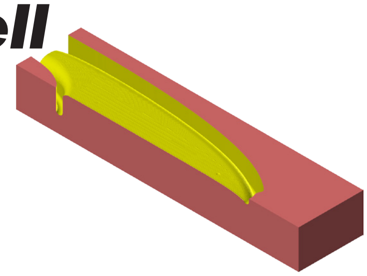
Toolpaths for CO2 Shell

Wheel Shells (Area Roughing & Raster)
Cut Body (Equal Scallop)



A. Machine Type and Stock Setup1.

Step 1. If necessary, open your file from Chapter 5.

Step 2. If necessary, display Toolpaths Manager. On the View tab View click Toolpaths (**Alt-O**).

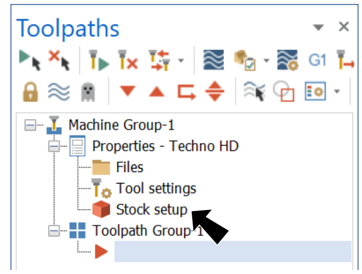


Fig. 1

Step 3. If Machine Group is **not** displayed in the Toolpaths Manager, **Fig. 1** on the Machine tab Machine, click Mill > **Default** from the menu.

Step 4. Expand **Properties** (click +) in Toolpaths Manager and click **Stock setup**, **Fig. 1**.

Step 5. In the Machine Group Setup on Stock Setup page set:
under Selection, **Fig. 2**
click **Add two corners**
sketch **a rectangular in the graphics area**
under Origin coordinates key-in:
X 0
Y -21
Z 0
under Anchor point
click **top left corner**
key-in X, Y and Z stock dimension:
X 305
Y 42
Z 70

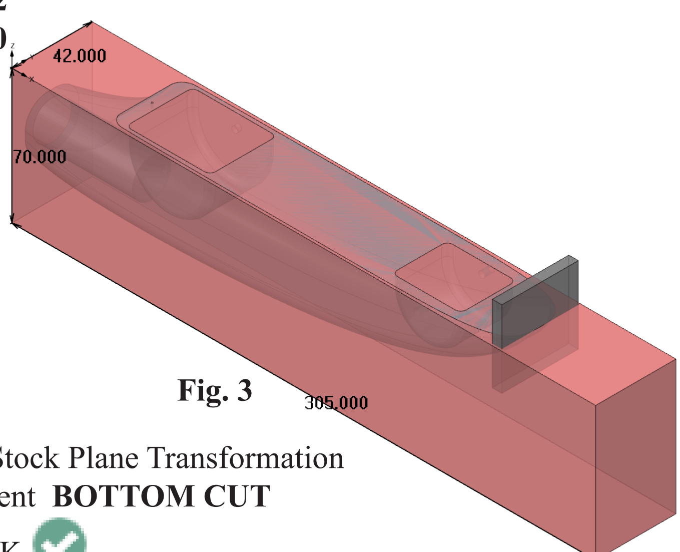


Fig. 3

under Stock Plane Transformation
Current **BOTTOM CUT**
click OK.

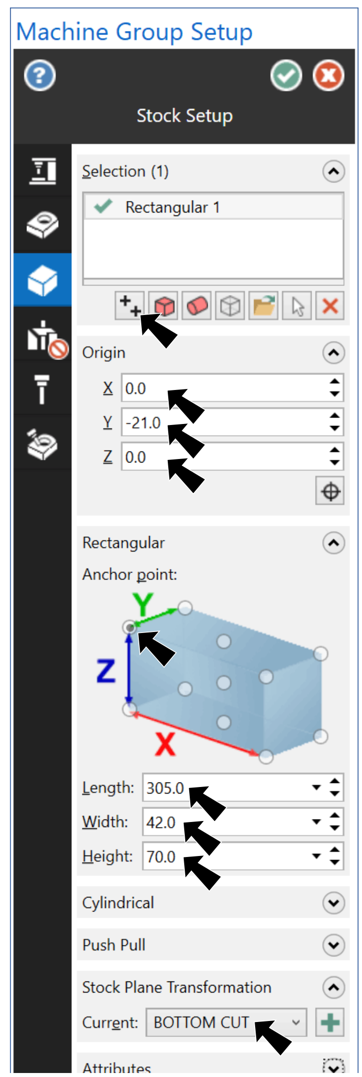


Fig. 2

4/5/24

http://www.cudacountry.net email:cudacountry@hotmail.com

B. Confirm WCS BOTTOM CUT.

Step 1. On the Toolpaths tab 

click **Stock Display** 

and Stock is displayed as red wireframe, **Fig. 4**.

