ADVANCED MACHINING
BETP 3584
ROUGHING OPERATION

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

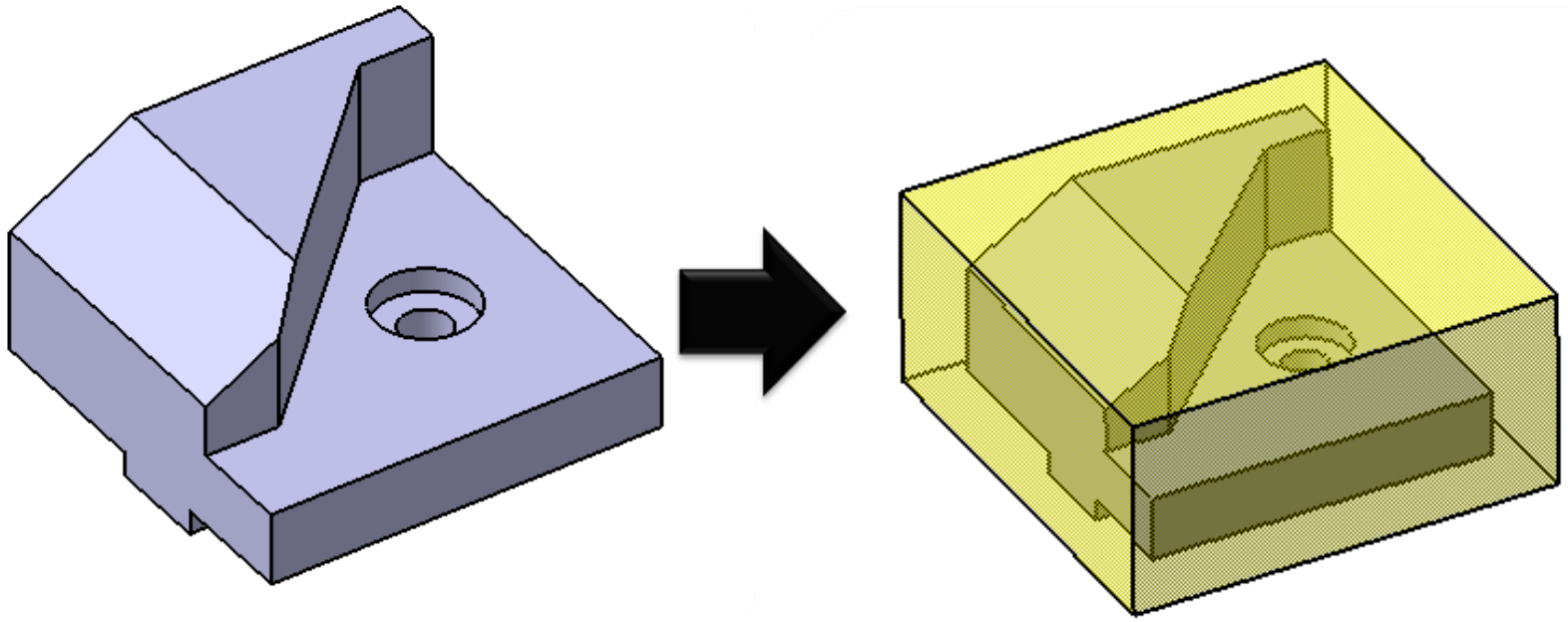
Roughing Operation

- In BETP 2514 CADCAM, the approach of Roughing process learnt was by using Profile Contouring or Pocketing operation with offset of 1mm for Finishing process.

- This approach is called **Conventional Roughing** method. It is quite time consuming but better machining tool paths control.

- In this subject, a new machining process definition will be explored called **"Roughing" operation**. Massive time reduction as far as the programming is concerned but slightly harder in controlling the machining tool paths.

Roughing Operation



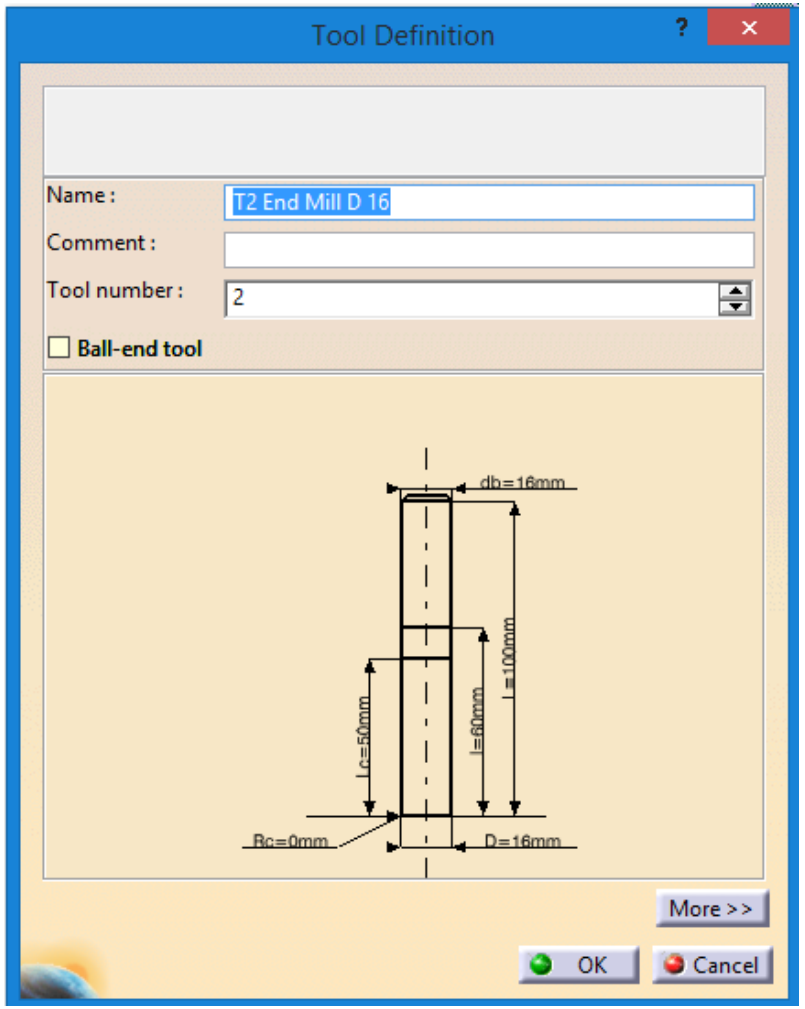
Original CAD Model

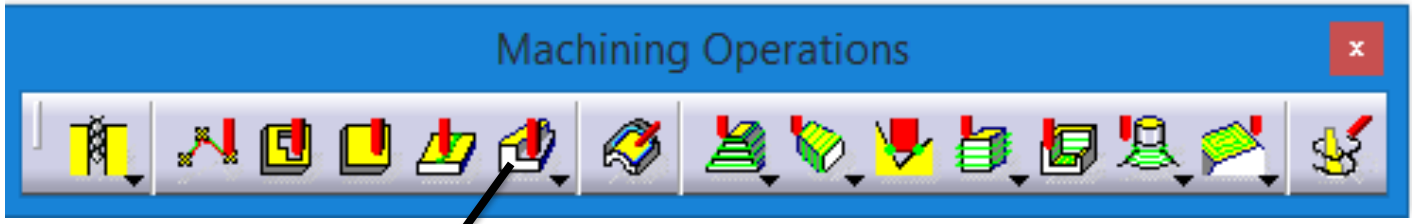
Stock Preparation

- From **Stock** size given obviously there are **almost every single side** of the CAD model needs to be machined.
- For the **TOP Surface**, **Facing Operation** is the best machining process to be used to **cut off the top excess material**.
- On the other hand, **Profile Contouring Operation** is the most appropriate machining process to be utilized in order **to cut off surrounding excess material**

Roughing Operation

Conventional Roughing Method





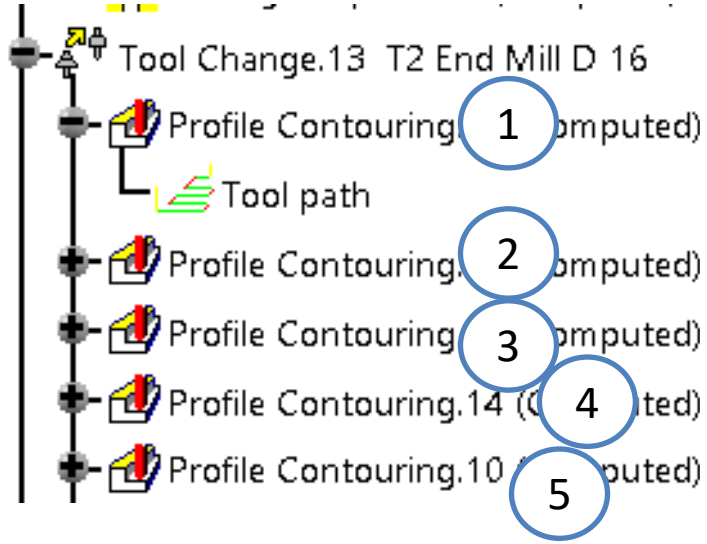
Profile Contouring

- Remember to **leave 1 mm** material for **Finishing Process**
- This is very important in order **to ensure better surface finish** obtained by utilizing **different machining parameters**

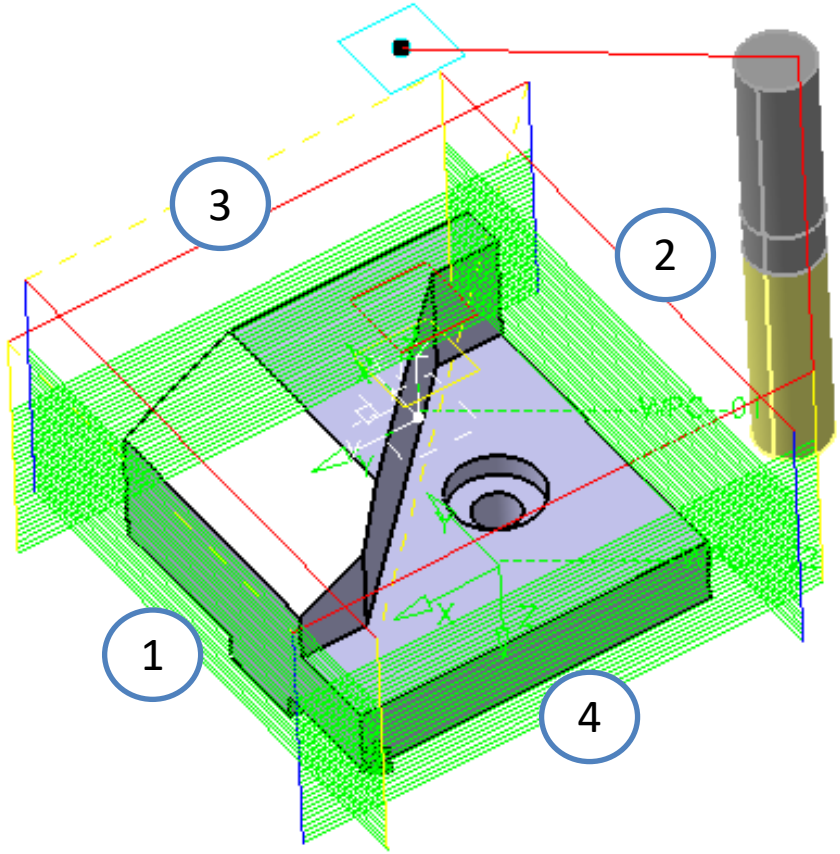
Select the right **CUTTING TOOL – End Mill D16**

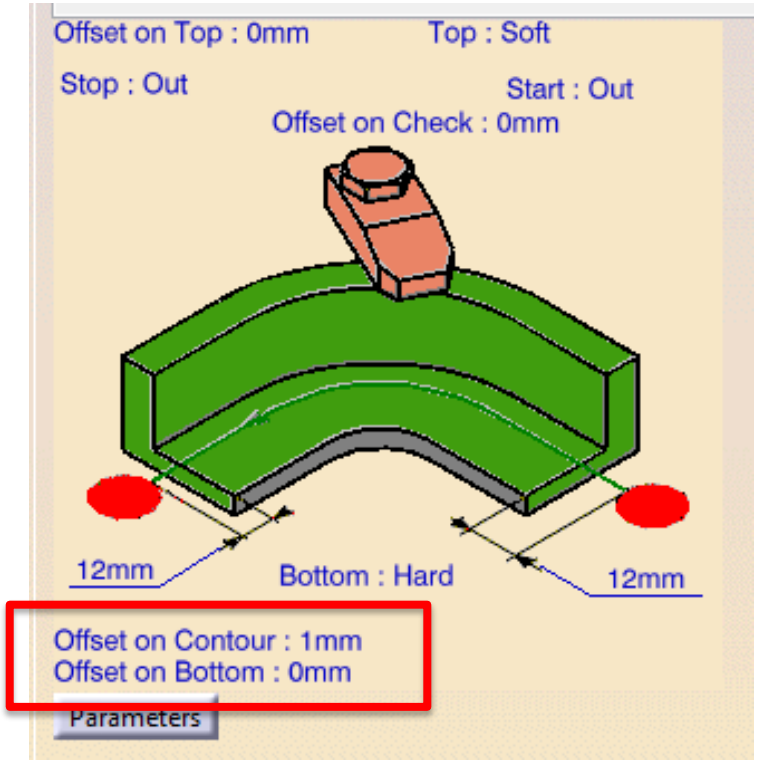
Roughing Operation

Conventional Roughing Method



Specification TREE – Conventional Roughing using Profile Contouring – FOUR (4) Sides

