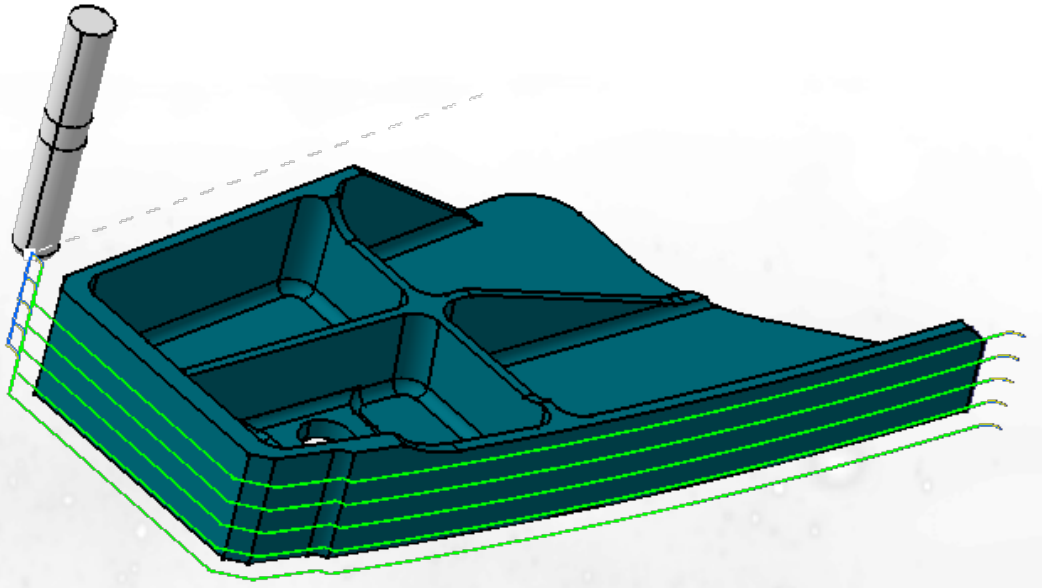
CATIA Training
Foils



Advanced Machining

Version 5 Release 9
June 2002

EDU-CAT-E-AMG-FF-V5R9

Course Presentation

Objectives of the course

In this course you will learn how to define a Multi-Axis Flank Contouring operation

Targeted audience

Manufacturing users knowing how to work with CATIA V5 Parts

Prerequisites

Fundamentals about CATIA V5

1 day

Table of Contents

Workbench Presentation

- The Advanced Machining Workbench
- The Multi-Axis Contouring Icon

The Advanced Machining Workbench

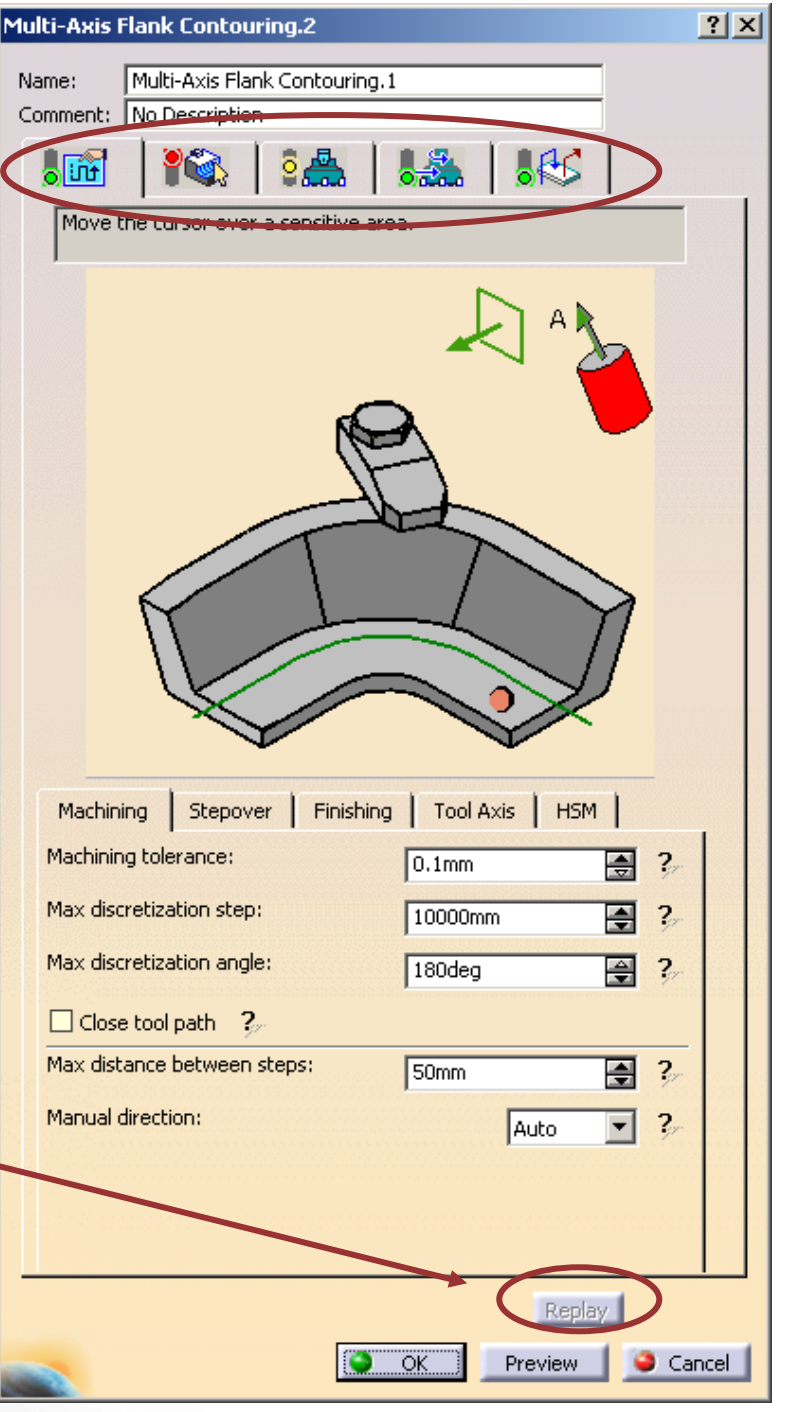
- **Multi-Axis Flank Contouring operation is available in AMG Workbench**
  - **AMG Workbench provides you with all milling capabilities from 2.5 to 5 Axis**
  - **In the toolbar you will find**
    - PMG and Drilling operations
    - SMG operations
    - MMG operations
    - Multi-Axis Flank Contouring operation

Multi-Axis Flank Contouring Presentation

- **User Interface**
  - **Enter the name of the operation**
  - **Enter a line of comment**
  - **Define operation parameters**

- Strategy tab
- Geometry tab
- Tool definition tab
- Feeds & Speeds tab
- Transition paths tab

- **Replay and/or simulate toolpath**



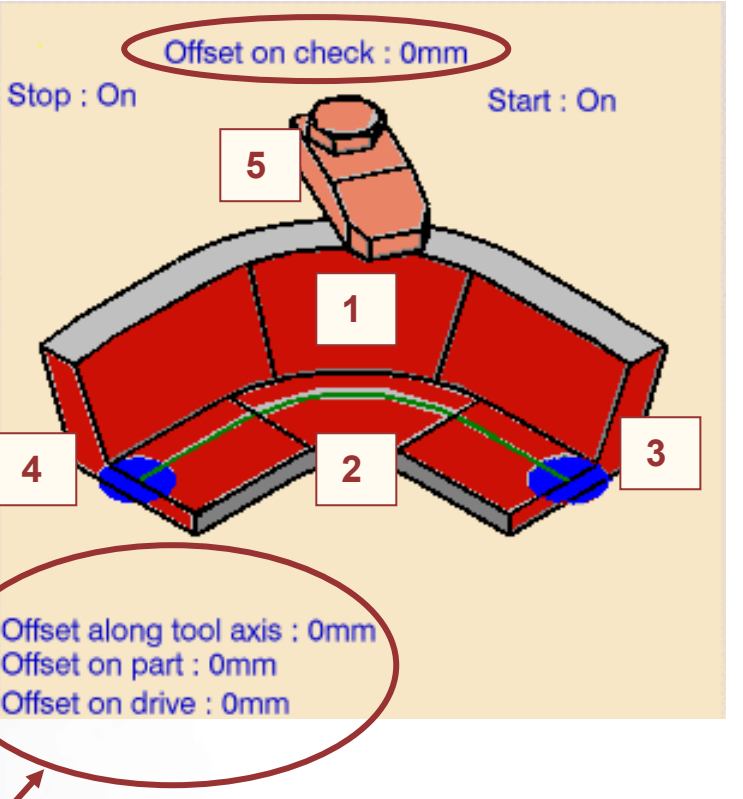
The Geometry Tab

- Presentation
- Drives Elements
- Part Elements
- Start and Stop Elements

Presentation

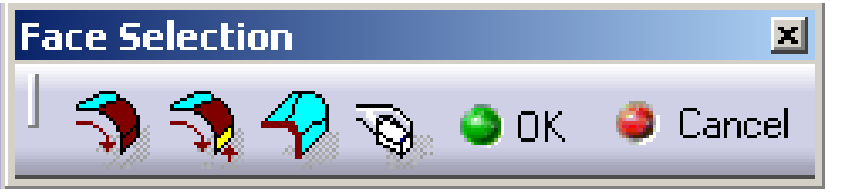
This Tab Page includes a sensitive Icon dialog box that allows the selection of :

- **Drive Surface elements** 1
  - **Flank tool will lean on Drives**
    - With respect of tool axis strategy and offset
- **Part surface elements** 2
  - **Tool end will lay down on Part**
    - With respect of tool axis strategy and offset
- **Start element** 3
  - **Used to compute first tool position**
- **Stop element** 4
  - **Used to compute last tool position**
- **Check elements** (optionnal) 5
  - **Elements to avoid during toolpath**