Step 2. In Status bar at bottom of display, confirm **CPLANE**: **BOTTOM CUT**, **Fig. 4**.

Step 3. Confirm **Bottom Cut Origin**. Use **F9** to toggle axes.

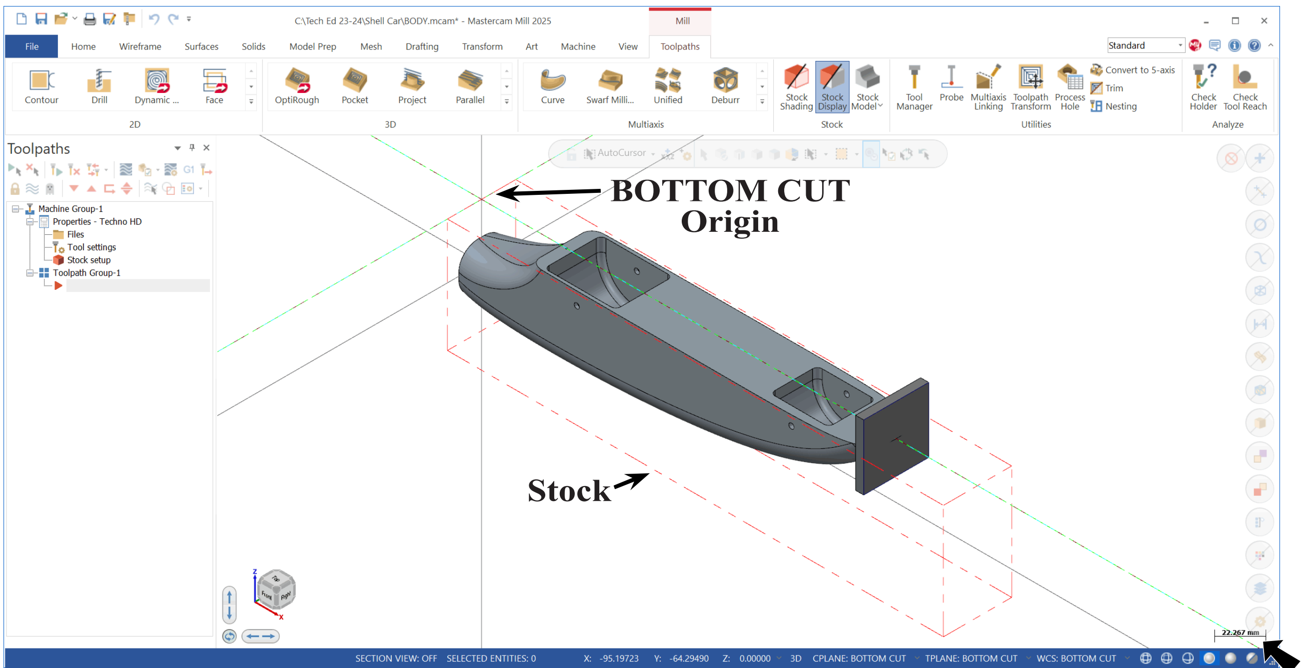


Fig. 4

C. REAR SHELL Rough Area Roughing Toolpath.

Step 1. On the Toolpaths tab 

in the 3D group click **expand gallery** button  and click **Area Roughing** 

, **Fig. 5**.

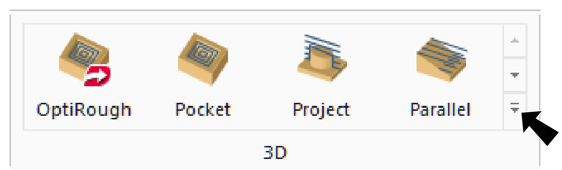
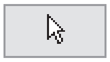


Fig. 5

Step 2. Select **Model Geometry** from the tree control and set:

Under **Machining Geometry** click **Select entities**  button **Fig. 6**.

Step 3. **Triple click** the **solid car body** to select as machine geometry and click **End Selection** 

(ENTER), **Fig 7**.