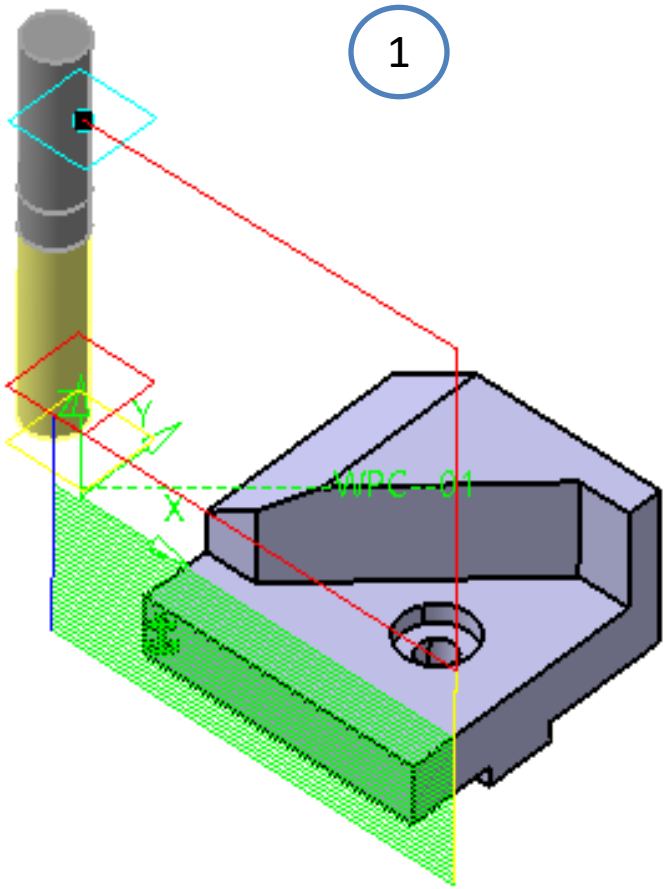


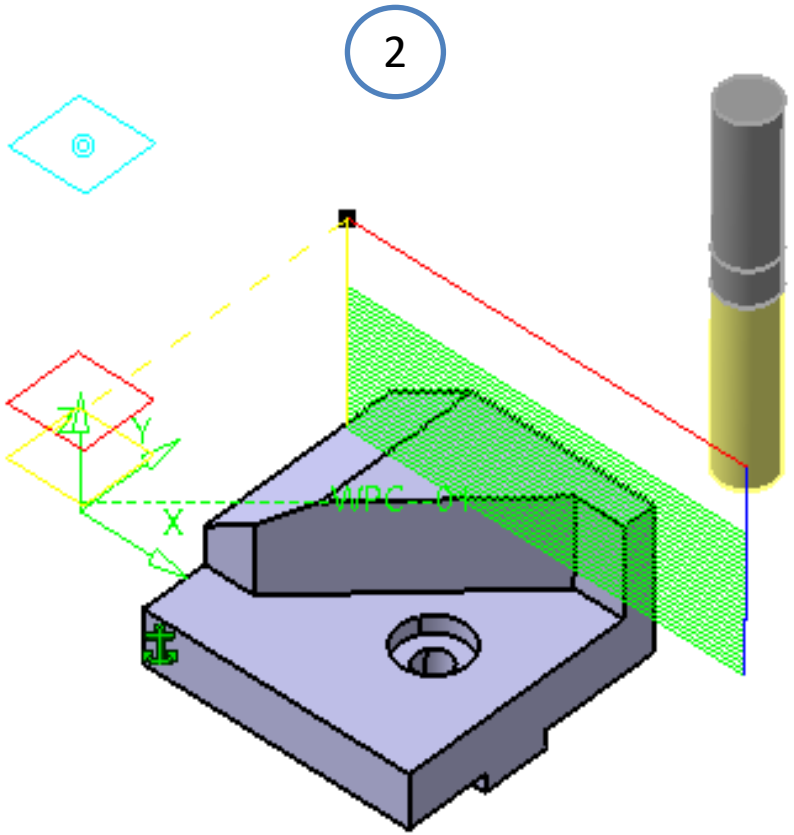


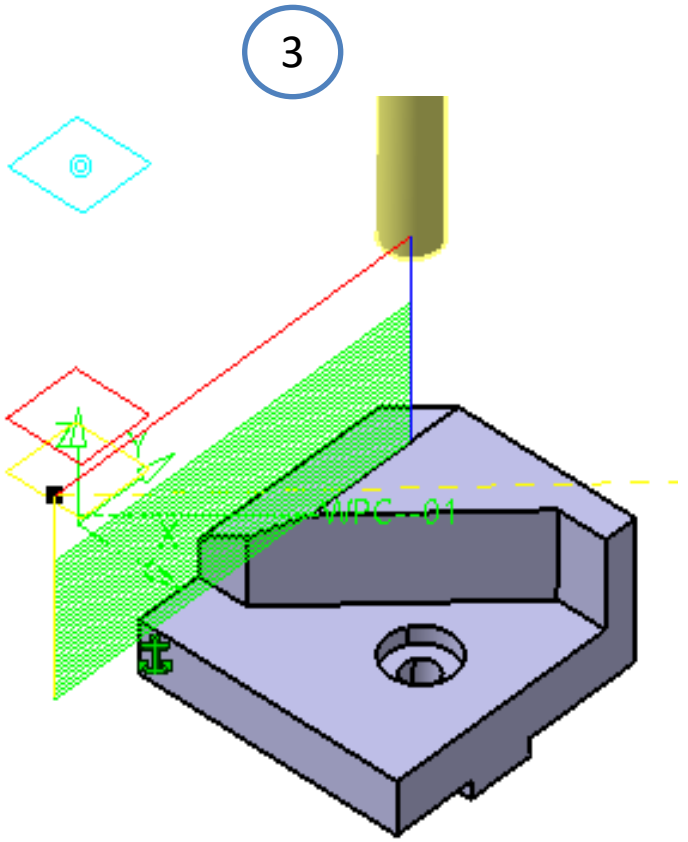
Offset on Contour = 1 mm
Leaving for Finishing Process

Roughing Operation

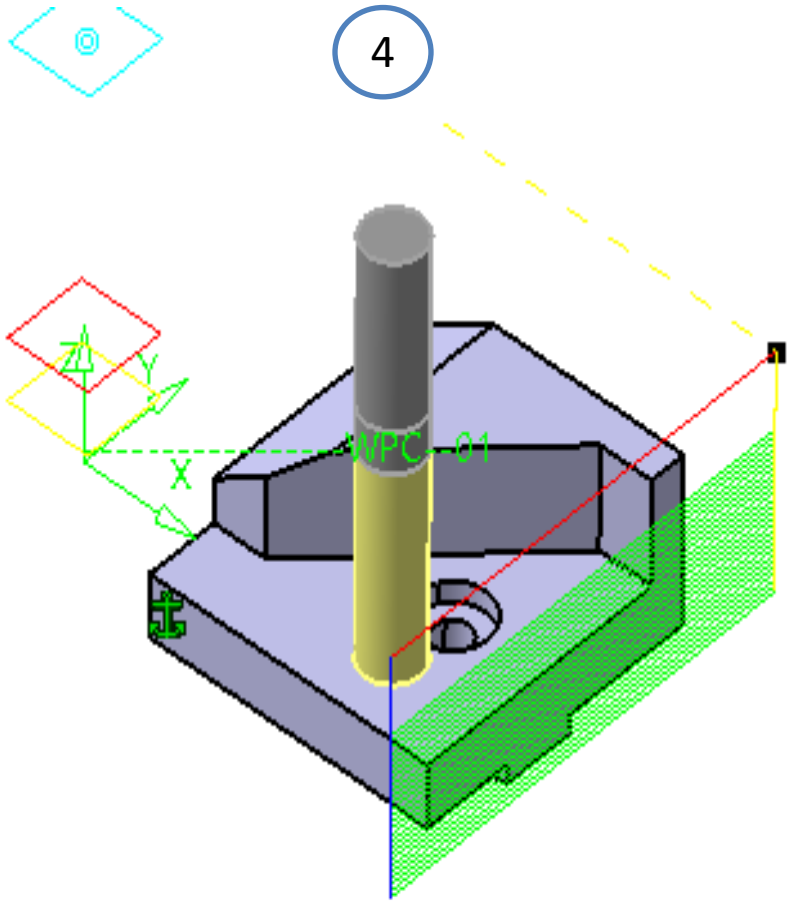
Conventional Roughing Method

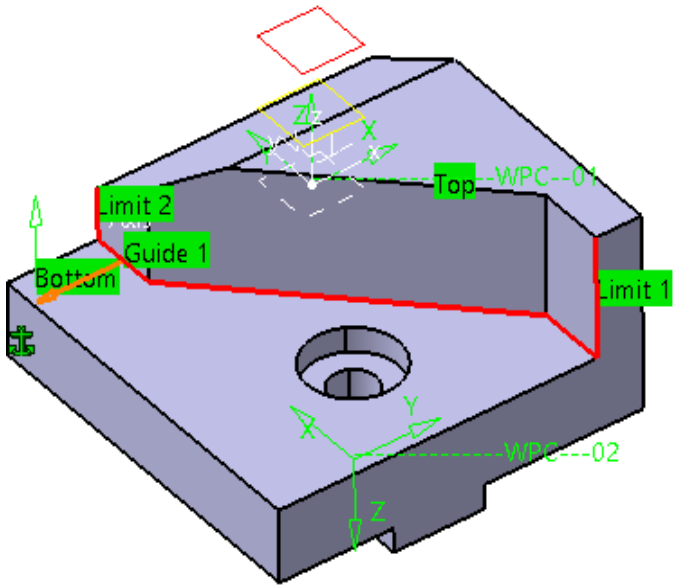






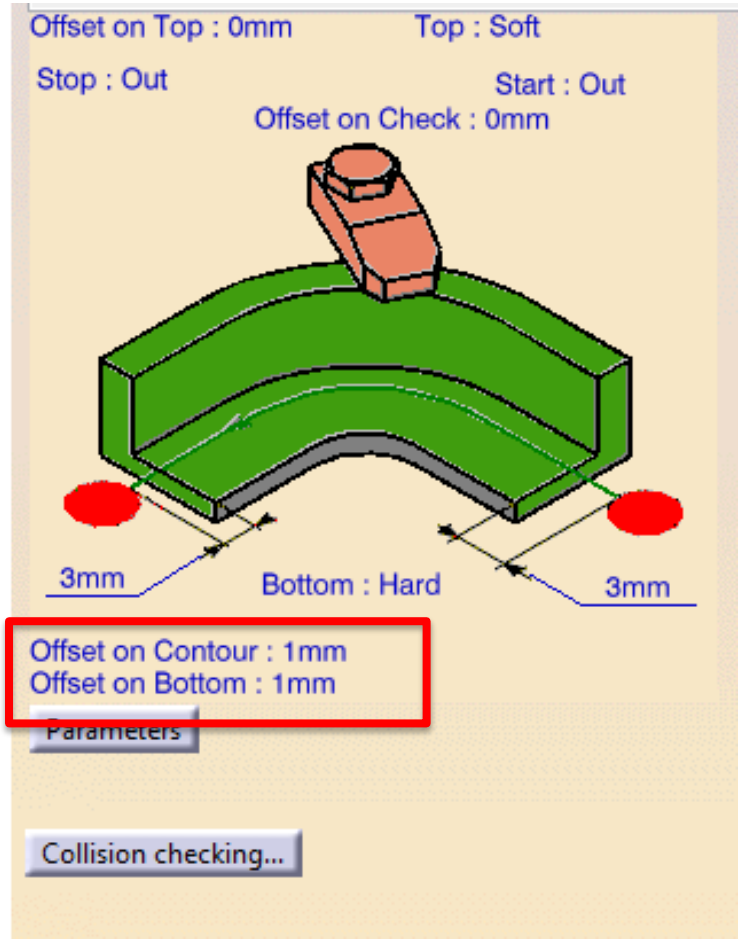
Roughing Operation





Geometries that need to be set

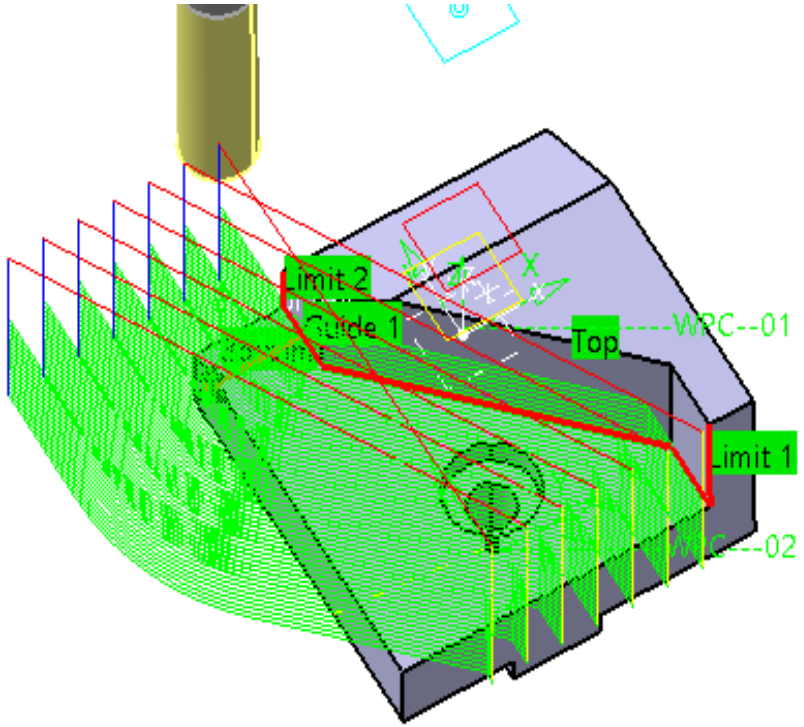
Conventional Roughing Method



Offset on Contour = 1 mm
Offset on Bottom = 1mm
Both Side Wall (Contour) and Bottom leaving 1 mm for Finishing Process