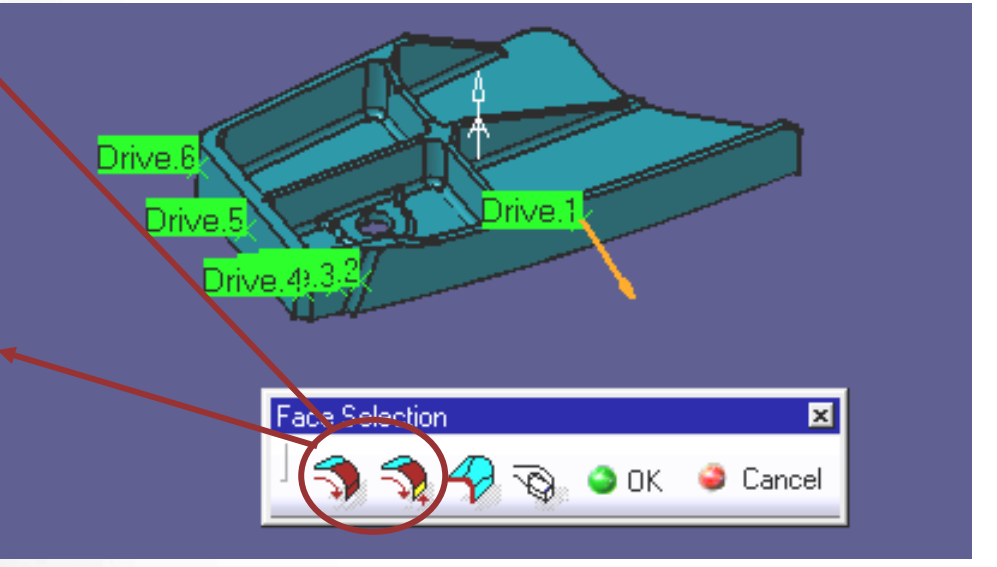


- Offset can be applied on part, drive, check and tool axis

Drives Elements (1/2)



- **Face selection:**
  This wizard allows you to select quickly drives
  - **To start the navigation, you always need to select at least two faces (first one is start element, second one give the direction to navigate)**
  - **Then you can select**
    Navigates on belt of faces
    Navigation is done in order to follow a belt
  - **Or you can select**
    Navigates on Faces Until a Face
    Navigation is done until a selected face

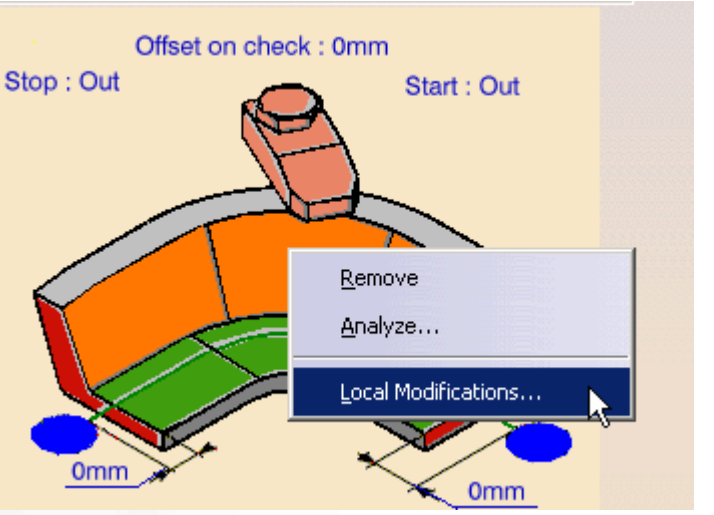


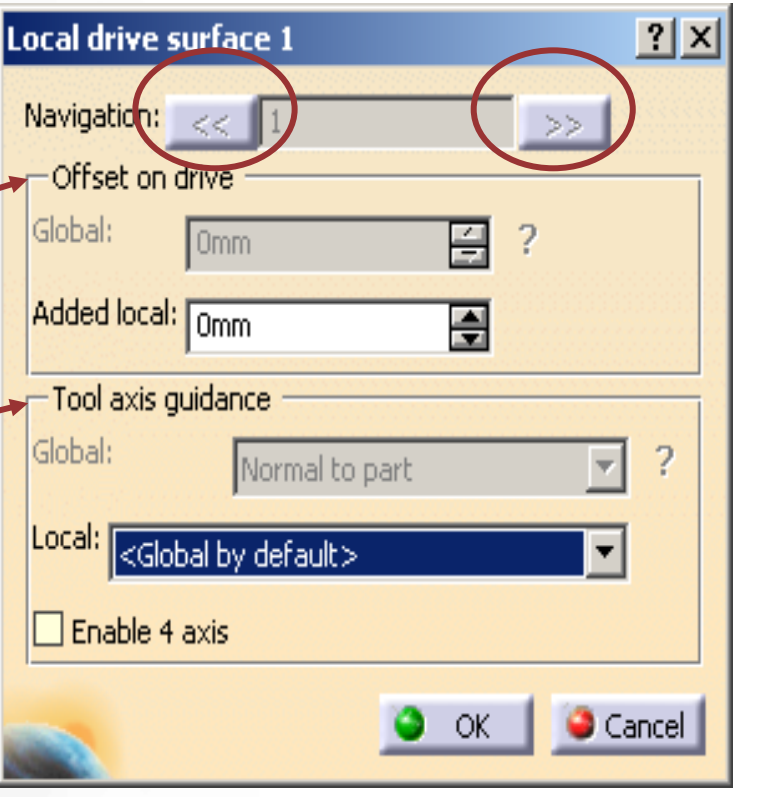
Drives Elements (2/2)

Local modification :

- Once all drives are selected you can modify locally strategy and offset on each drives

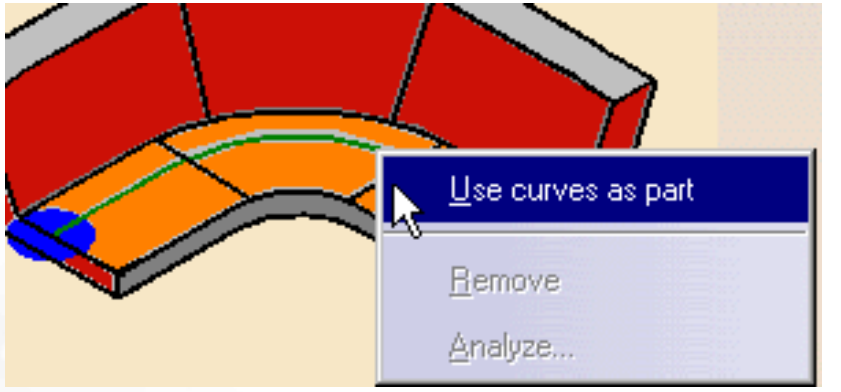
- Local modification wizard
  - Browther on drive : select the drive on which you want to perform modification (selected drive is highlighted)
  - Offset modification
  - Tool axis guidance modification





Part Elements

- **Use curves as part :**
  part surface element can be a curve
  - **Click right on part element sensitive icon and select ‘Use curves as part’**
    - The system accepts only curves that are boundary of selected drives



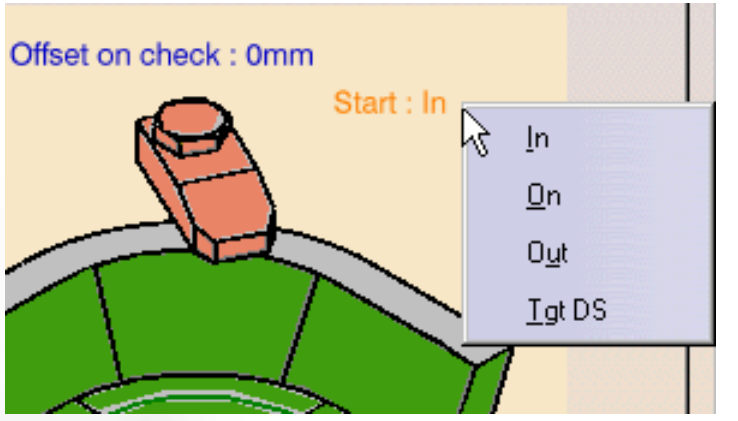
  - **Edge selection :**
    This wizard allow you to select quickly curves
    - To start the navigation, you always need to select at least two edges (first one is start element, second one give the direction to navigate)
    - Then you can select
      Navigates on belt of edges
      Navigation is done in order to follow a belt

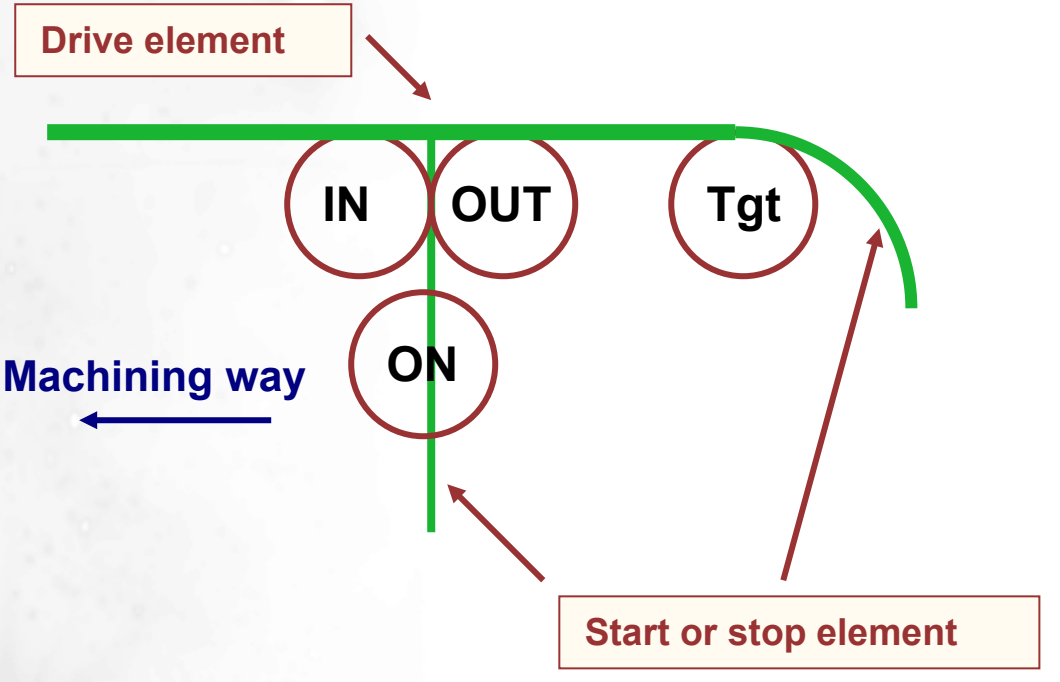
    - Or you can select
      Navigates on Edges Until an Edge
      Navigation is done until a selected face