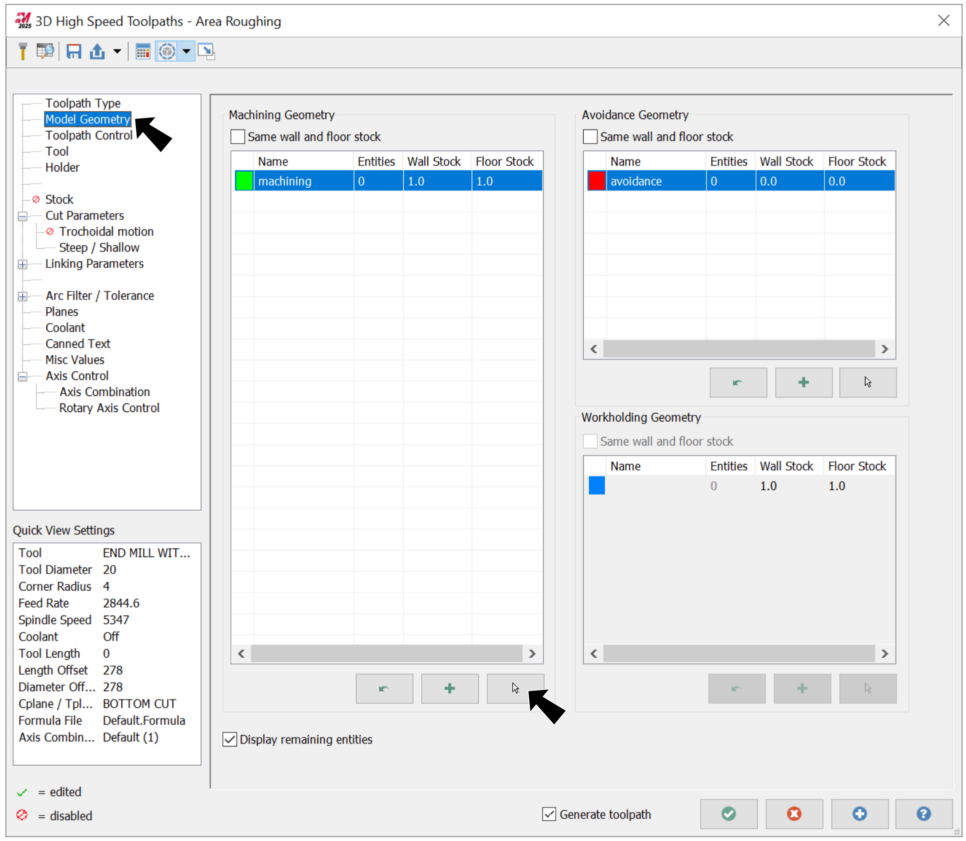


Fig. 6

Step 4. Back in **Model Geometry** page set:

Wall Stock 1

Floor Stock 1

To set, double click and key-in. **Fig. 8**.

