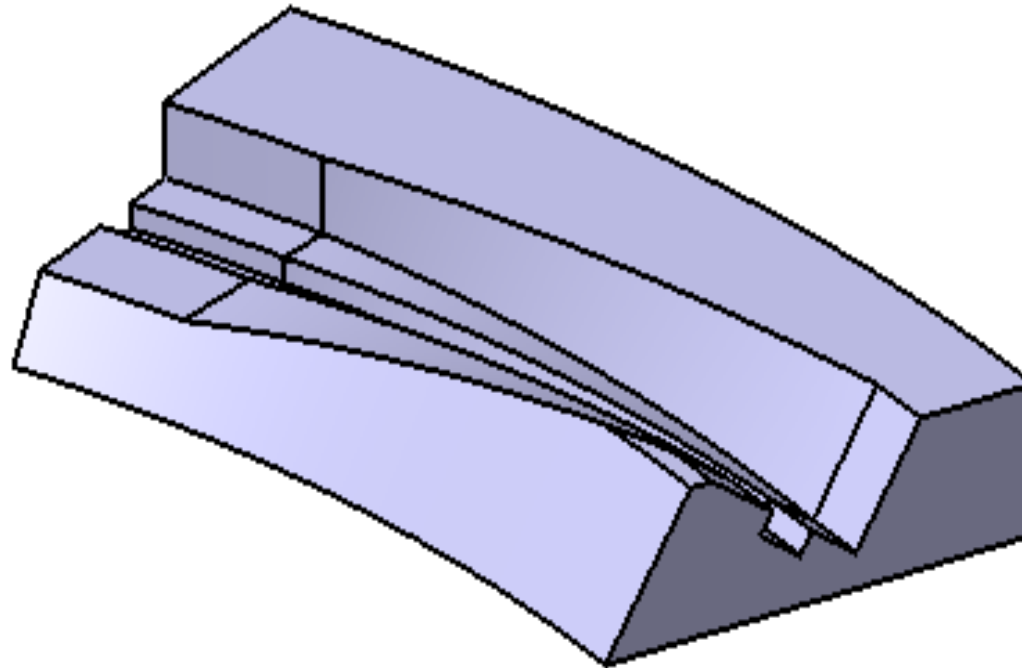
Multi-Axis Flank Contouring - Completed

Multi-Axis Flank Contouring



**Final Simulation Result of
Roughing Operation +
Finishing Profile Contouring Operation +
Multi-Axis Pocketing Operation + Multi-Axis Profile Contouring + Multi-Axis
Flank Contouring**

Multi-Axis Flank Contouring

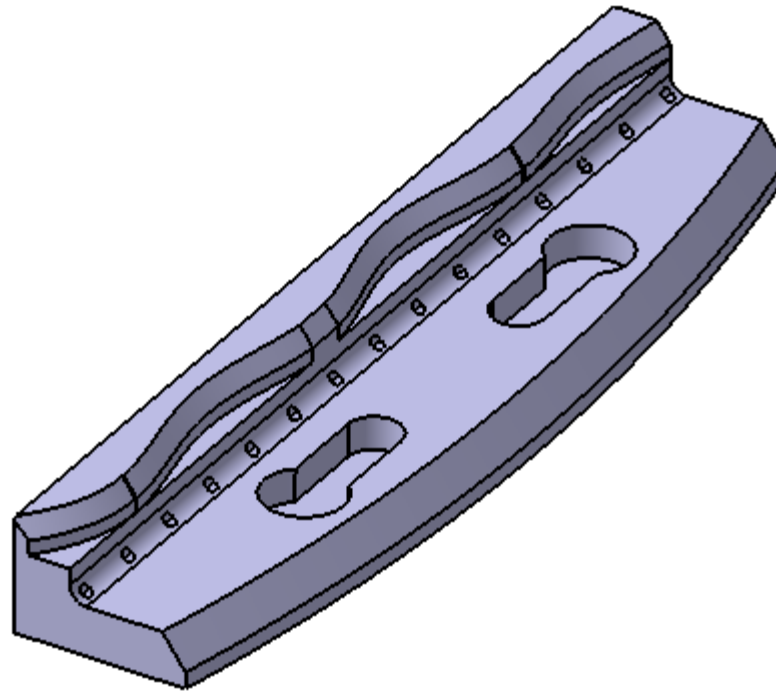


Exercise 1

Please prepare the CAM Programming following the instructions below:

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

Multi-Axis Flank Contouring

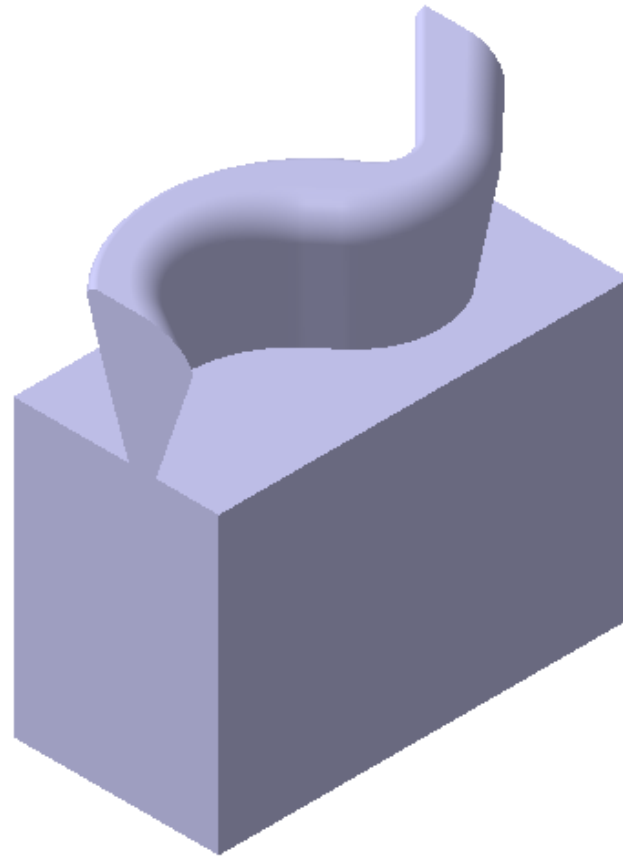


Exercise 2

Please prepare the CAM Programming following the instructions below:

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

Multi-Axis Flank Contouring



Exercise 3

Please prepare the CAM Programming following the instructions below:

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

Multi-Axis Flank Contouring

ALL THE BEST

THANK YOU