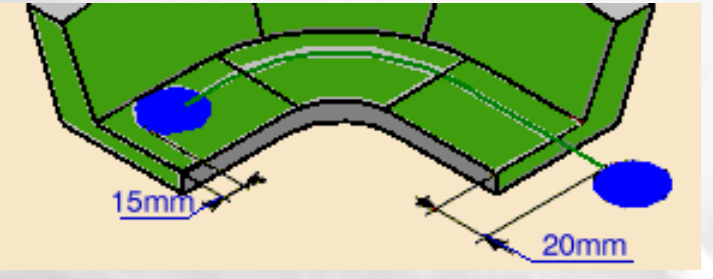
Start and Stop Elements

Must be a surface, a plane, an edge or a vertex

- **Start**
  - The algorithm needs to know a start position. This position is computed using the first selected drive and the start element
- **Stop**
  - As for the start element this position is computed using the last selected drive and the stop element
- **Start/Stop conditions**
  - Positionning of the tool is automatically computed. But it can be modified using right click on « start » or « stop »
  - An offset can be applied







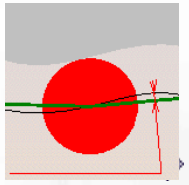
The Strategy Tab

- Machining Tab
- Stepover Tab
- Finishing Tab
- Tool Axis Tab
- Other Parameters
- HSM Tab

Machining Tab (1/2)

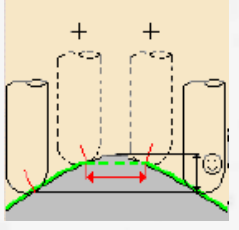
Machining tolerance

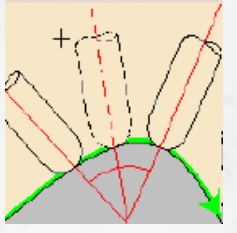
- Value of the maximum allowable distance between the theoretical toolpath and the toolpath computed



Max discretization step and angle

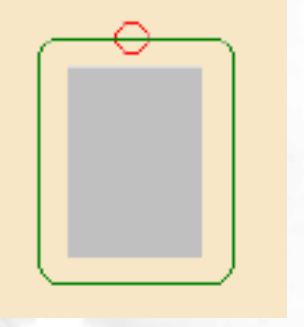
- Maximum distance and angle between two outputed points of toolpath (default values are infinite, different settings has to be done according to post-processor and machine feature)

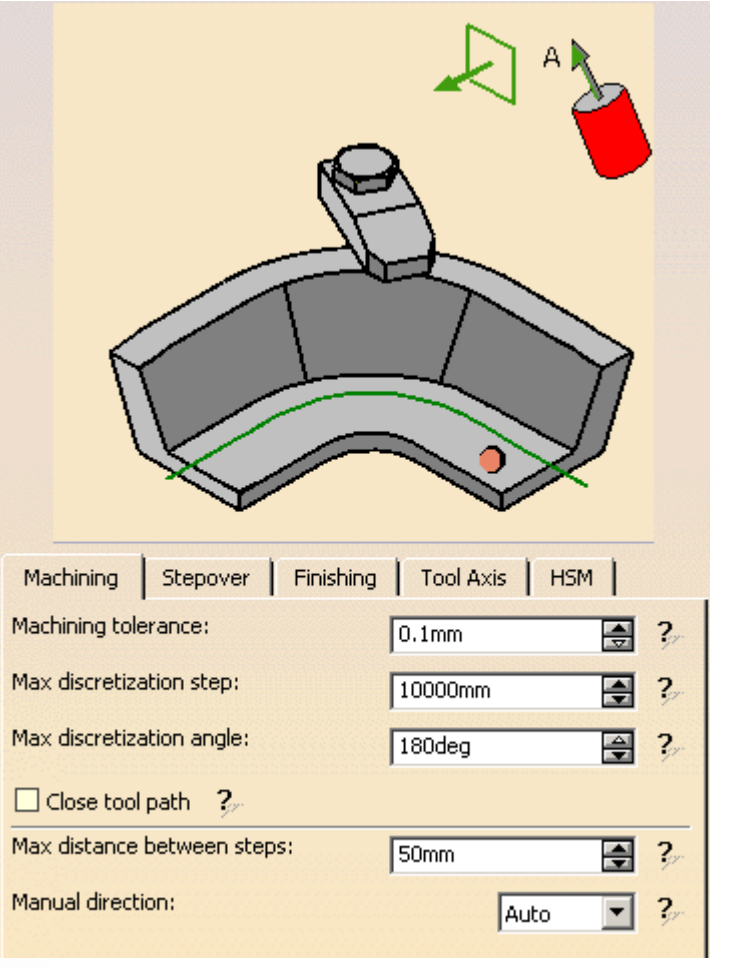




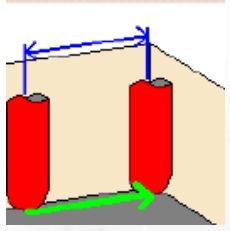
Close toolpath

- Option to activate in closed pocket when the first drive element is used as last drive





Machining Tab (2/2)

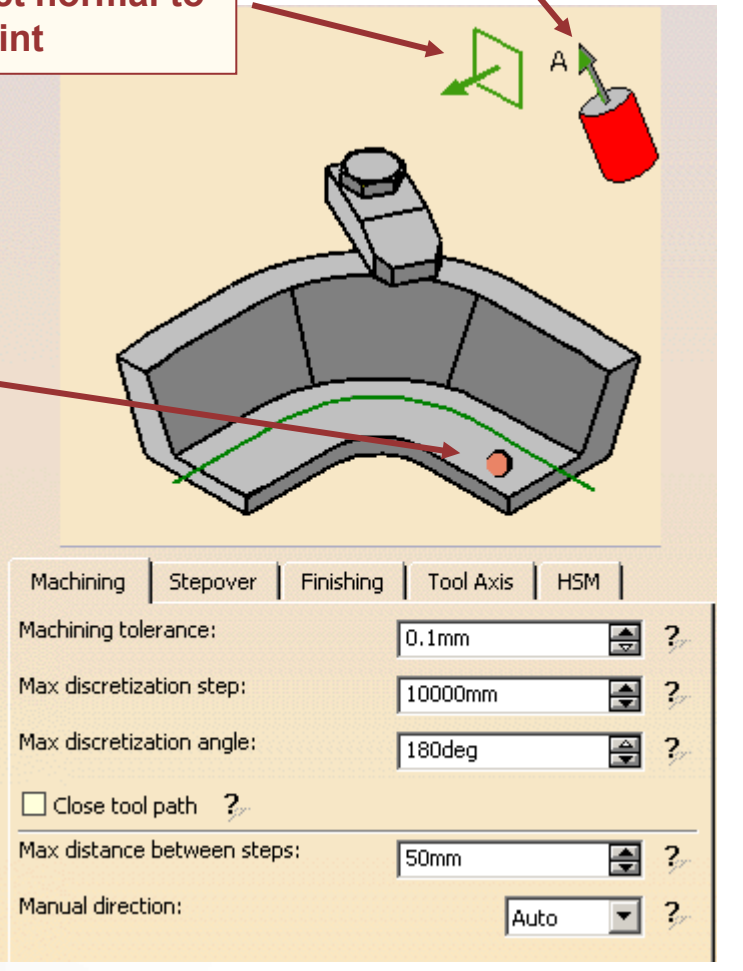


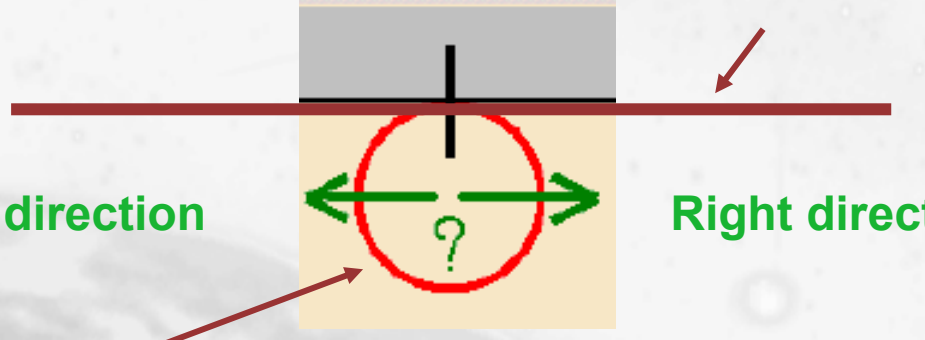
- **Maximum distance between ste**
  - Rough estimate distance used by the algorithm to search for next drive or check element (In most of cases do not modify this parameter)

- **Reference point and Manual direction**
  - This point is automatically computed (using first drive, part and start element) But in particular geometric cases it could have to be manually defined
  - Using a reference point, direction can be automatic, right or left:

Click here to select Tool Axis

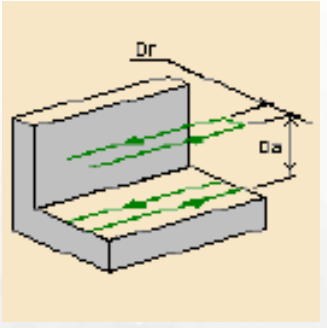
Click here to select normal to planar 4X constraint

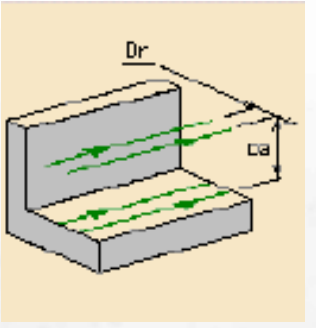




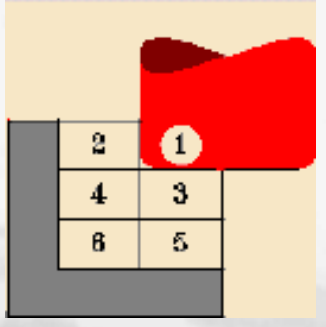
Stepover Tab (1/2)