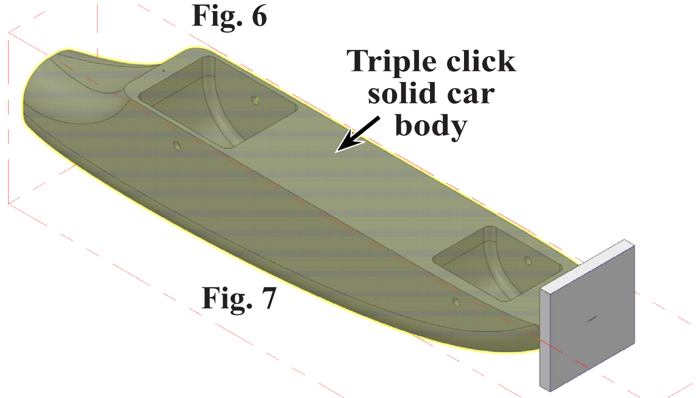


Fig. 7

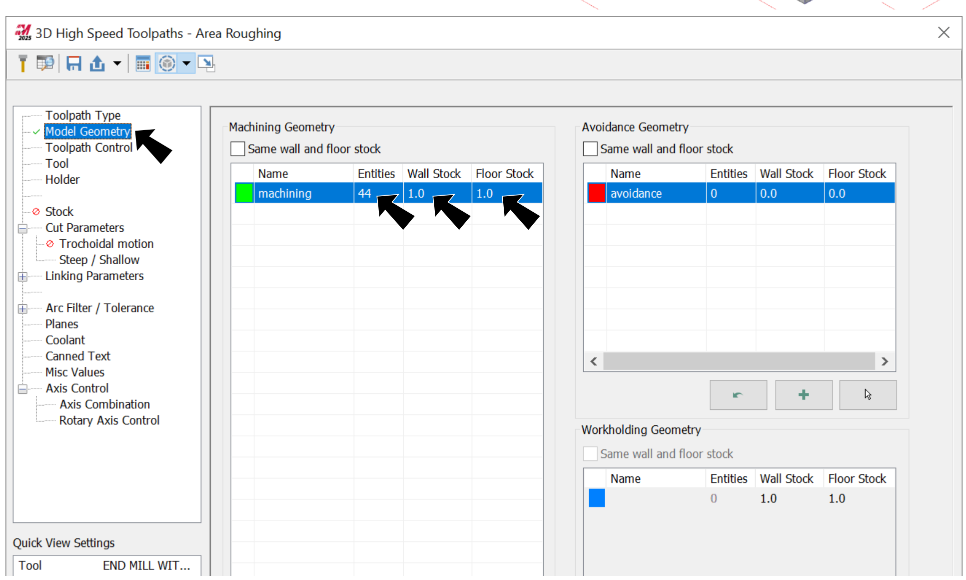


Fig. 8

Step 5. Select **Toolpath Control** from the tree control and set:

Click **Containment Boundaries** button **Fig. 9**.

Step 6. Select **Solids** in the Chaining dialog box, **Fig. 10**.

Step 7. Under Selection Method in the Chaining dialog box, click **Loop** and unselect all others.

Step 8. Click **edge of rear wheel shell**, **Fig. 11**.
If you select the wrong edge, click **Unselect** .

Step 9. Click the OK in the Chaining dialog box.