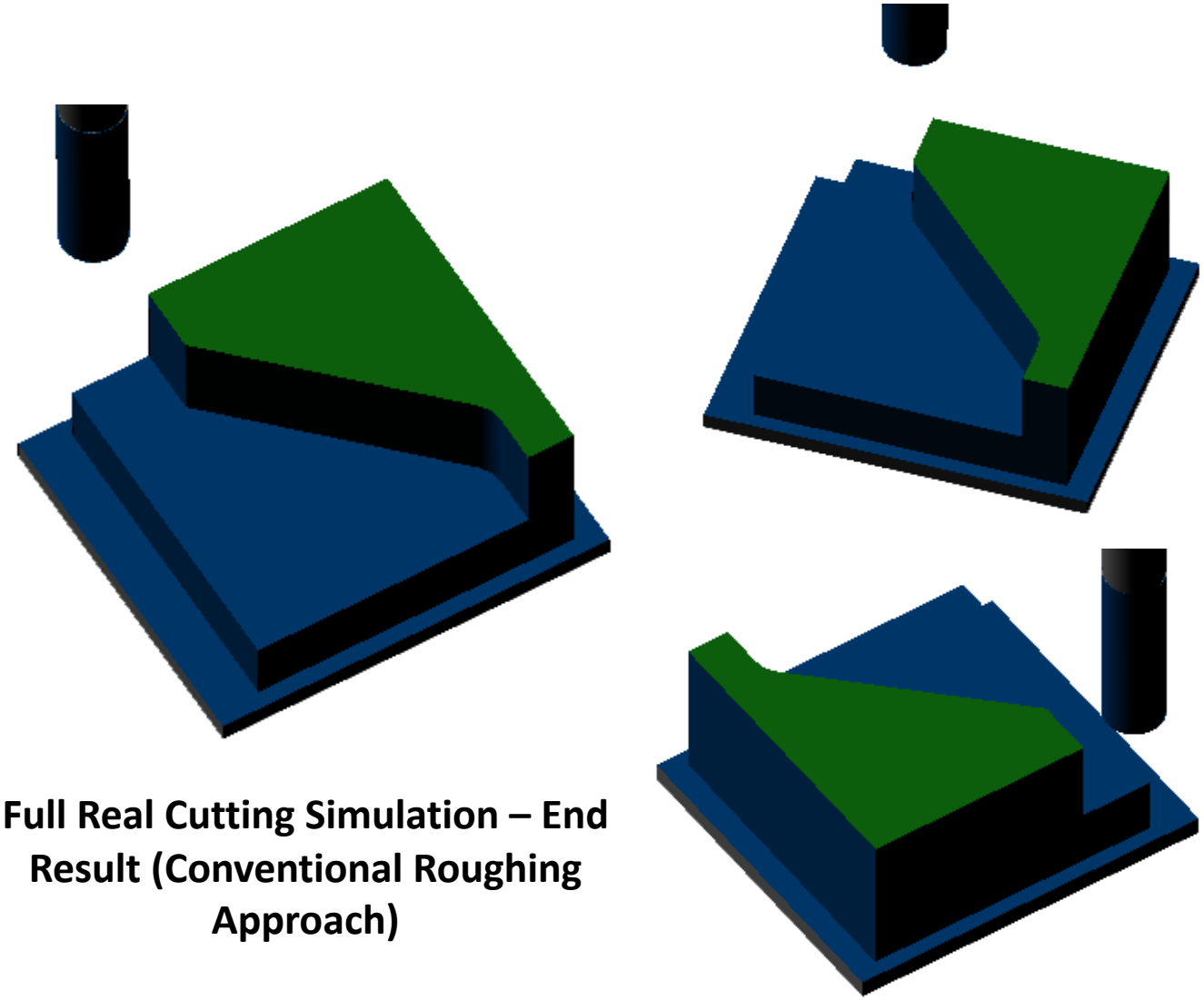
Roughing Operation

5



Tool Paths Calculation / Simulation

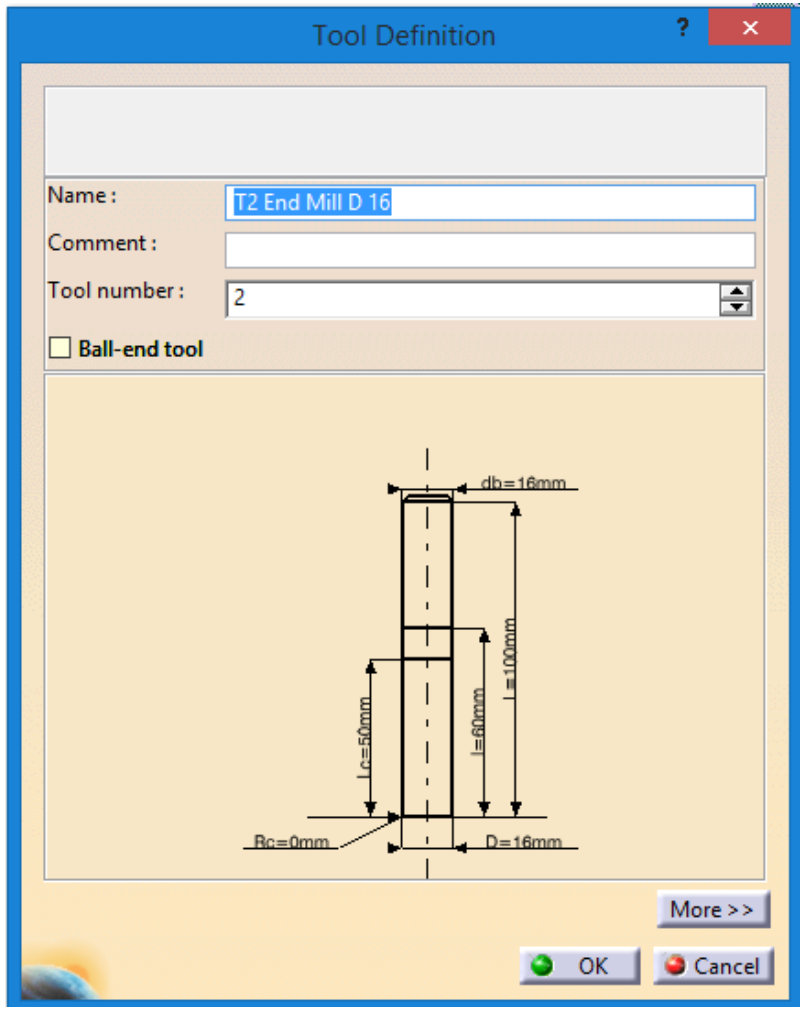
Roughing Operation



Full Real Cutting Simulation – End Result (Conventional Roughing Approach)

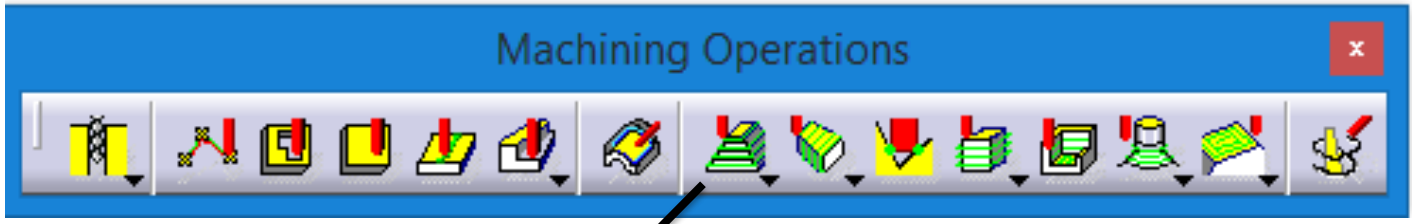
Roughing Operation

Roughing – NEW Approach



Select the same tool as previous operation

CUTTING TOOL – End Mill D16

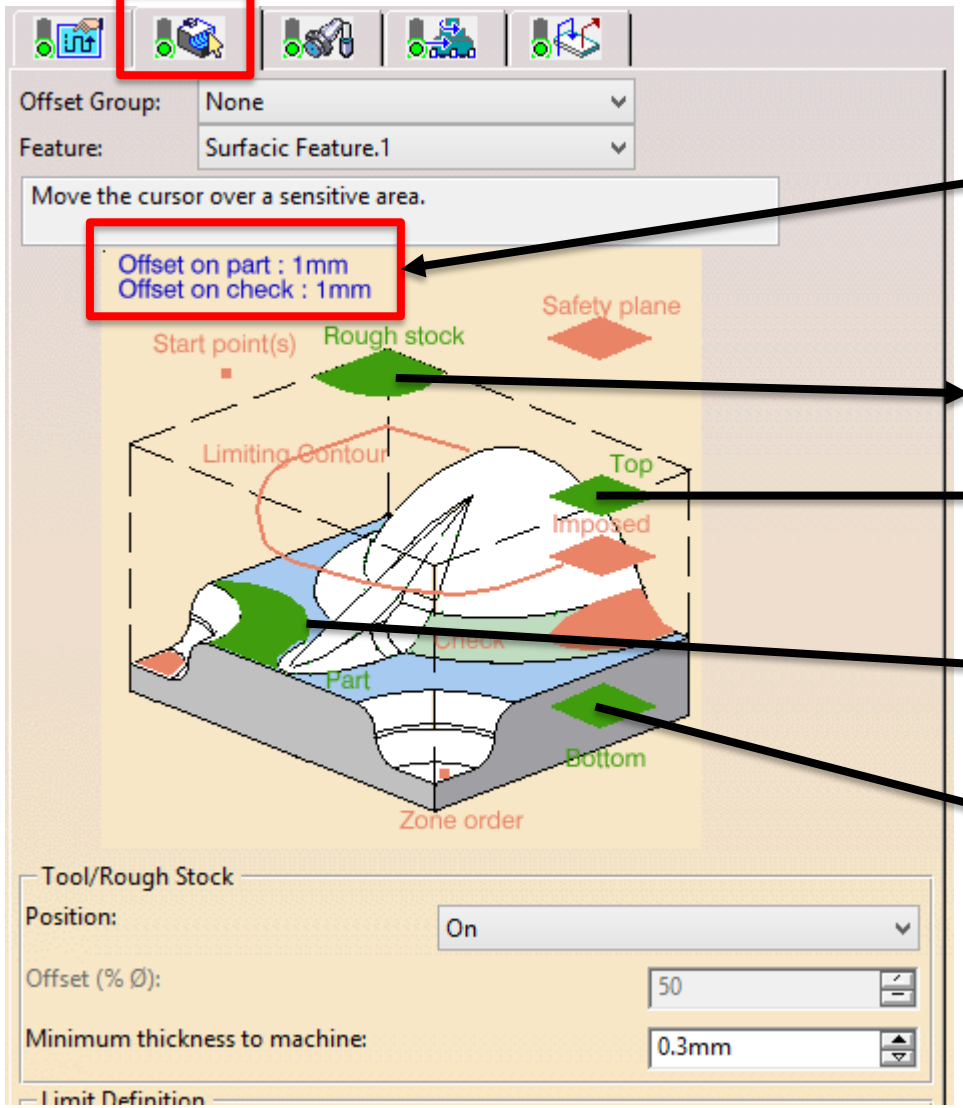


Roughing Operation

- The New Approach will be using a new operation called “Roughing”.
- This operation is very useful and easy to be used in every initial process of machining.
- Users just need to define ONLY at least two (2) main geometries and CATIA will calculate the tool paths according to the parameters defined.