- **Tool path style**
  - Zig-zag or one way

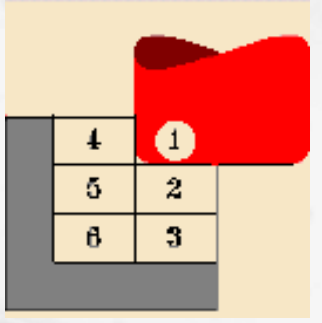




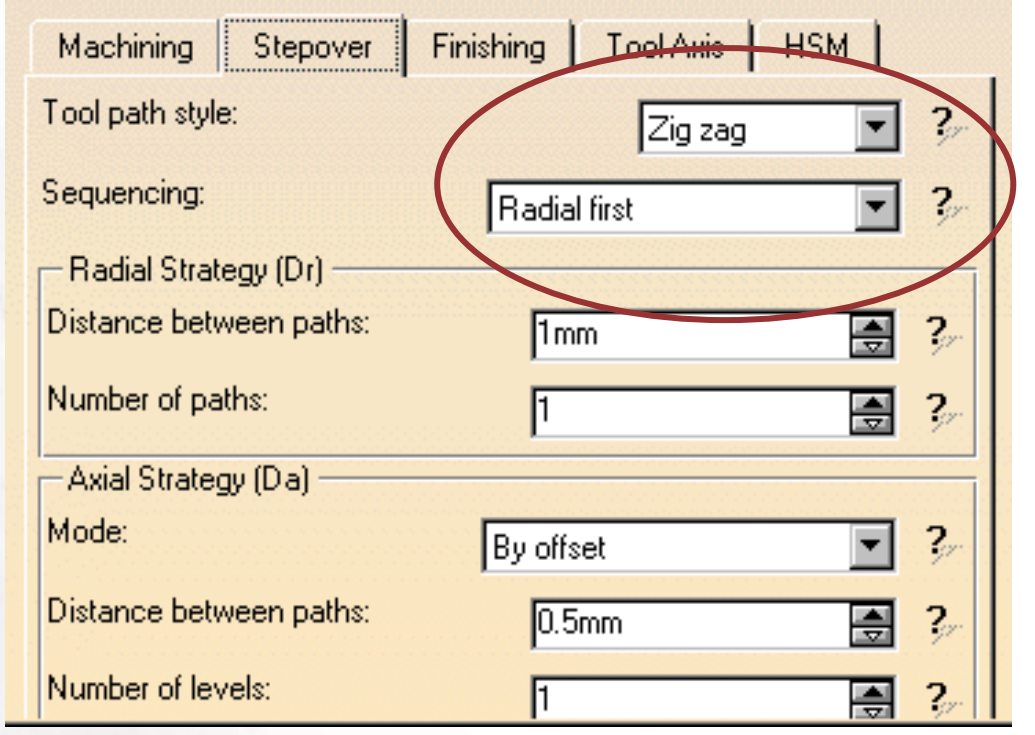
- **Sequencing**
  - Radial or Axial priority



Radial priority



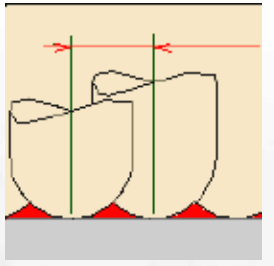
Axial priority

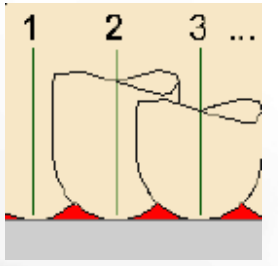


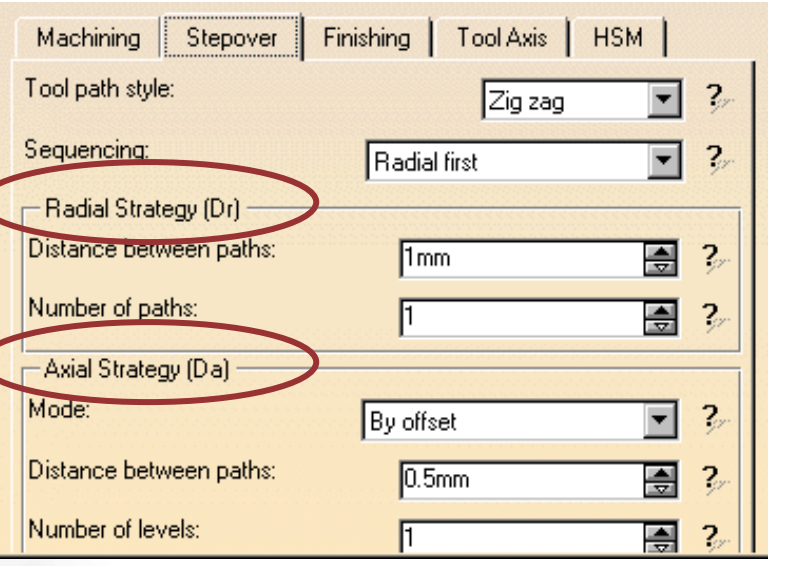
Stepover Tab (2/2)

Radial strategy

- Define the distance between paths and the number of paths

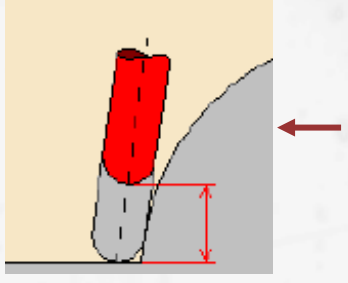




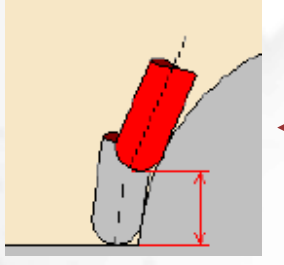


Axial strategy

- Select the mode by offset or by thickness

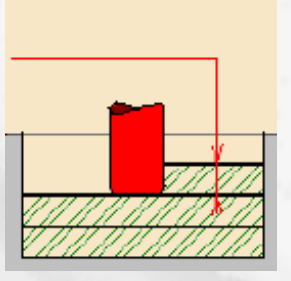


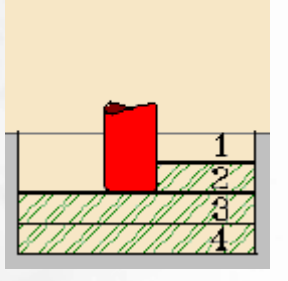
By offset: toolpath is computed once then an offset along axis is applied for each level



By thickness: toolpath is re-computed for each level

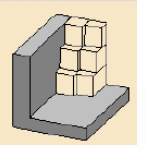
- Define the distance between paths and the number of levels



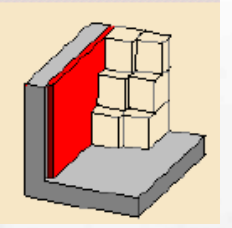


Finishing Tab

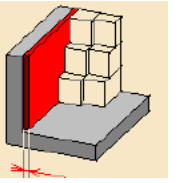
- **Mode**
  - No side finish



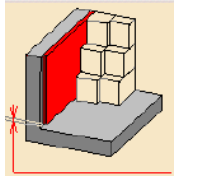
  - At last level



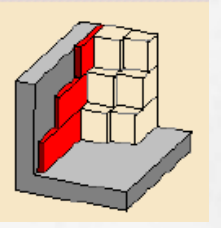
Side thickness



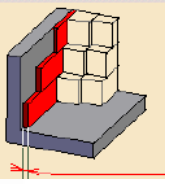
Side thickness on bottom



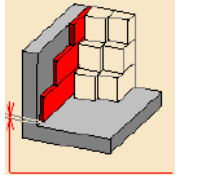
  - At each level



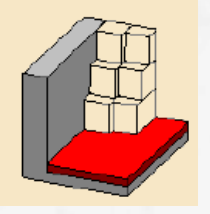
Side thickness



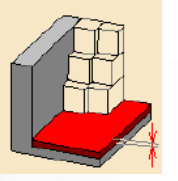
Side thickness on bottom



  - At bottom



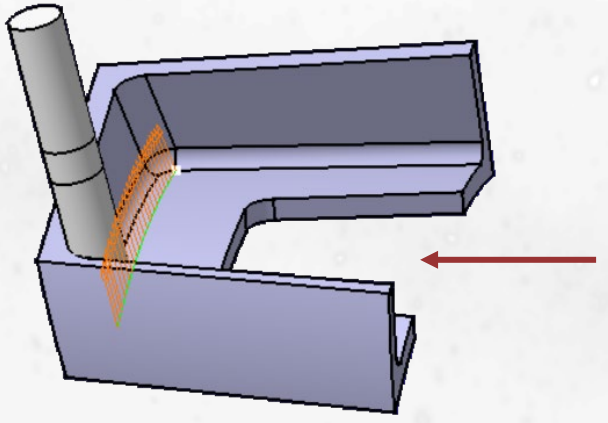
Bottom thickness



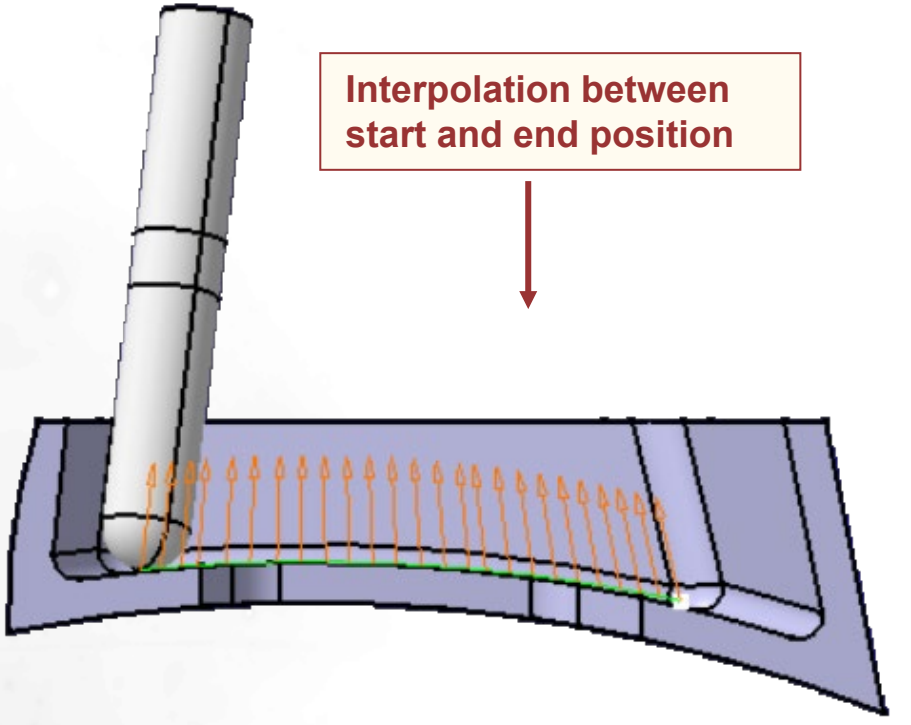
- **Each side and bottom finishing strategies can be combined:**
  - At each level and bottom
  - At last level and bottom

Tool Axis Tab (1/6)

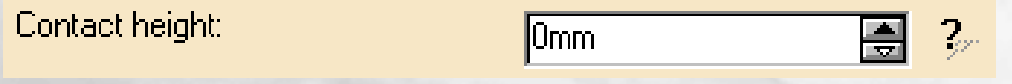
- **Tanto Fan guidance definition:**
  - Tool is tangent to the drive surface at a given contact height*.
    Tool axis is the interpolation between the start and end positions

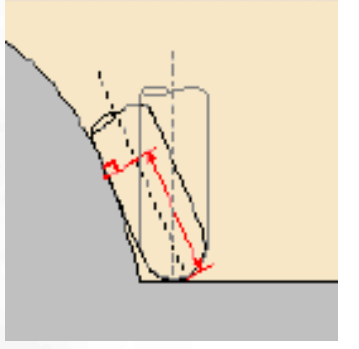


Tool tangent to the drive at a given contact height point



  - * The contact height is used to determine a point on the drive surface where the tool must respect tangency conditions
    Default value is zero and is related to the bottom of the tool.