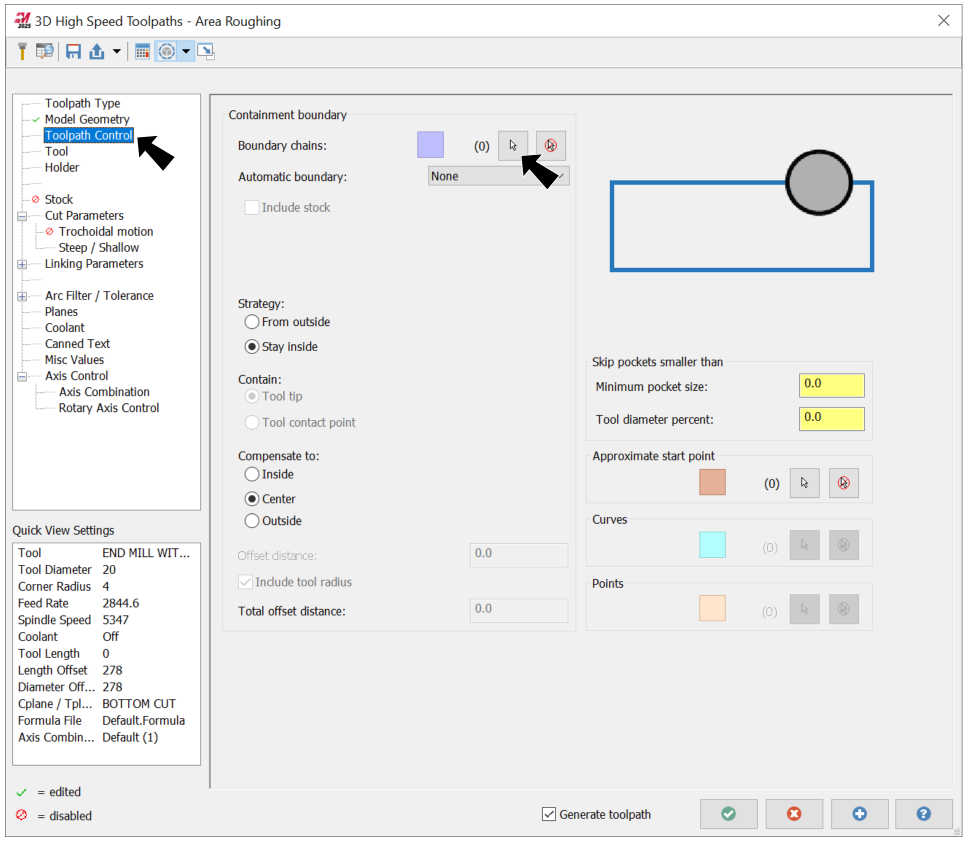


Fig. 9

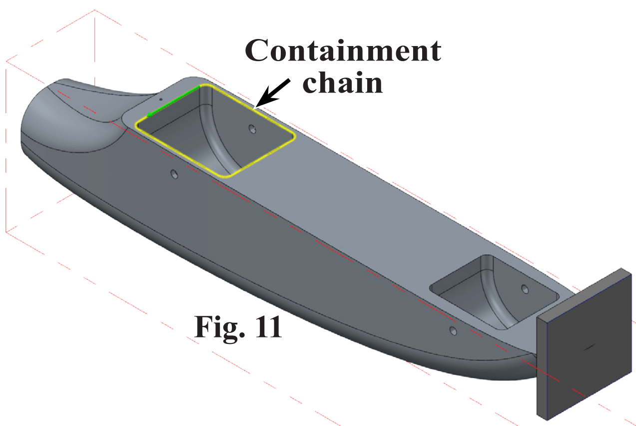


Fig. 11

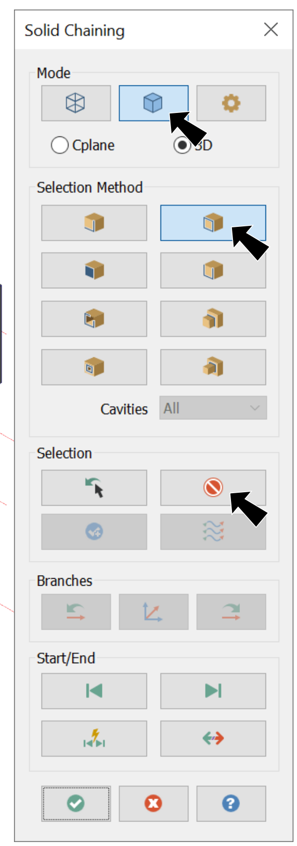


Fig. 10

Step 10. Back in **Toolpath Control** page:

Confirm **1 Boundary chain**

Compensate to Inside

Check **Include tool radius** **Fig. 12**.

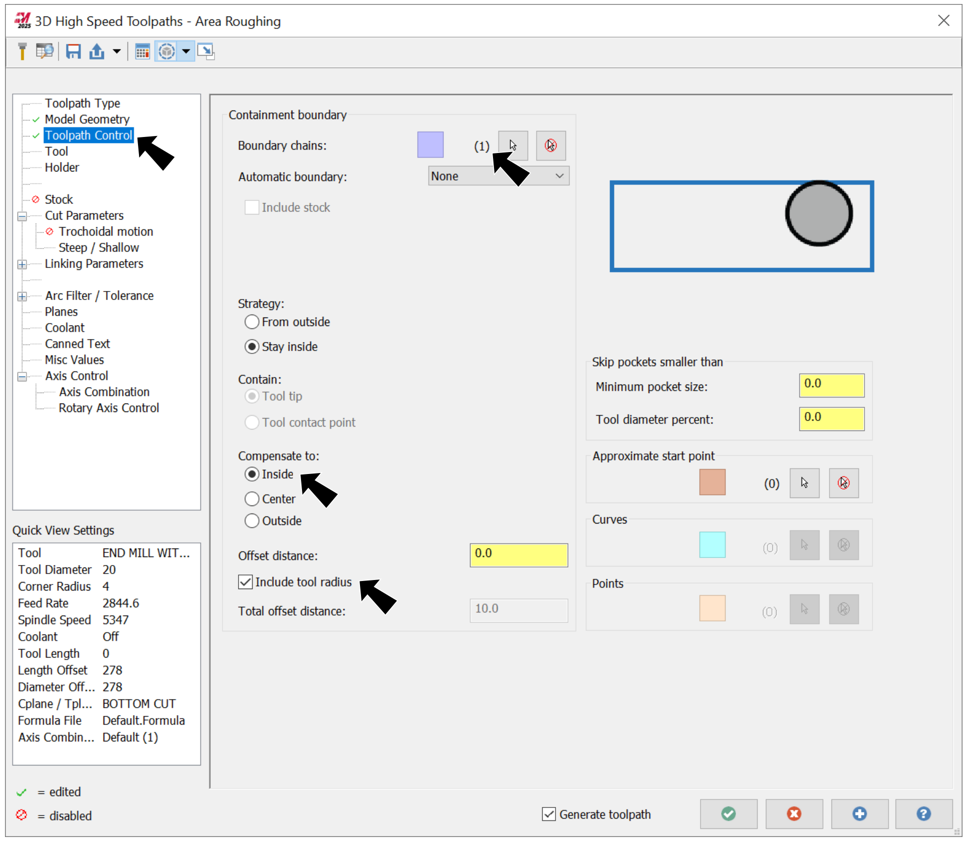
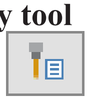


Fig. 12

Step 11. Select **Tool** from the tree control and:

click **Select library tool** button  **Fig. 13**.