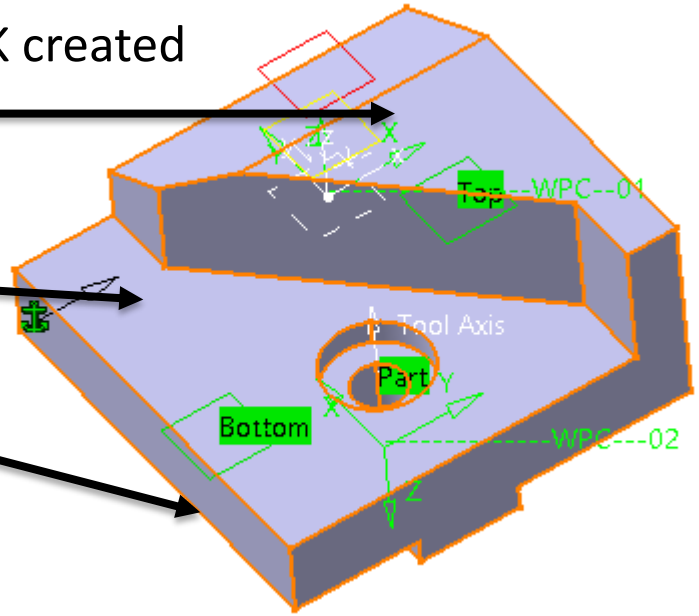
Roughing Operation

2



As defined in previous method, to leave 1 mm for **Finishing** process **Offset on Part** need to be defined as **1 mm**

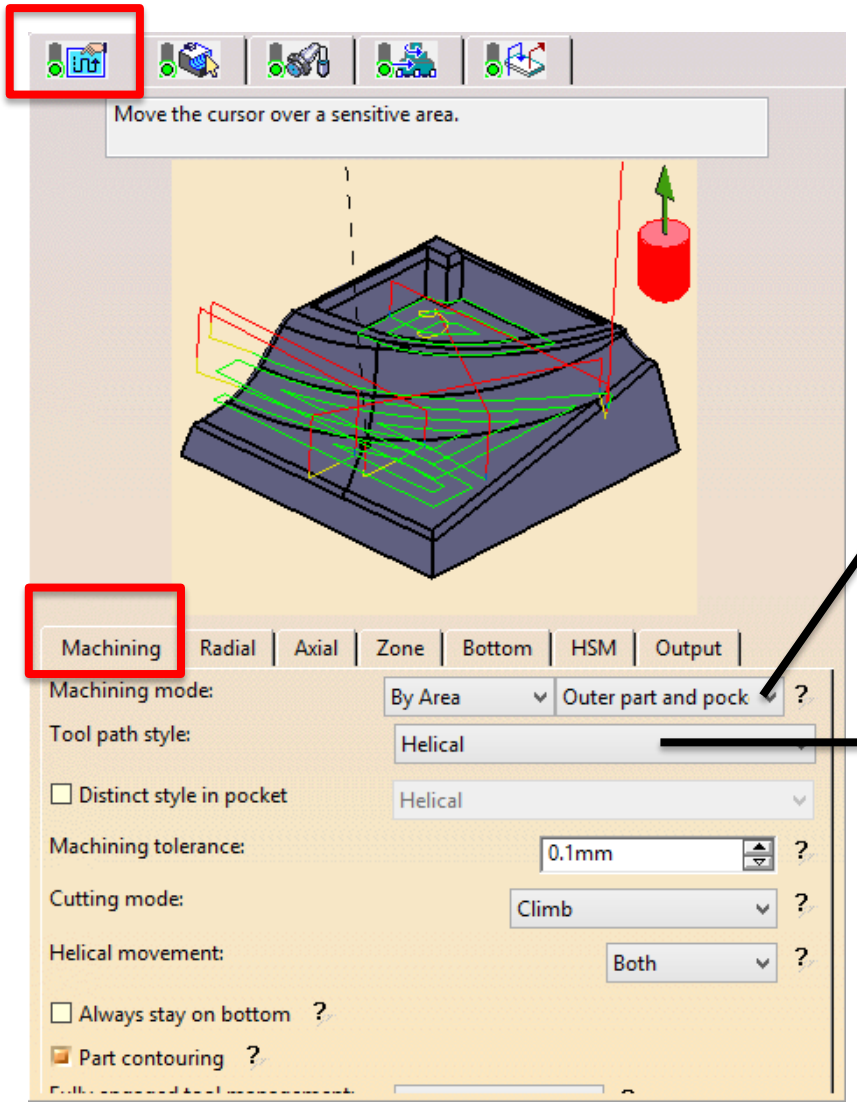
Select initial STOCK created

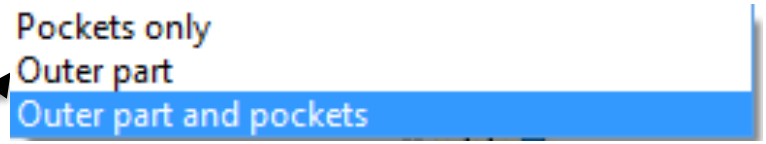


- **TWO (2)** Compulsory **Geometries** that need to set are **PART & Rough STOCK**
- Excess material from the TOP Surface needs to finish by **Facing Operation**.
- Thus, **TOP Surface** really important to be defined in **Roughing Operation** to avoid air cuts.

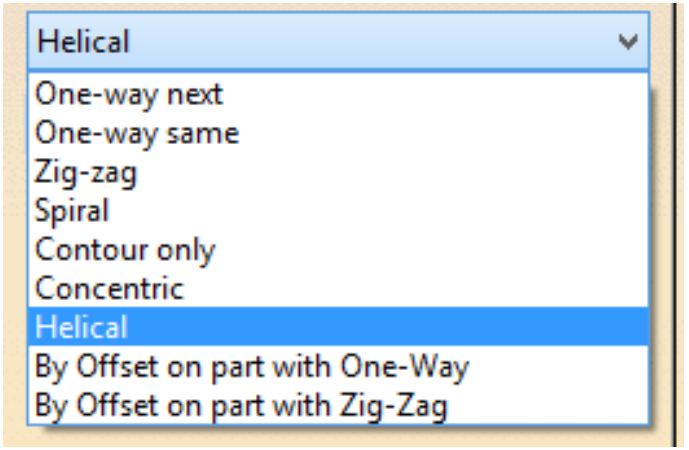
Roughing Operation

1





Options given of machining areas



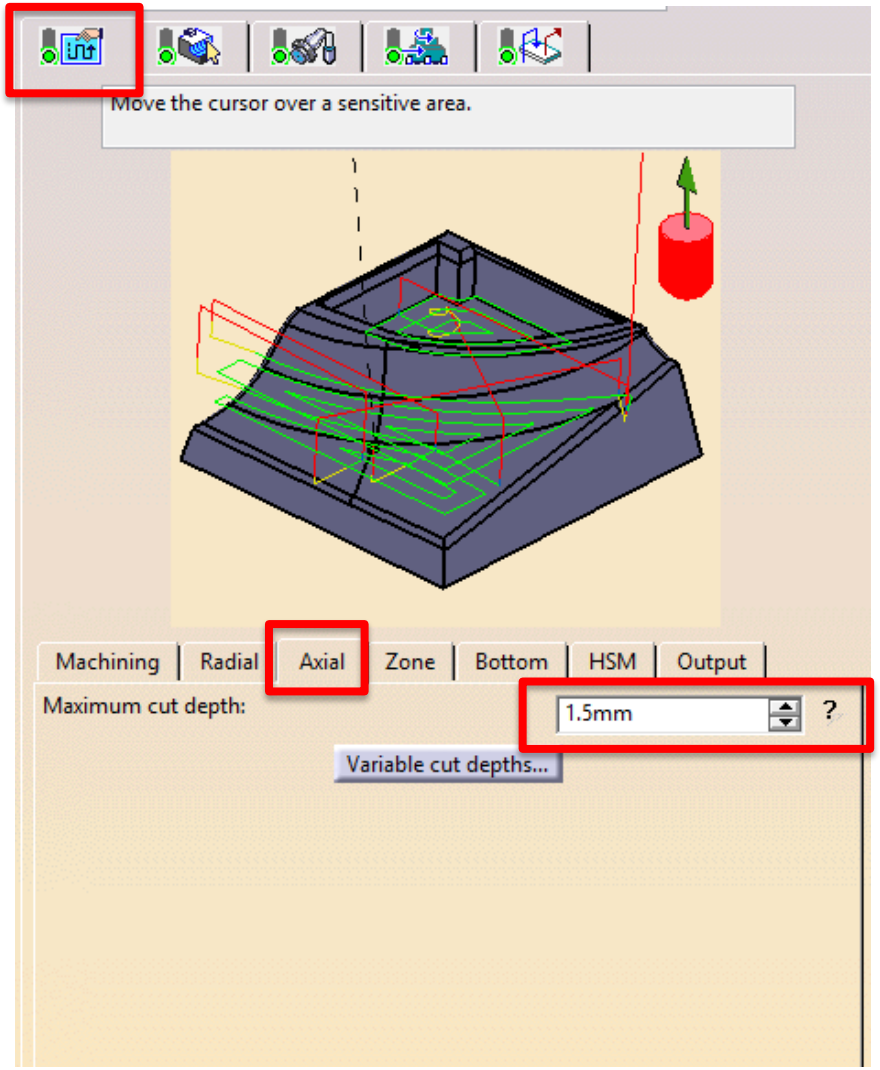
Options given of machining areas

- User can choose to machine both **Outer Part and Pockets or separately** machine both profiles.

- There are lots of **machining strategy** offered by CATIA. There are **THREE (3)** main strategies being used namely; **Zig-zag, Helical, Spiral**

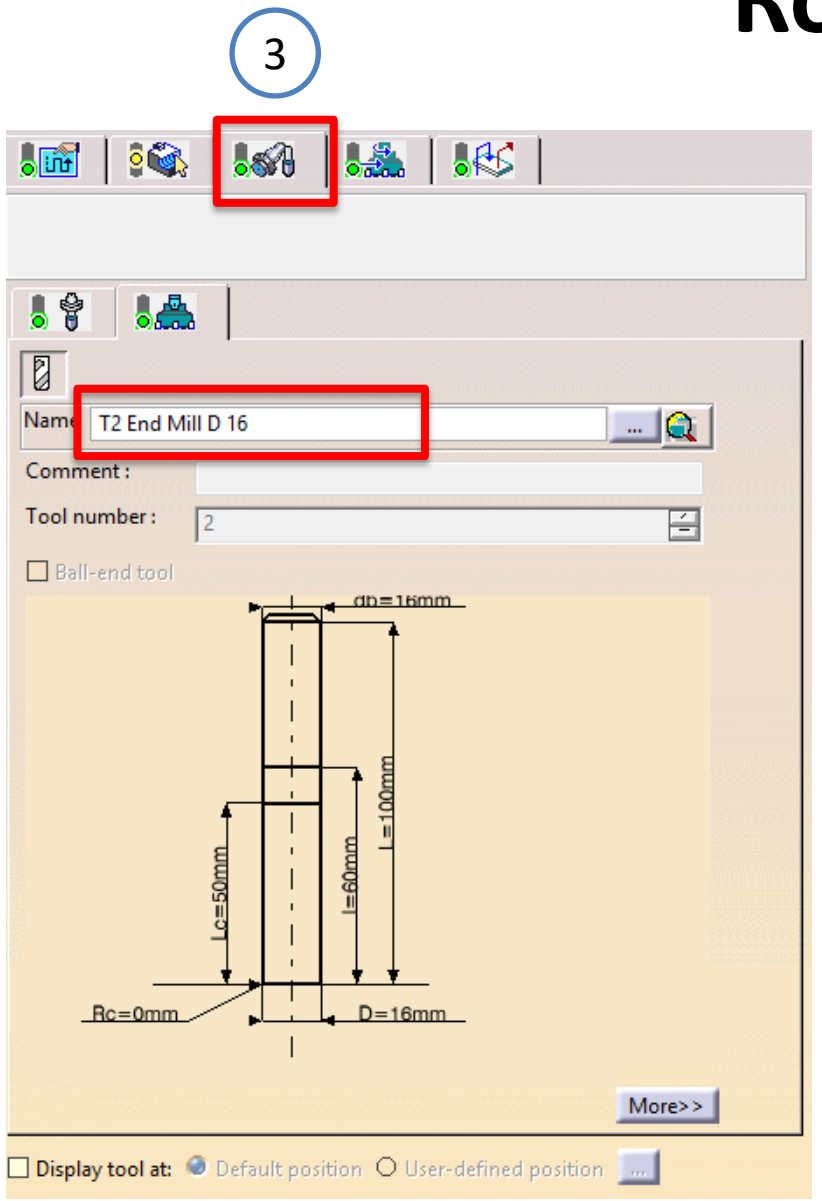
Roughing Operation

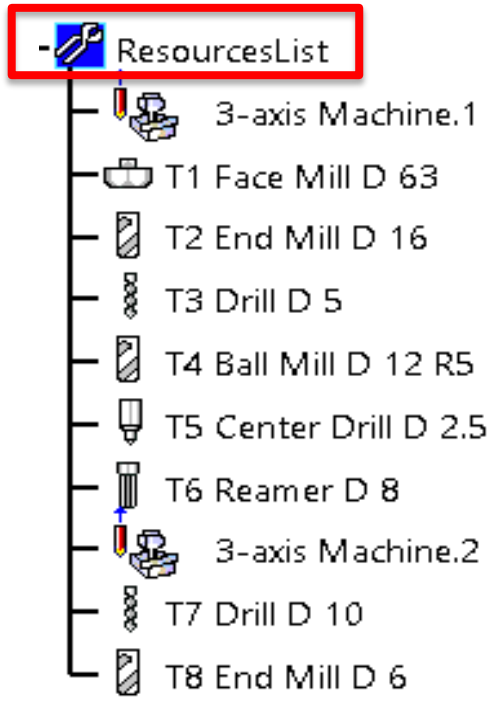
1



- Still on the TAB -1 but in **AXIAL** option where the **Maximum Depth of Cut** is defined here.
- Depth of cut is one of **main machining parameters** that need to be defined correctly in order **to avoid tool from broken.**
- Depth of cut normally depending on the **workpiece material**, **type of cutting tools** used as well as **material of the cutting tool.**