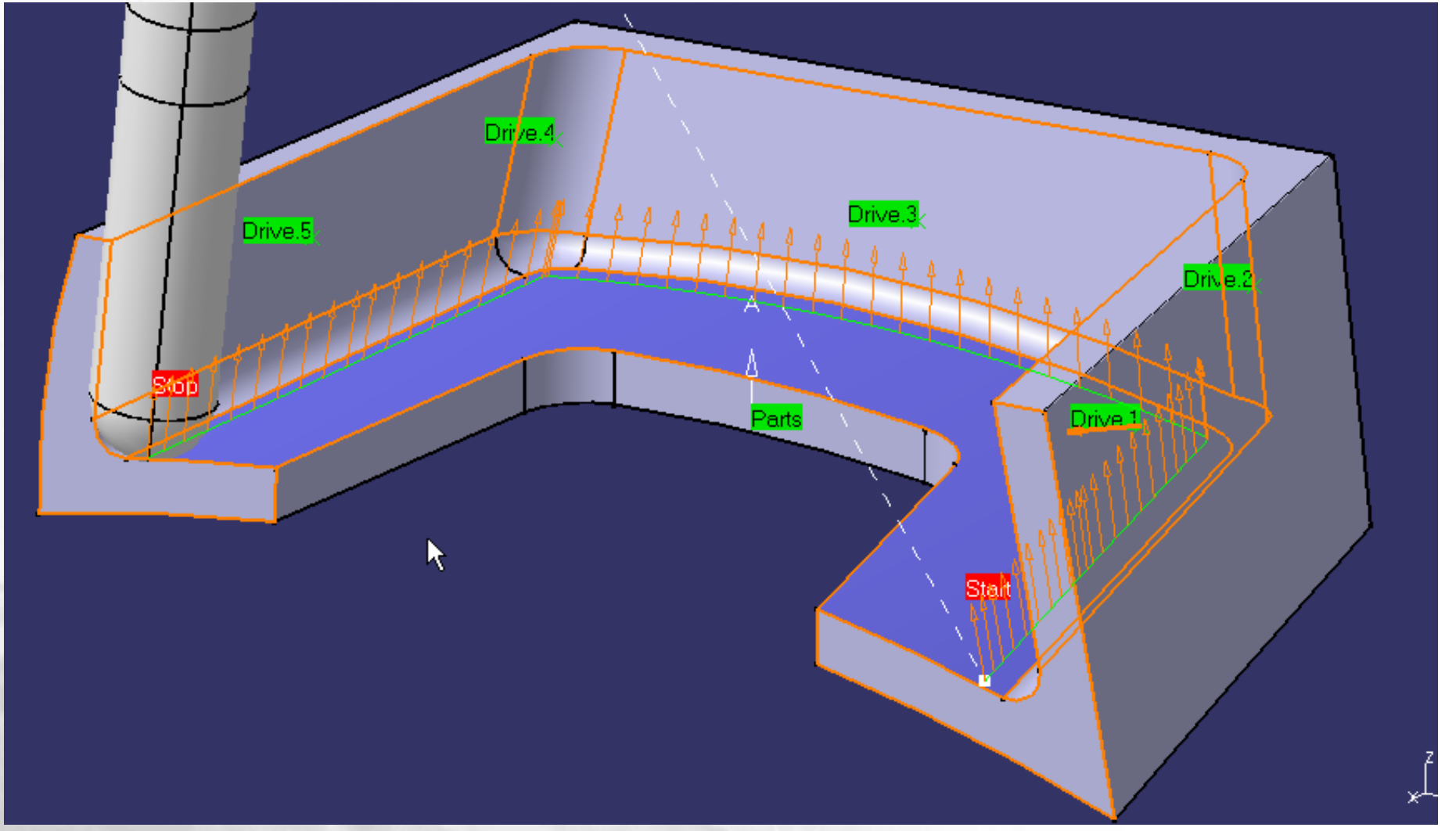




Exercise Presentation

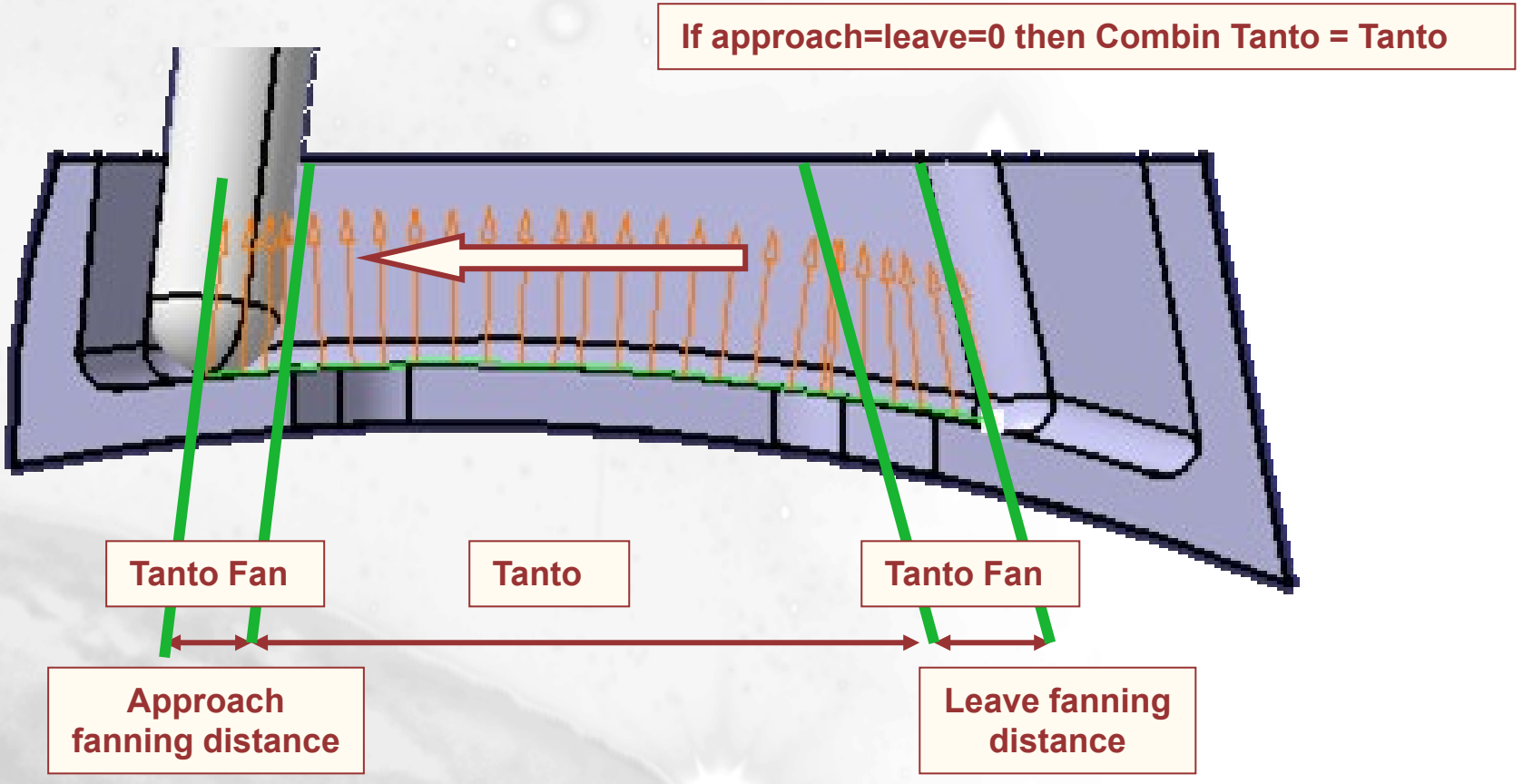
And now practice on the Ex01-TantoFan exercise, to learn about:

- Geometry definition
- Tanto Fan strategy



Tool Axis Tab (2/6)