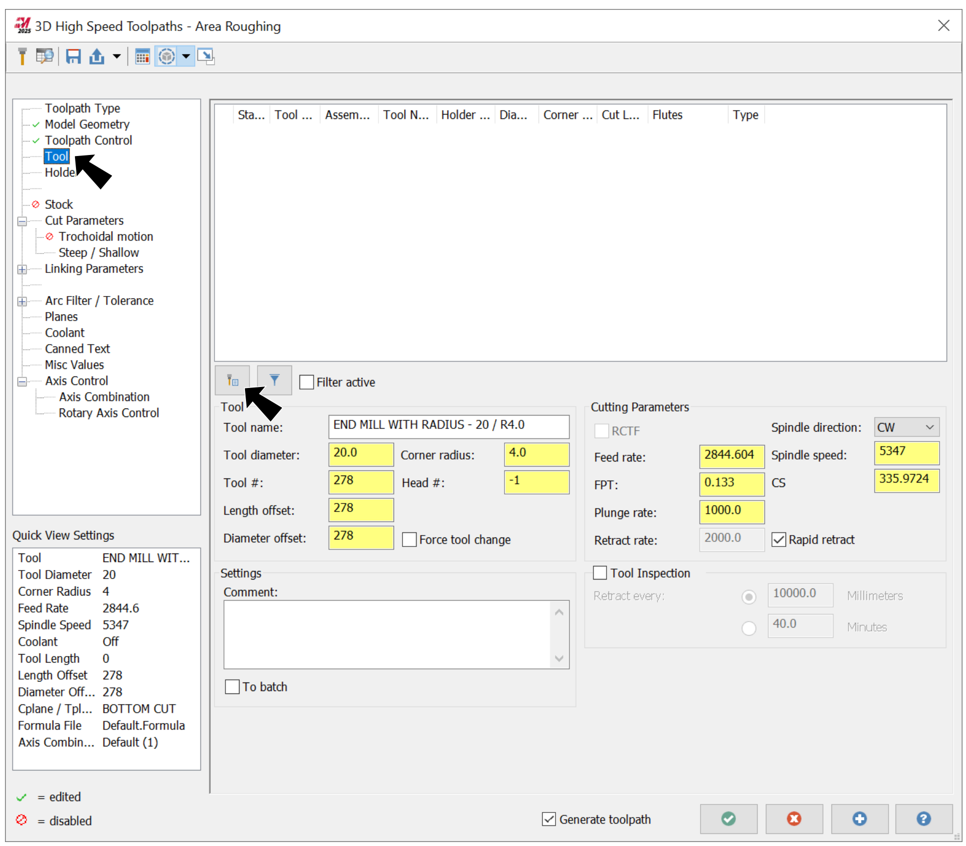


Fig. 13

Step 12. Click the **Filter** Filter... button **Fig. 14**.