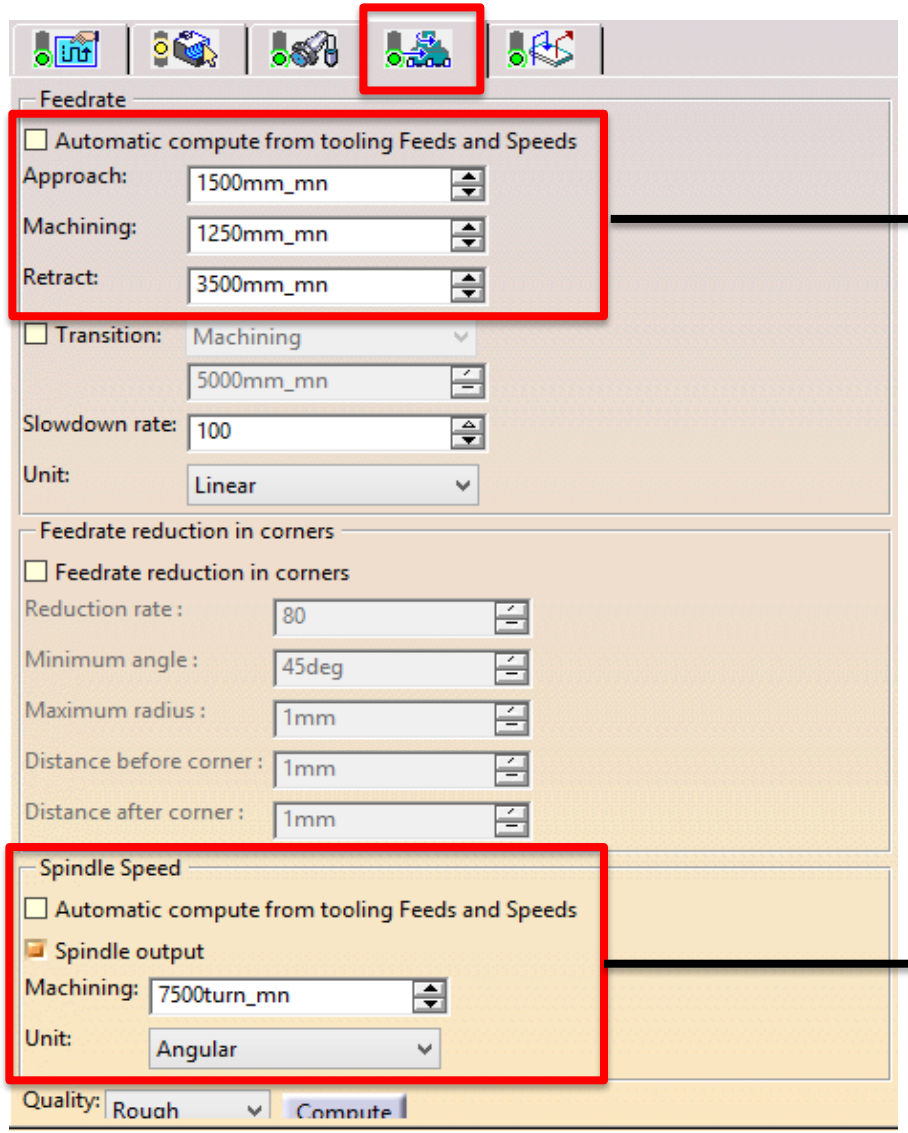
Roughing Operation



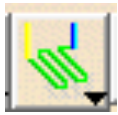


- On the TAB-3, user **need to check cutting tool specification** is correct according to the machining process to be used.
- This is very important **to ensure the right machining simulation is calculated**.
- **No changes is allowed** to be done here.
- If there is **any modification needs to be made**,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

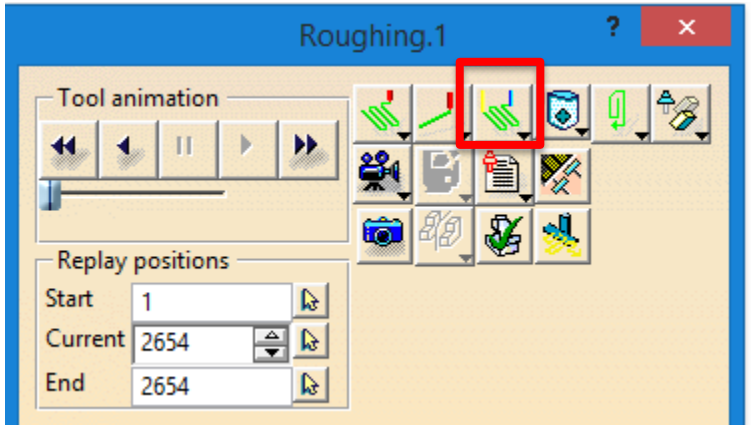
Roughing Operation



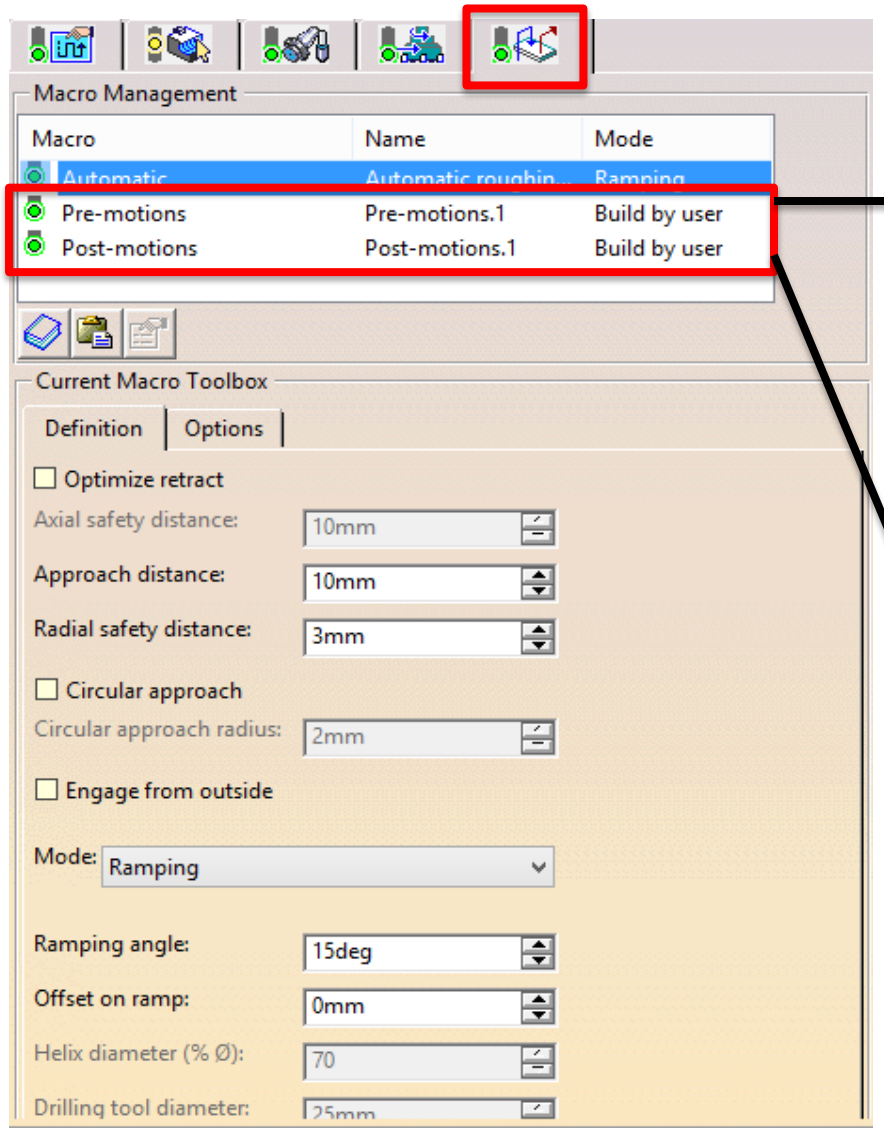
- There are **THREE (3) types** of **Feed Rates** which need to be defined namely **Approach, Machining & Retract.**
- **Color Coding** representing each Feed Rate are
  - **Approach = Yellow**
  - **Machining = Green**
  - **Retract = Blue**
- To view this, user needs to **change the setting** in **simulation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

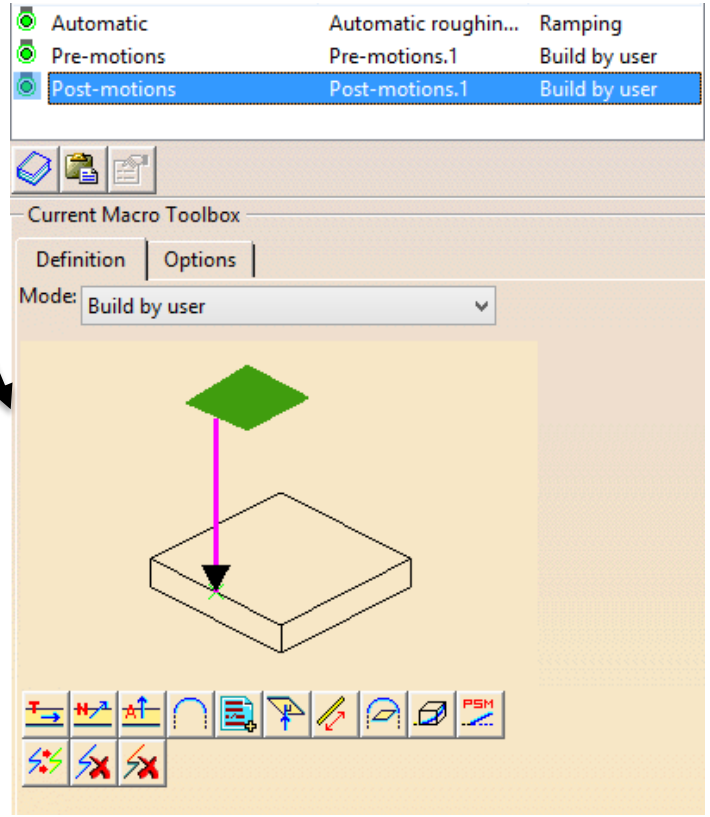


❑ **Another Setting** that needs to be defined is **Spindle Speed** which **relying on the size, type & material** of the **cutting tool** as well as the **workpiece**.