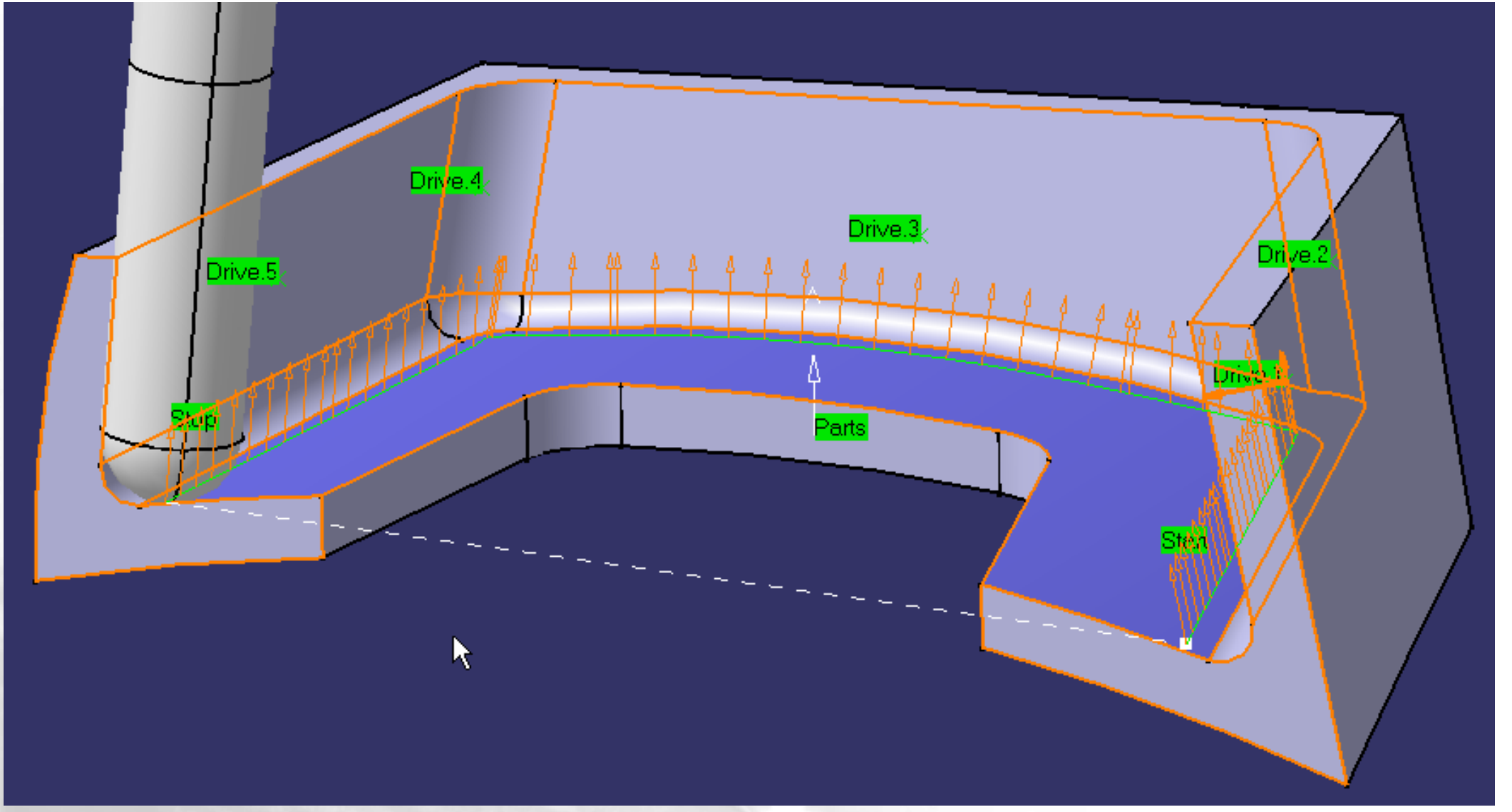
- **Guidance Combin Tanto**
  = Tanto Fan (during leave* distance) **+ Tanto + Tanto Fan** (during approach* distance)
- **Tanto guidance definition: (exists alone only as a local mode)**
  - **Tool is tangent to the drive surface at a given contact height.**
    Tool Axis contained in a plane normal to forward direction
  - ***Approach and leave distance parameters can be modified**



Exercise Presentation

And now practice on the Ex02-CombinTanto exercise, to learn about:

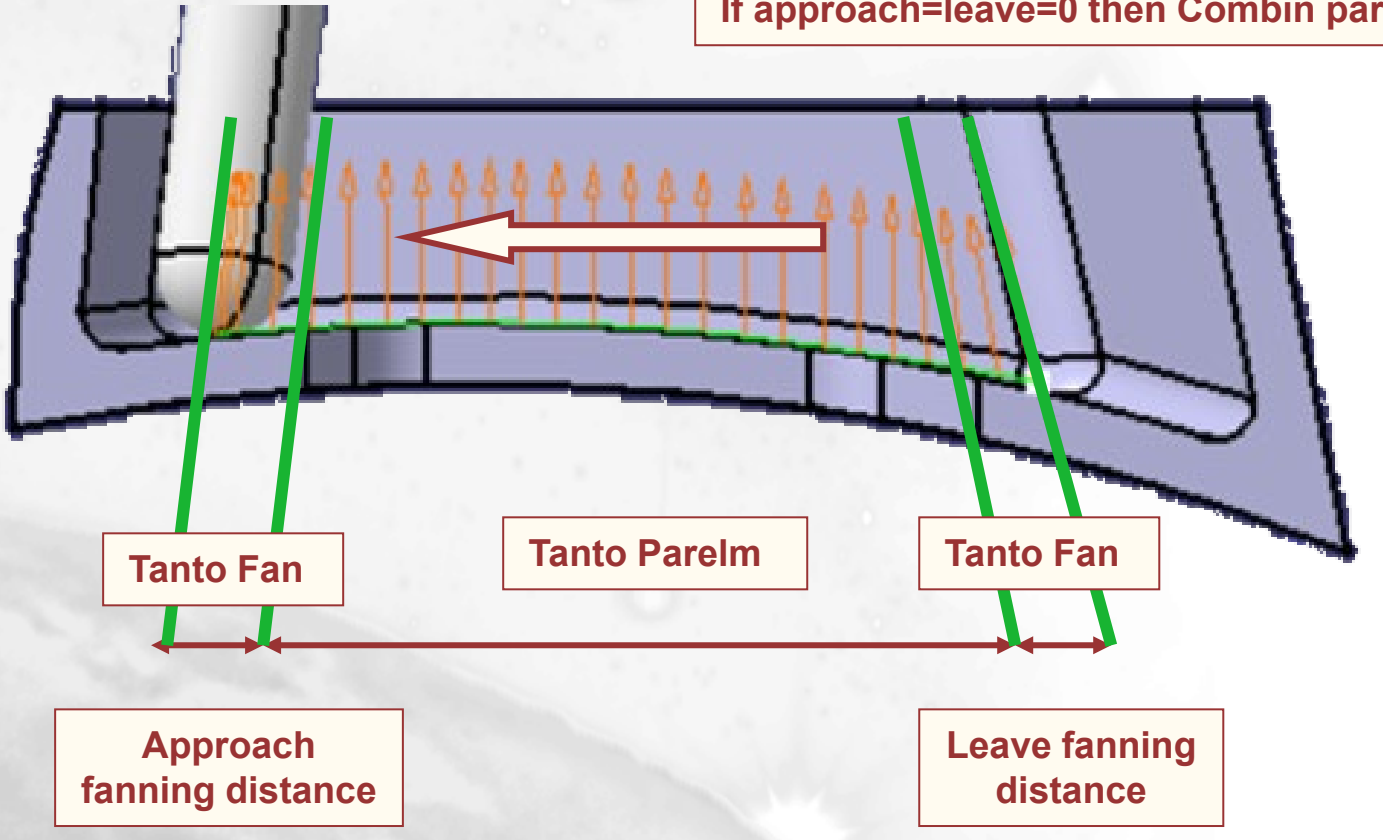
- Combin Tanto strategy



Tool Axis Tab (3/6)

- **Guidance Combin parelm**
  = Tanto Fan (during leave* distance) **+ Tanto Parelm + Tanto Fan** (during approach* distance)
- **Tanto parelm guidance definition:**
  - **The tool axis is tangent to the drive surface at the specified contact height and follows the isoparametrics of the Rsur**
  - ***Approach and leave distance parameters can be modified:**

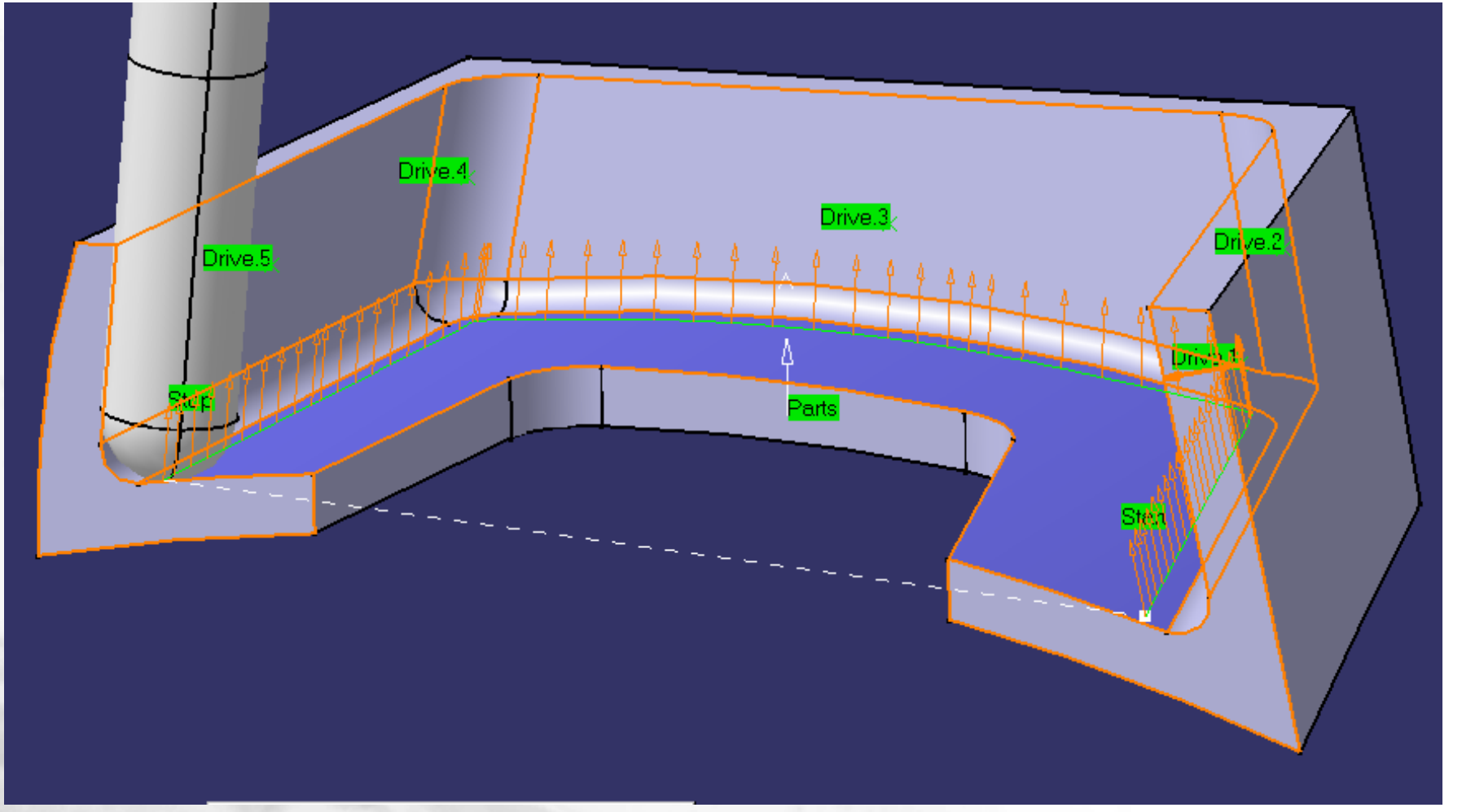
If approach=leave=0 then Combin parelm = Tanto parelm