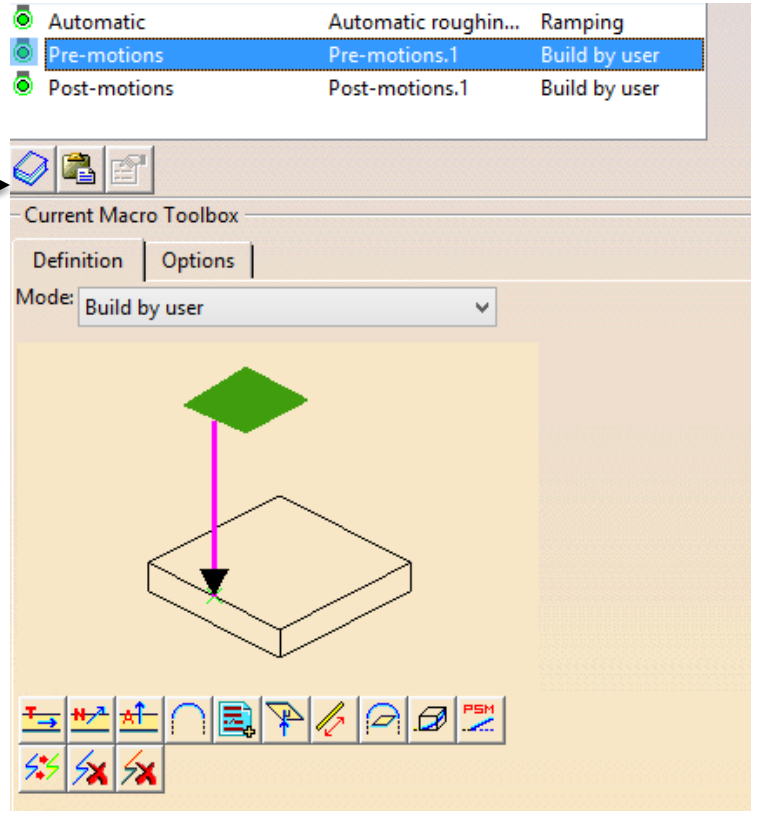


Roughing Operation





Roughing – NEW Approach

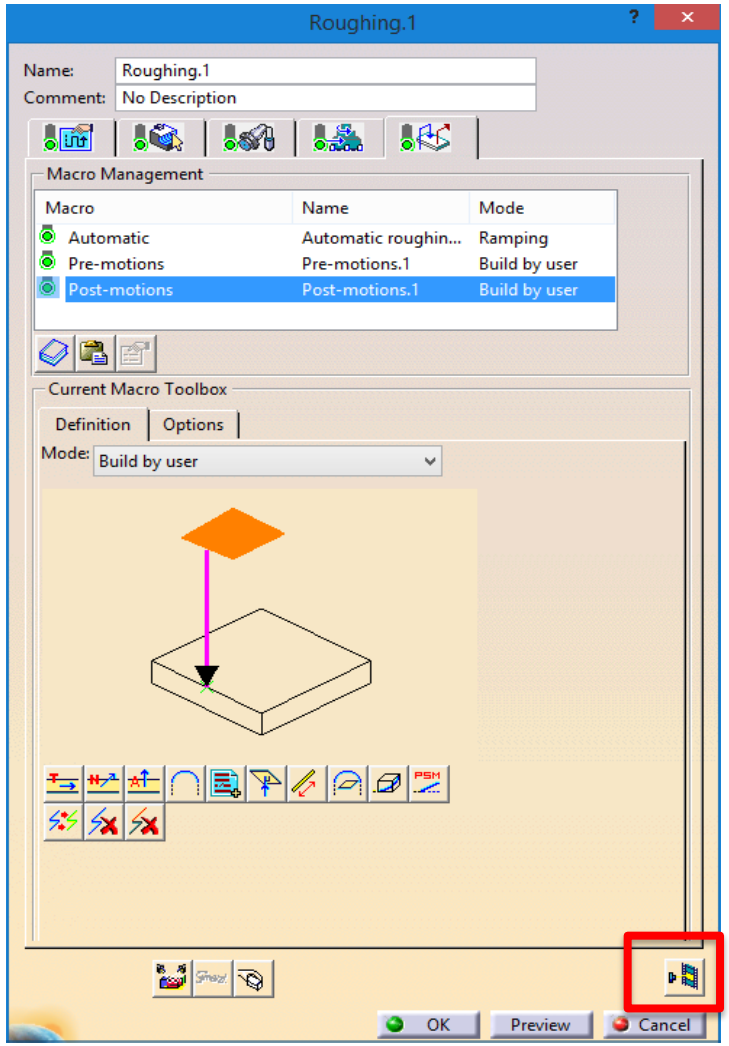


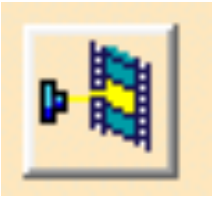
- In **Macro Setting** – Roughing Operation, **define** the **Pre – Motions and Post – Motion** as shown.

Roughing 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.

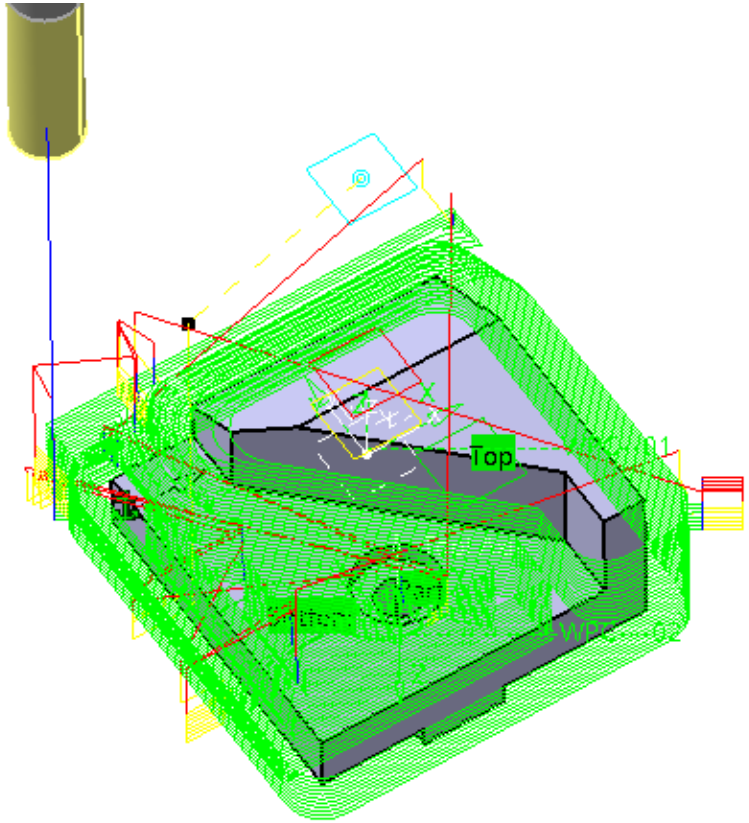




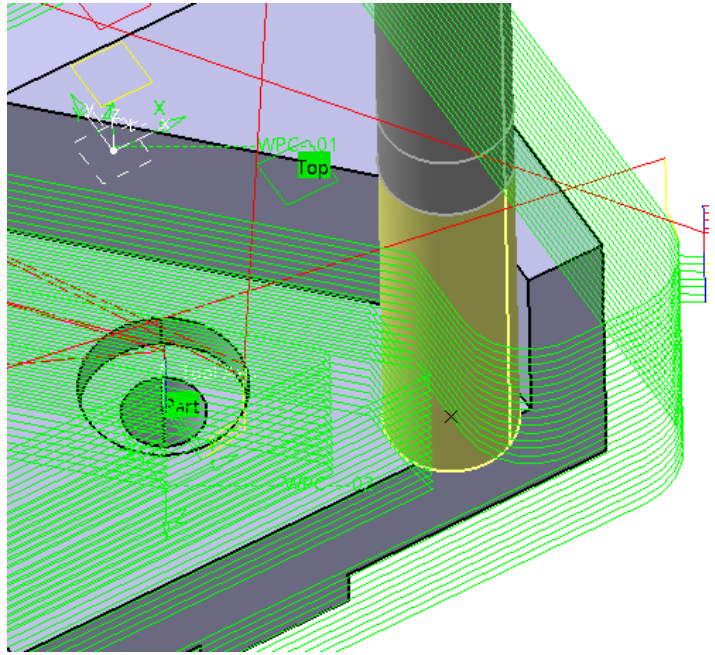
Tool Paths Reply

Roughing Operation

- CATIA will **generate full machining tool paths.**
- CATIA **offering flexibility** for users **to view motion of specific cutting tool** on each machining tool paths generated.
- User just **needs to point the cursor** to **any desired section** to **view the cutting tool motion on the specific se**ction selected.

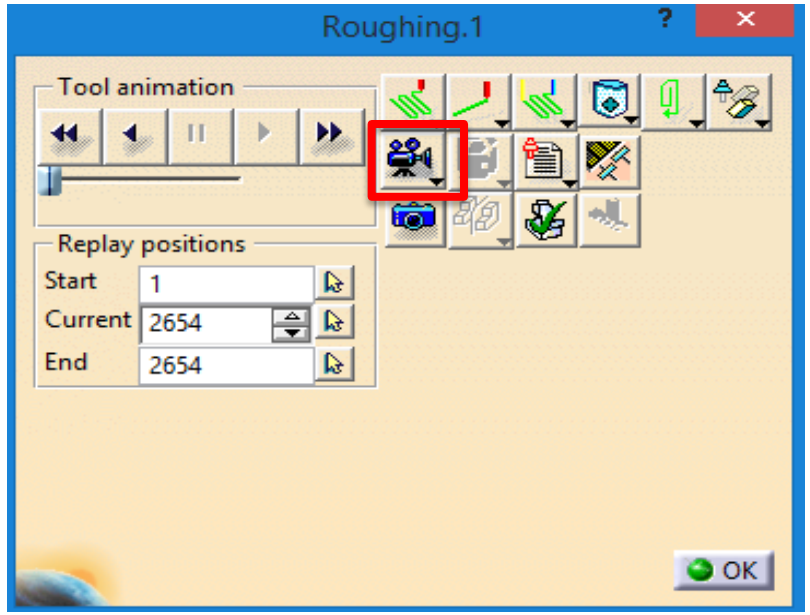


Machining Tool Paths Calculation



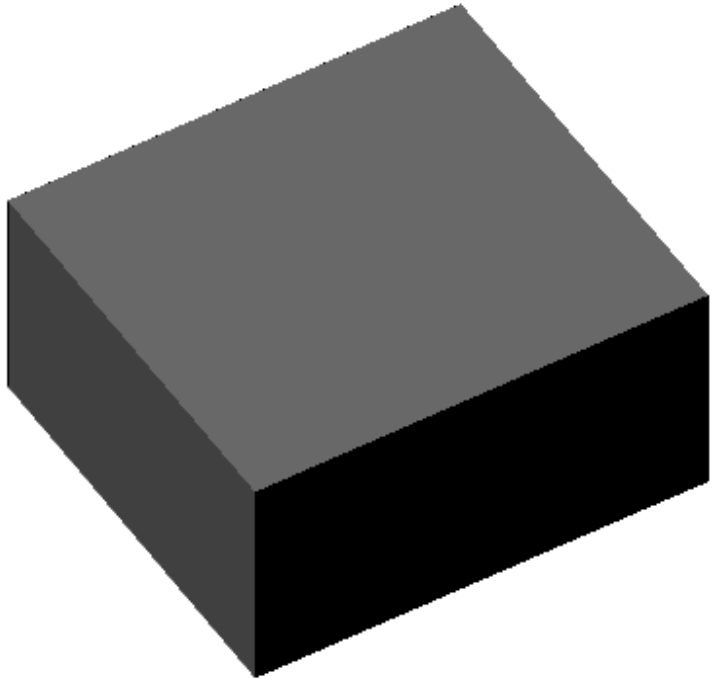
Cutting Tool on Specific Selection Section

Roughing Operation

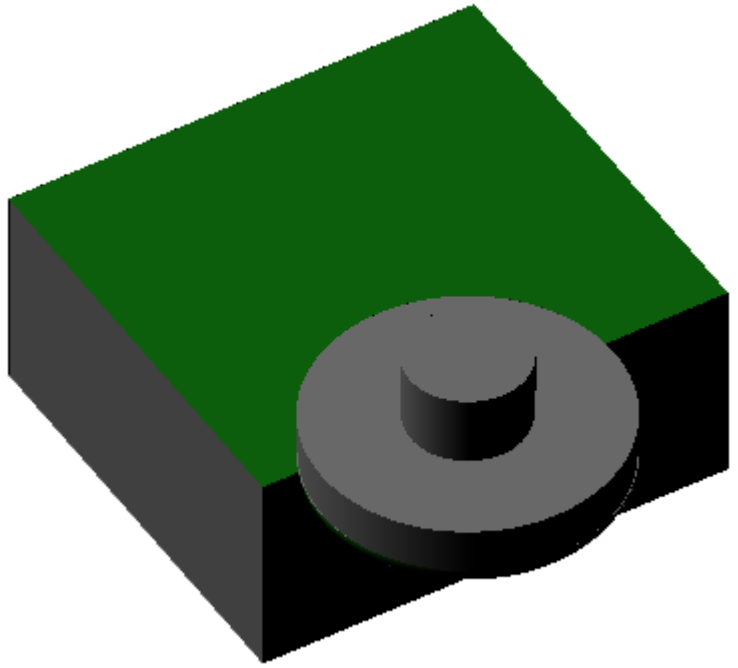


- There are THREE (3) options given by CATIA in viewing the full machining simulation. The description are as follows
  - 1 = Play video from last saved result
  - 2 = Full Video
  - 3 = Mixed Photo / Video
- Select 2nd icon to Play video from beginning. 
- Once satisfied with full machining simulation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