Exercise Presentation

And now practice on the Ex03-CombinParelm exercise, to learn about:

- Combin Parelm strategy

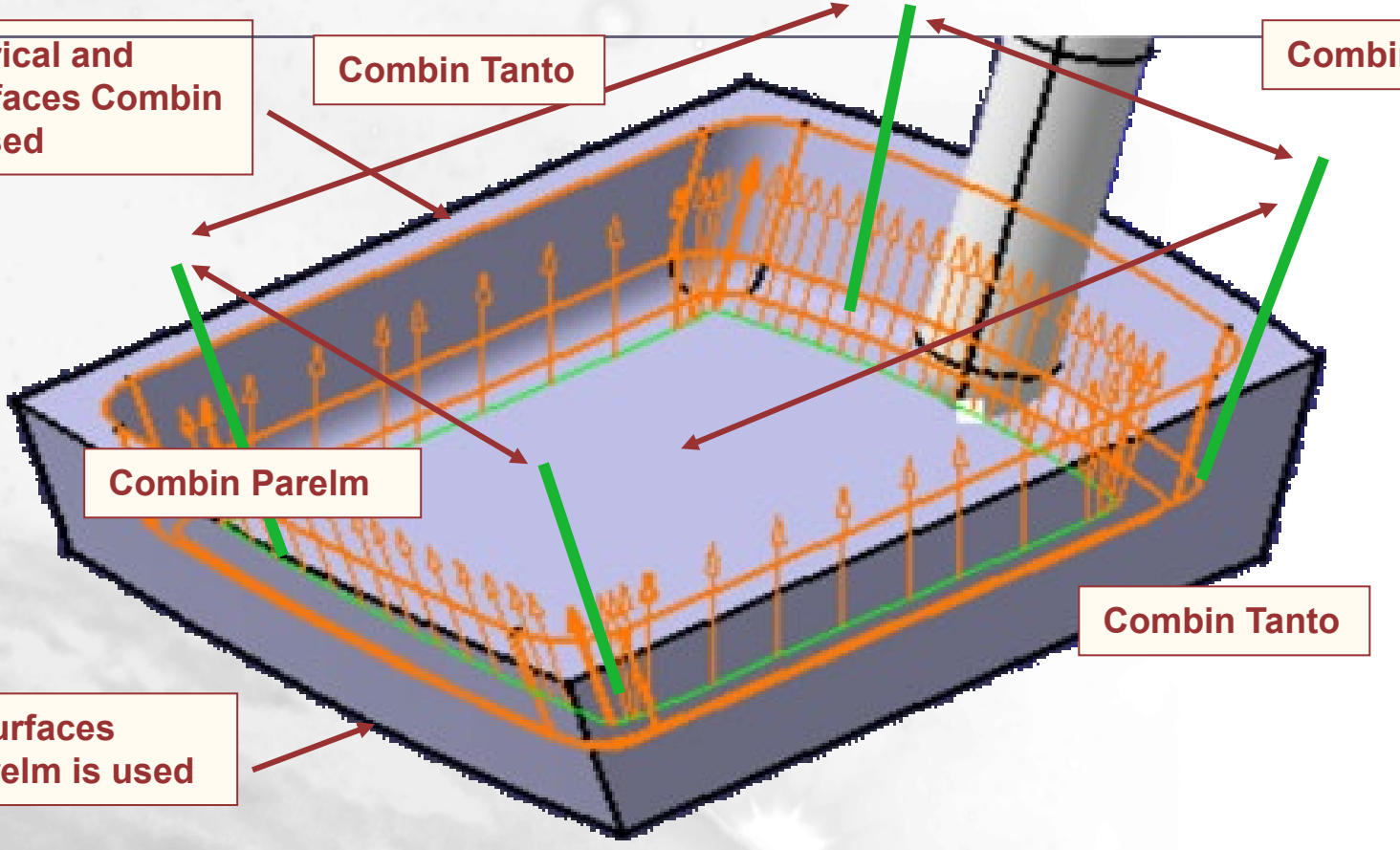


Tool Axis Tab (4/6)

Guidance Mixed Combin

- This strategy is equivalent to Combin Parelm except on planar or cylindrical surfaces on which Combin Tanto strategy will be applied (as isoparametrics direction may not be appropriate to follow on this kind of surface)

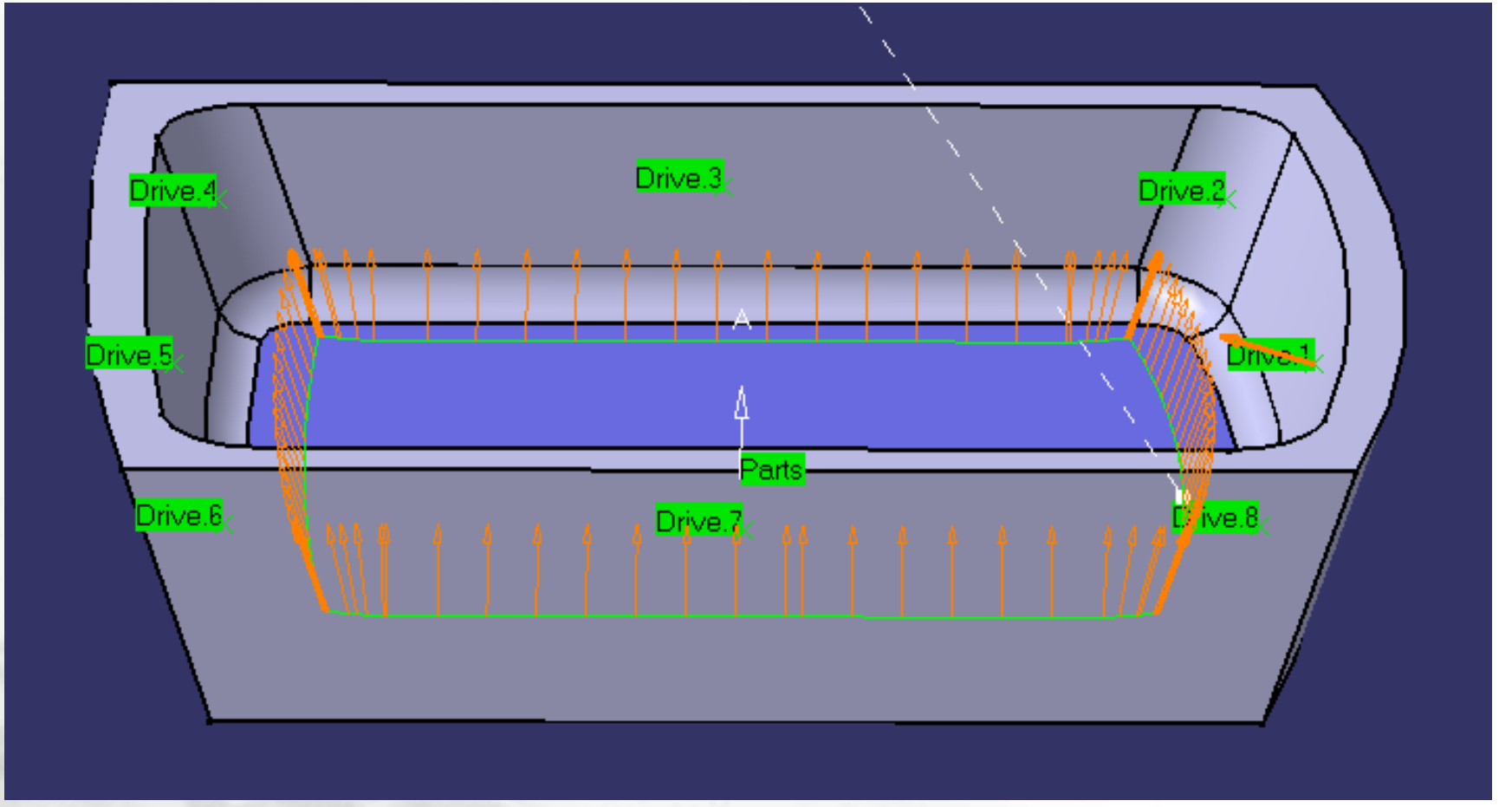
- *Approach and leave distance parameters can be modified



Exercise Presentation

And now practice on the Ex04-MixedCombin exercise, to learn about:

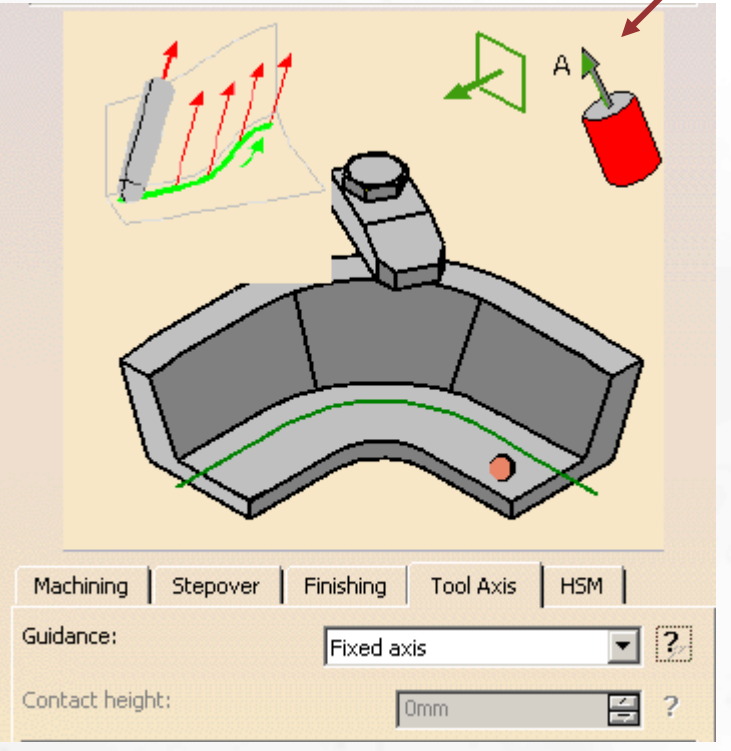
- Mixed Combin strategy



Tool Axis Tab (5/6)