Roughing Operation

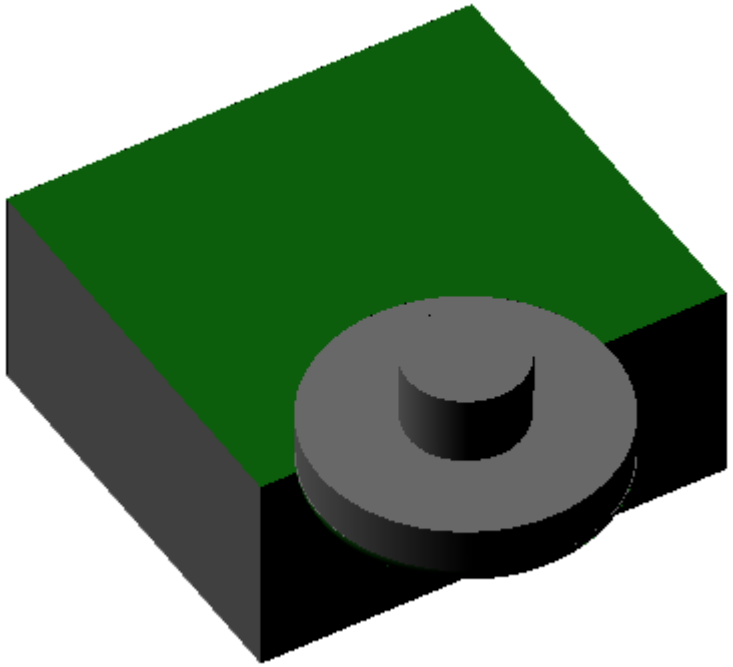


Initial Stock before any Machining Processes begin

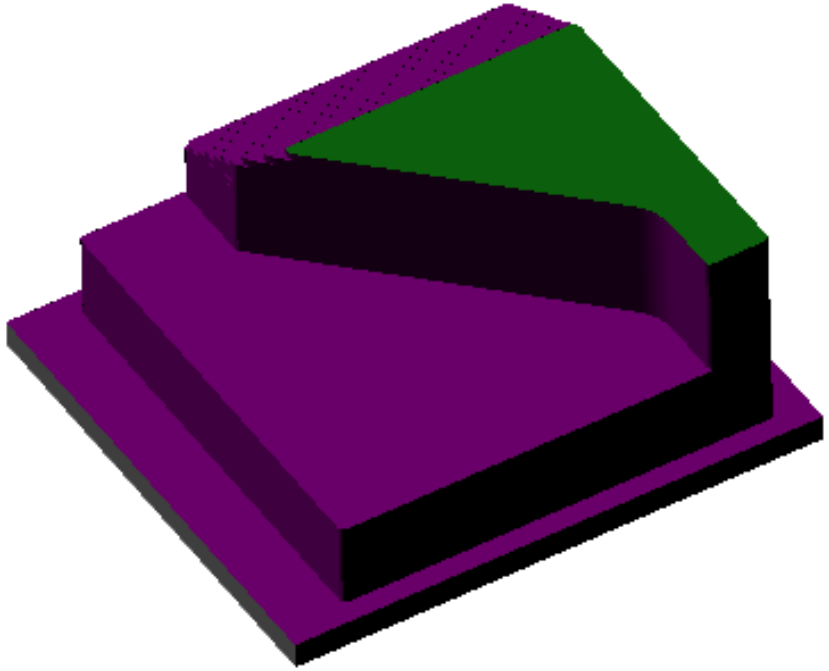


Facing Operation is in process

Roughing Operation



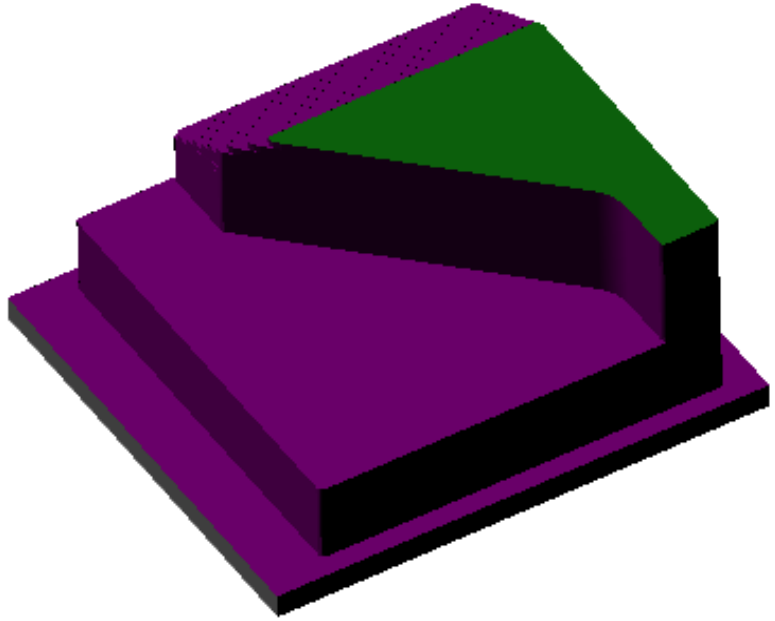
Facing Operation is in process



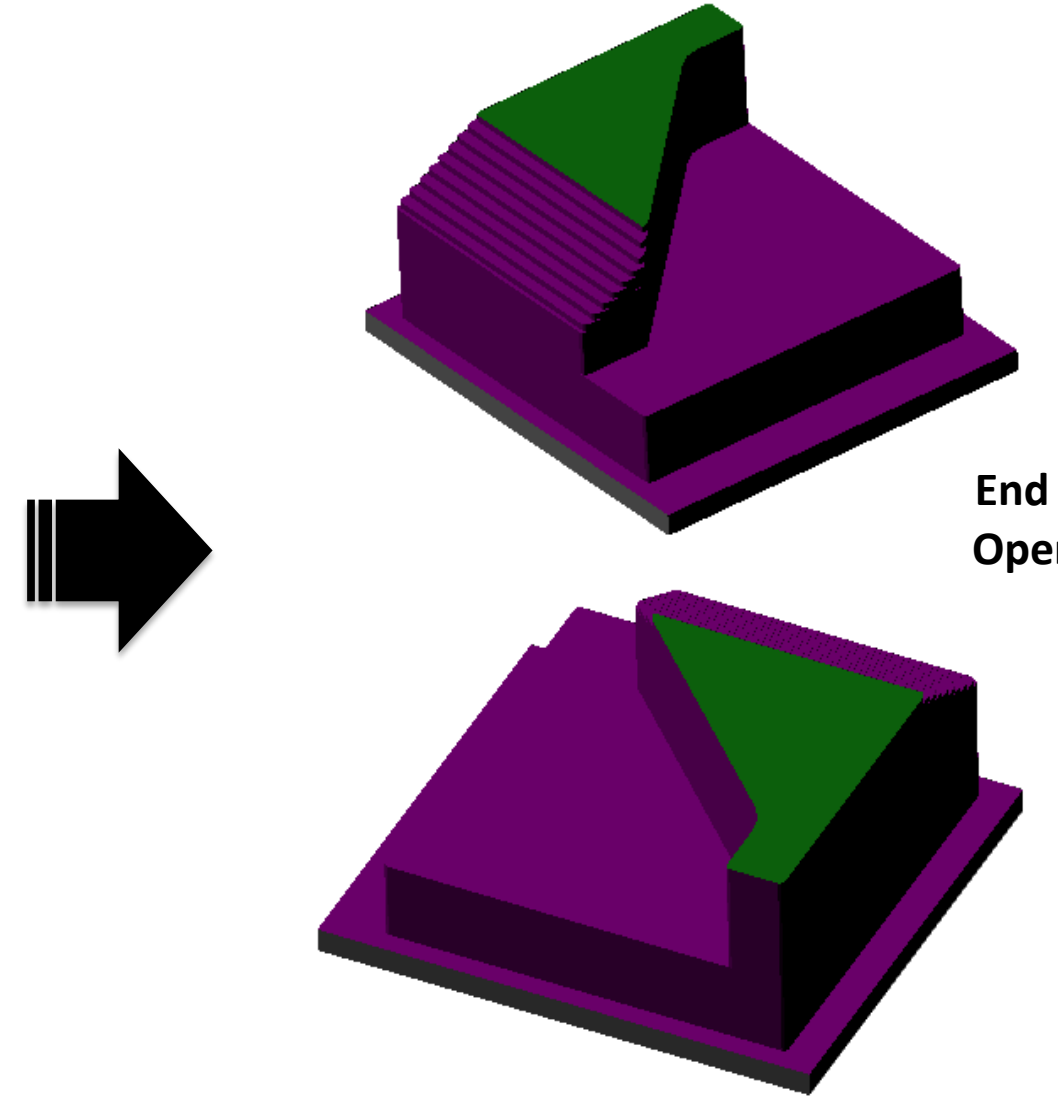
Roughing Operation – End Simulation Result

Roughing Operation

Roughing – NEW Approach



Roughing Operation – End Simulation Result

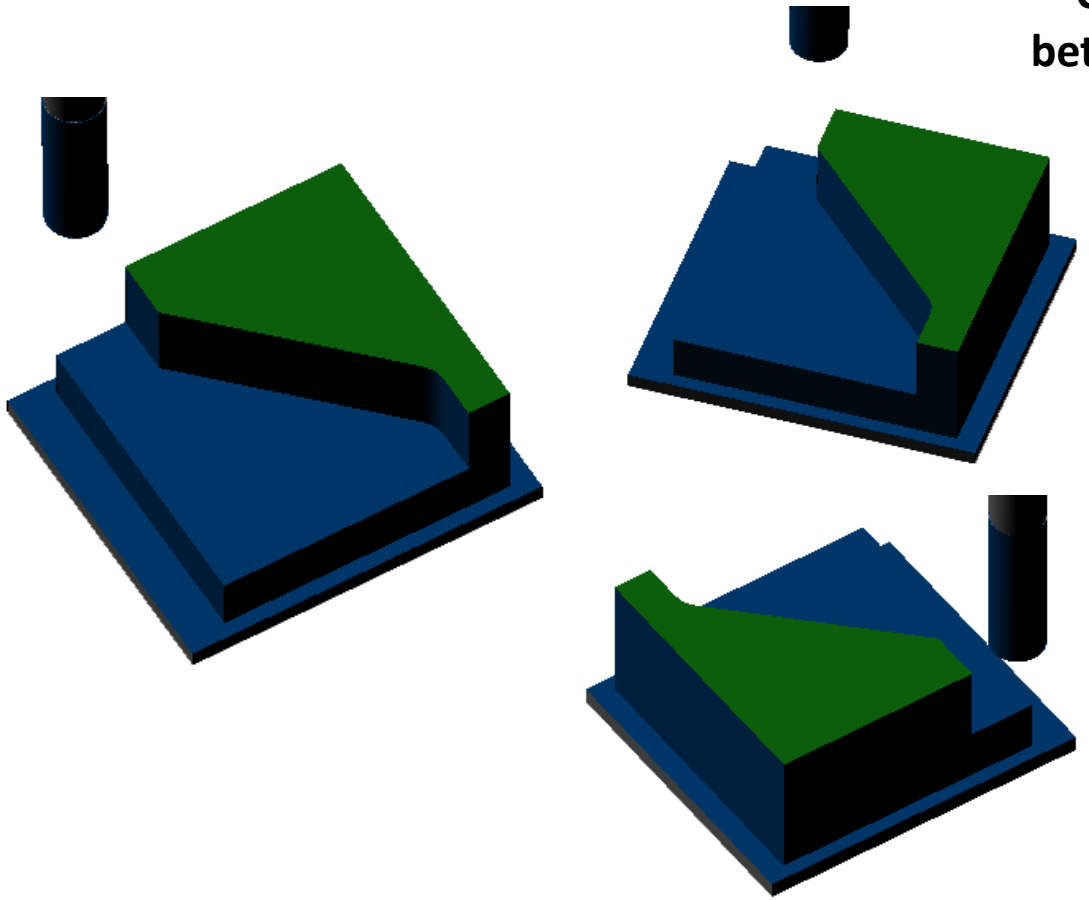


End Result of Roughing Operation - Views from different angle

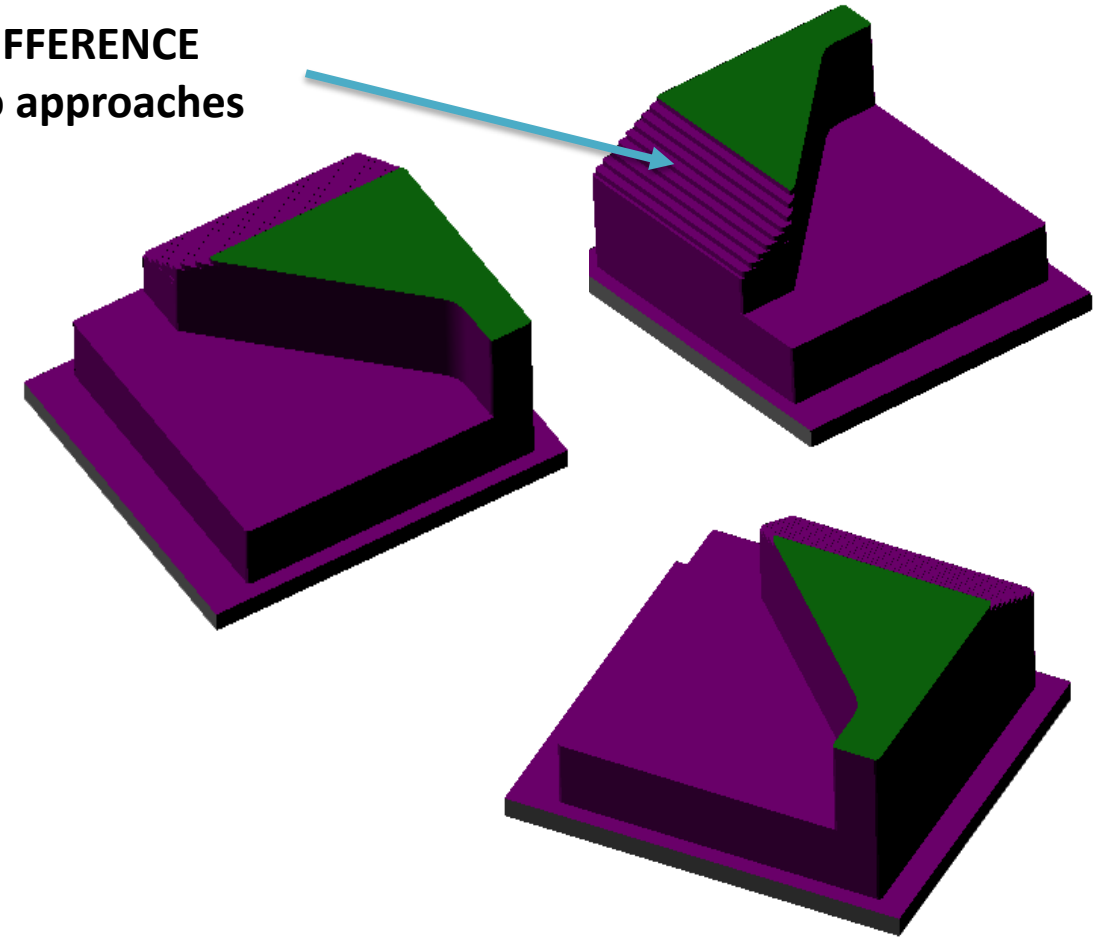
Roughing Operation

Roughing – NEW Approach

Obvious DIFFERENCE
between two approaches



Conventional Roughing Approach

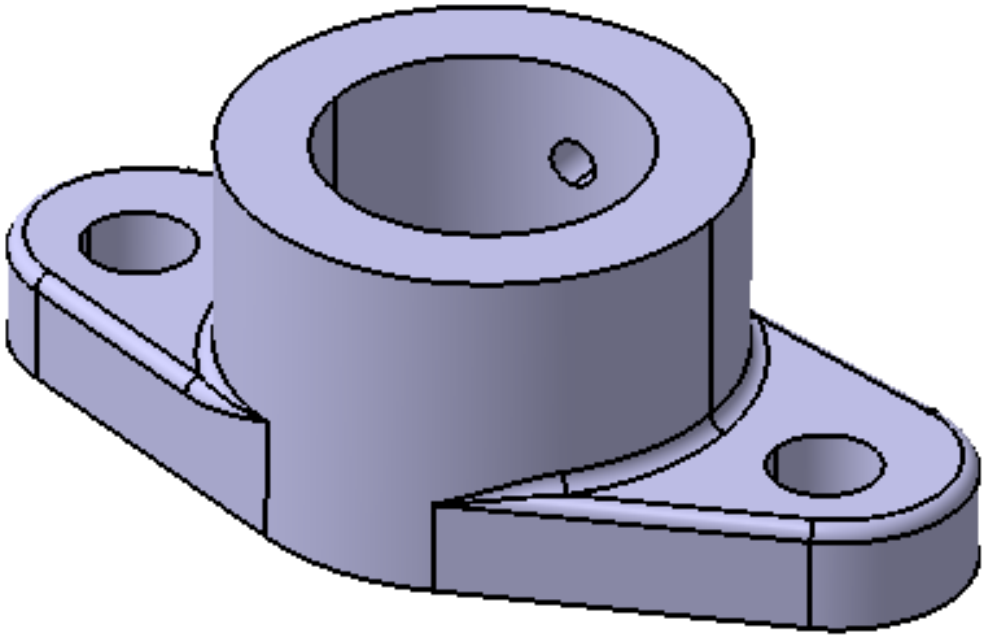


Roughing Operation – NEW Approach

Exercises – Self Practice

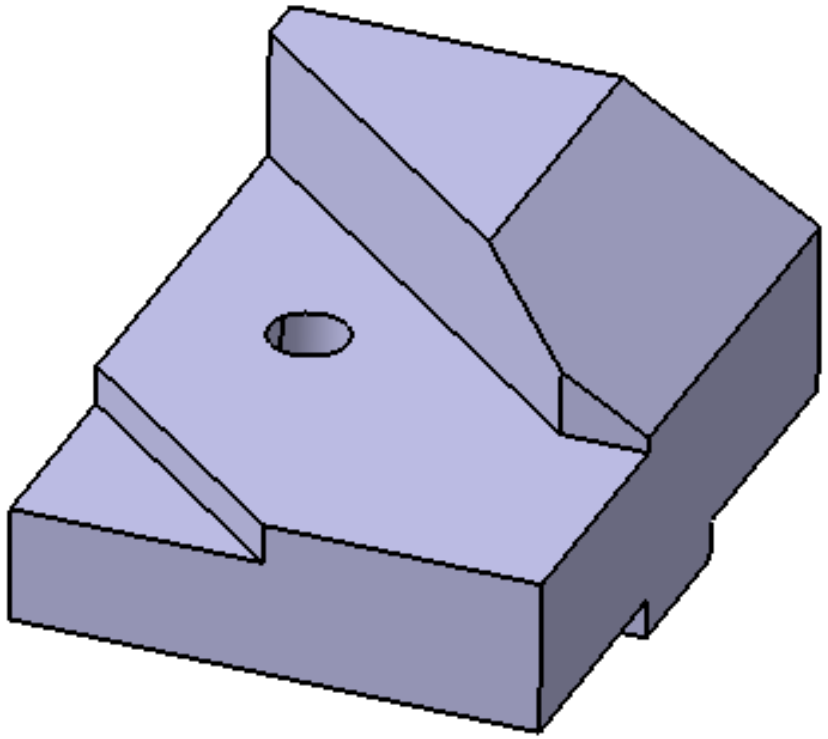
Roughing Operation

Exercise 1



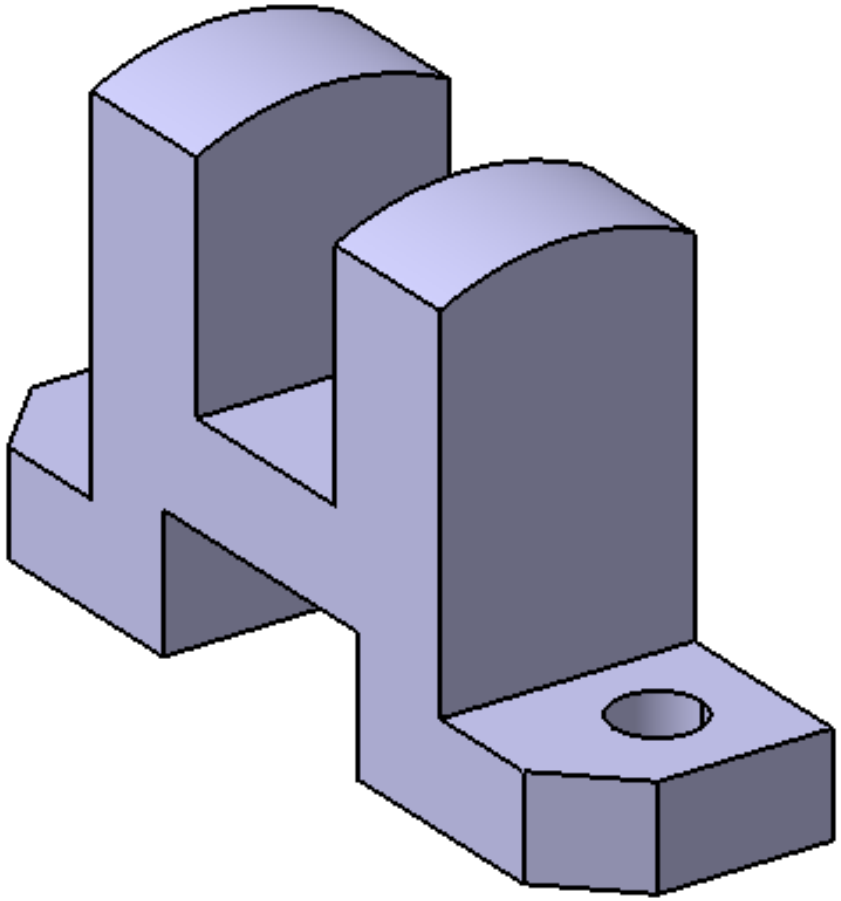
Roughing Operation

Exercise_2



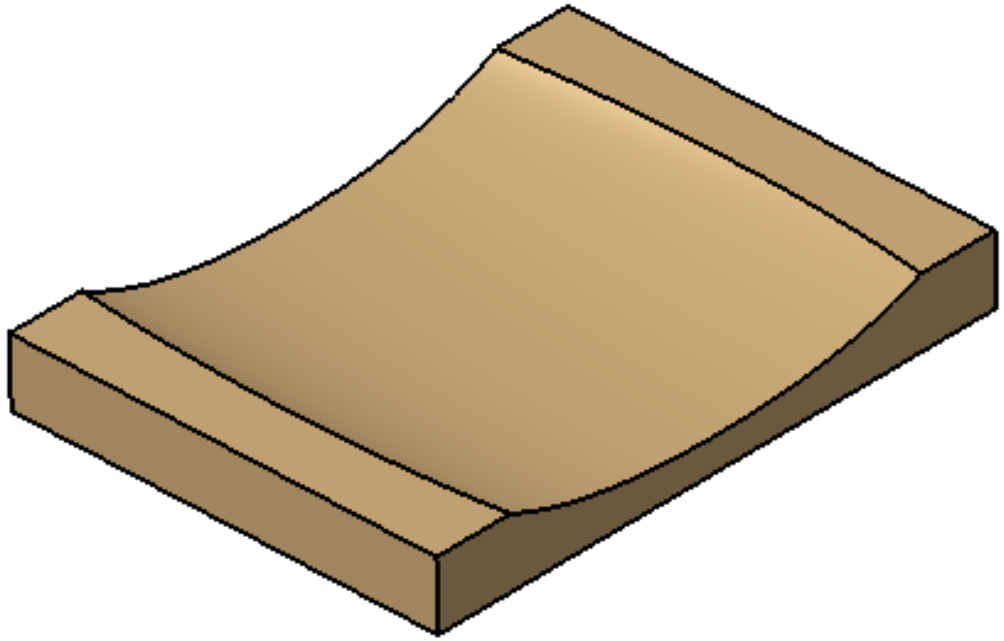
Roughing Operation

Exercise_3



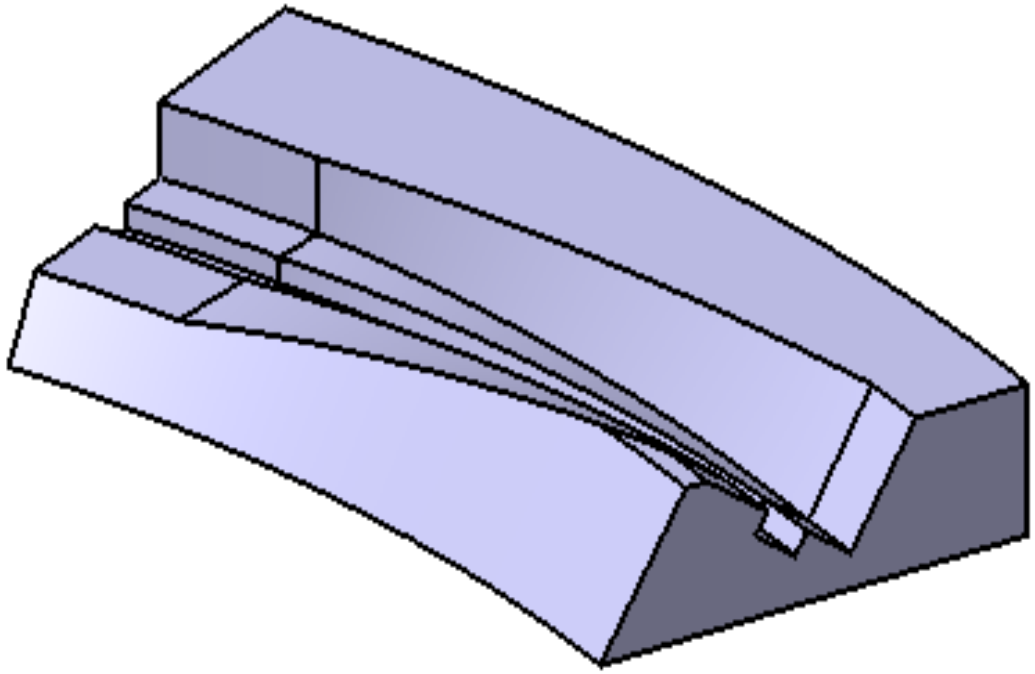
Roughing Operation

Exercise_4



Roughing Operation

Exercise_5



Roughing Operation

ALL THE BEST

THANK YOU