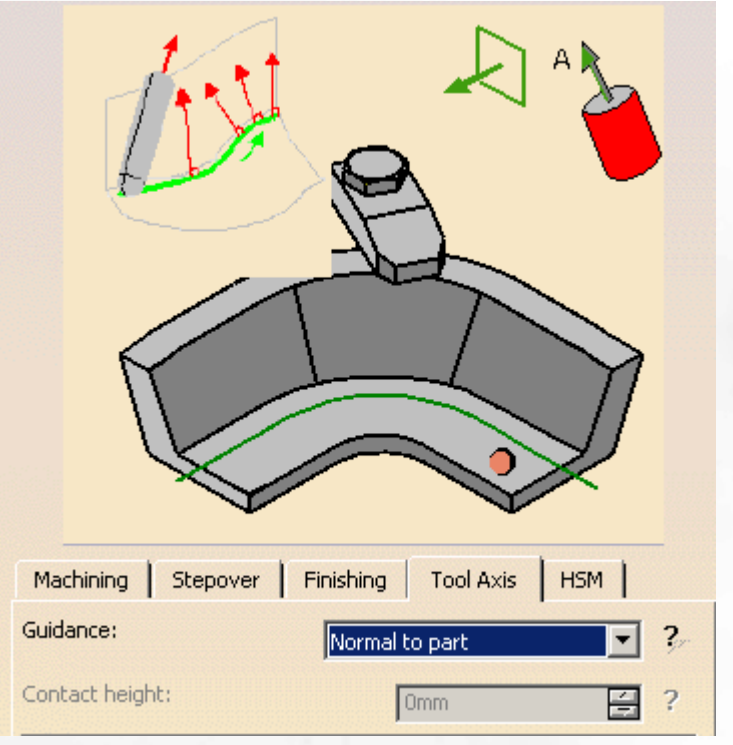
- **Fixed Axis guidance definition:**
  - **Tool Axis is fixed**

Click here to select Tool Axis



Tool Axis Tab (6/6)

- **Normal to part guidance definition:**
  - **Tool Axis is normal to selected part while the tool remains in contact with Drives**



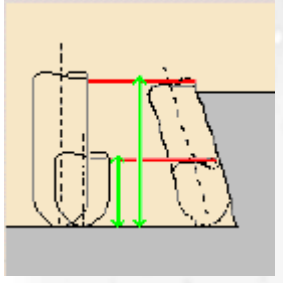
Other Parameters

Disable fanning:

- With Combin Tanto, Combin parelm and Mixed Combin strategy, you can desactivate fanning on start and stop element using this option.

Useful cutting length

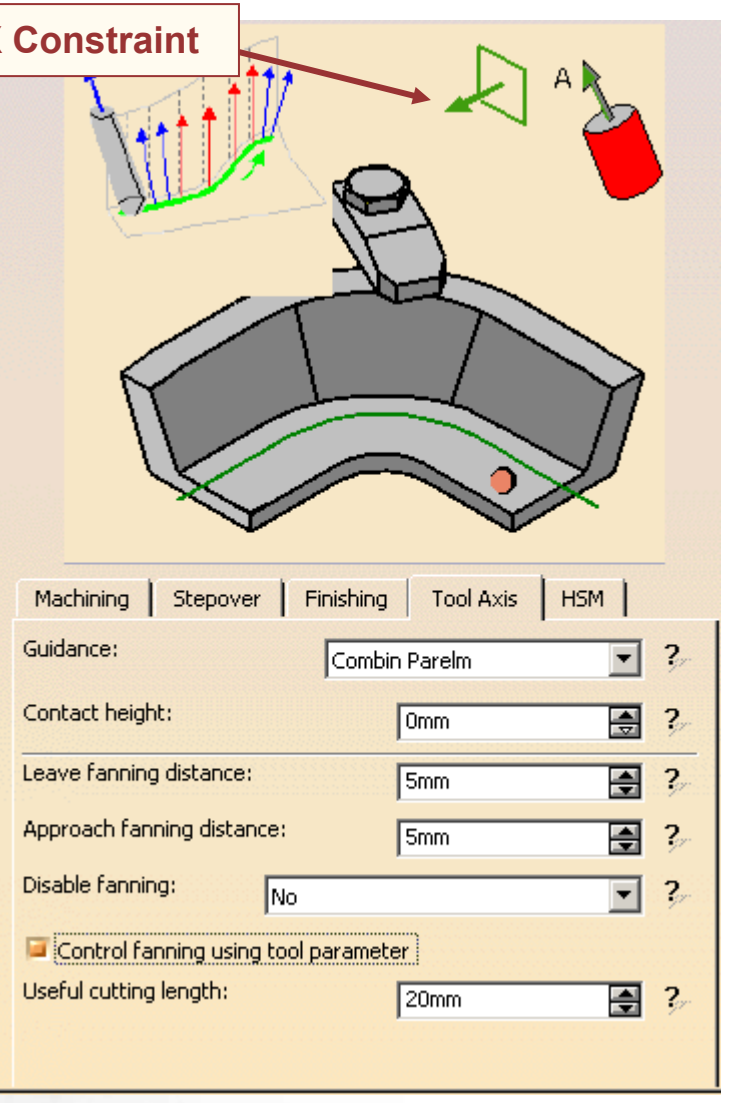
- Fanning algorithm is using tool cutting length parameter.
  If needed to control fanning, this parameter can be modified with this option.



4 Axis

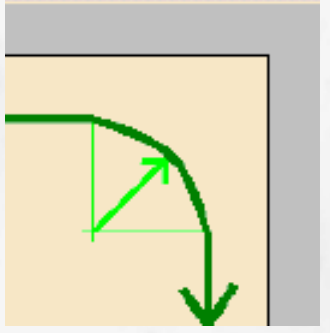
- In case of local modification on drives with Normal to part and Tanto guidance 4 Axis mode is available.
  Therefore you need to select planar 4X constraint

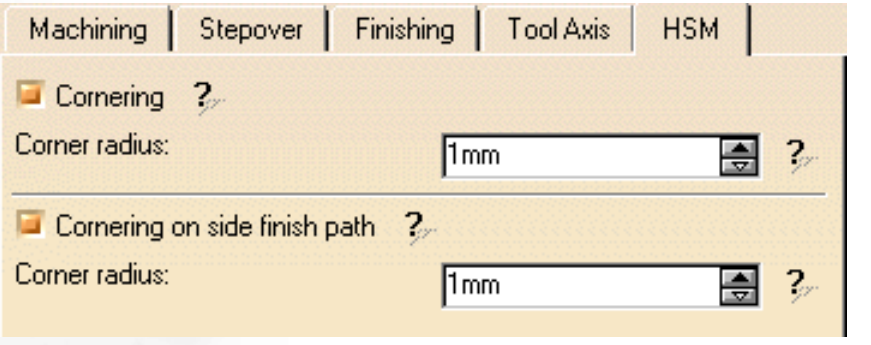
Planar 4X Constraint



HSM Tab

- **Cornering and cornering on side finish path**
  - **Allow the user to define a cornerisation of the toolpath by giving a corner radius**



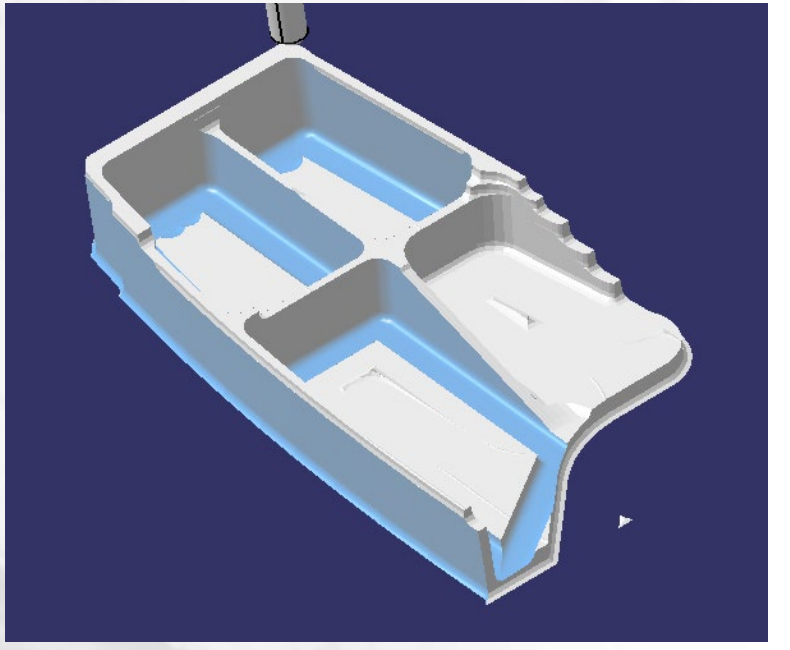


Added Exercise Presentation

And now practice on the added exercises, to learn about:

- Flank finishing
- Start and End in closed pocket
- Joggle management
- Thickness on toolpath
- Curves as part

At the end you will be able to fully finish 5 axis flanks of exercise part.



To Sum Up

In this course you have seen :

- **Necessary geometrical elements to define a Flank Contouring operation**
  - **Drives**
    - Navigation on drives, local modification on drives
  - **Parts** (can be a curve)
    - Multi part
  - **Start/Stop**
    - Open or closed pocket
- **5 Axis strategies of Flank Contouring operation**
  - **Tanto Fan, Combin Tanto, Combin Parelm, Mixed Combin, Fixed axis, Normal to part, 4-Axis**
- **Stepover management**
  - **Multi-radial**
  - **Multi-axial with thickness or offset**
  - **Side and bottom finishing strategies**
- **HSM option**