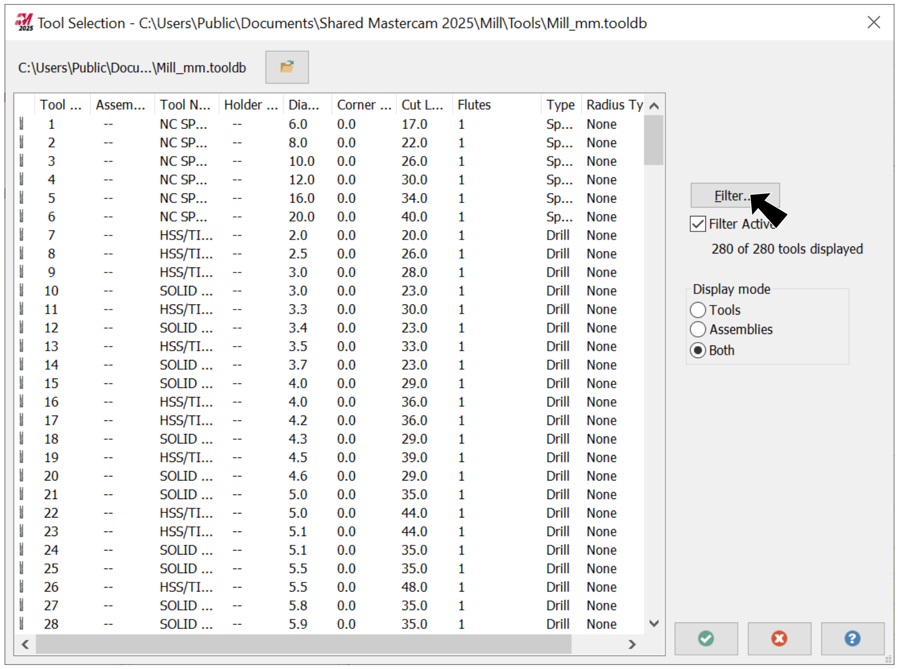


Fig. 14

Step 13. Click **None** None **button under Tool Types** **Fig. 15**.

Step 14. Click **Endmill2 Sphere**  button (second button top row) and click OK  **Fig. 15**.

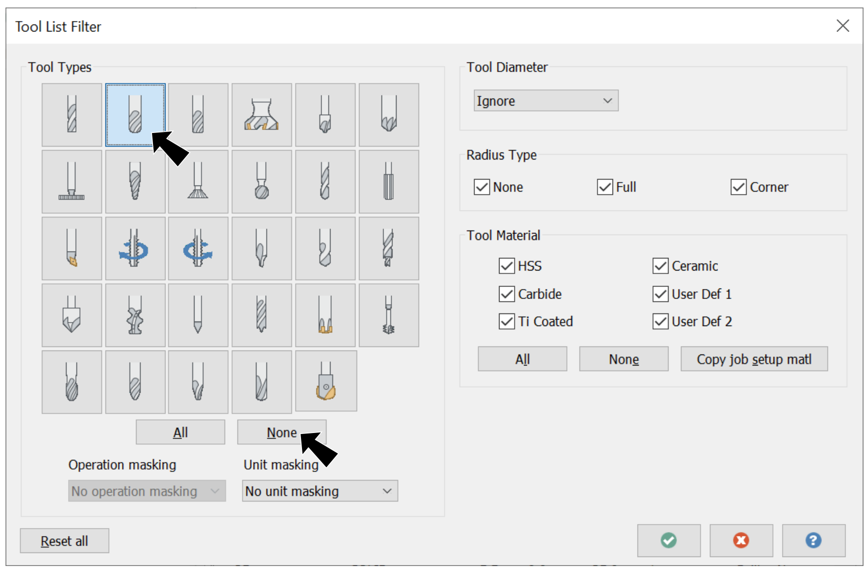


Fig. 15

Step 15. Select **BALL-NOSE END-MILL 6.0 mm Diameter** and click OK  **Fig. 16**.

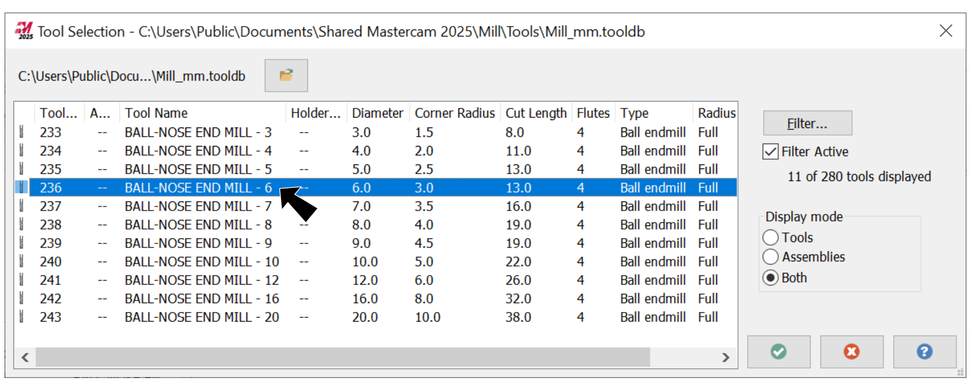


Fig. 16

Step 16. Back in **Tool** page set:

Feed rate 300

Plunge rate 200
Fig. 17.

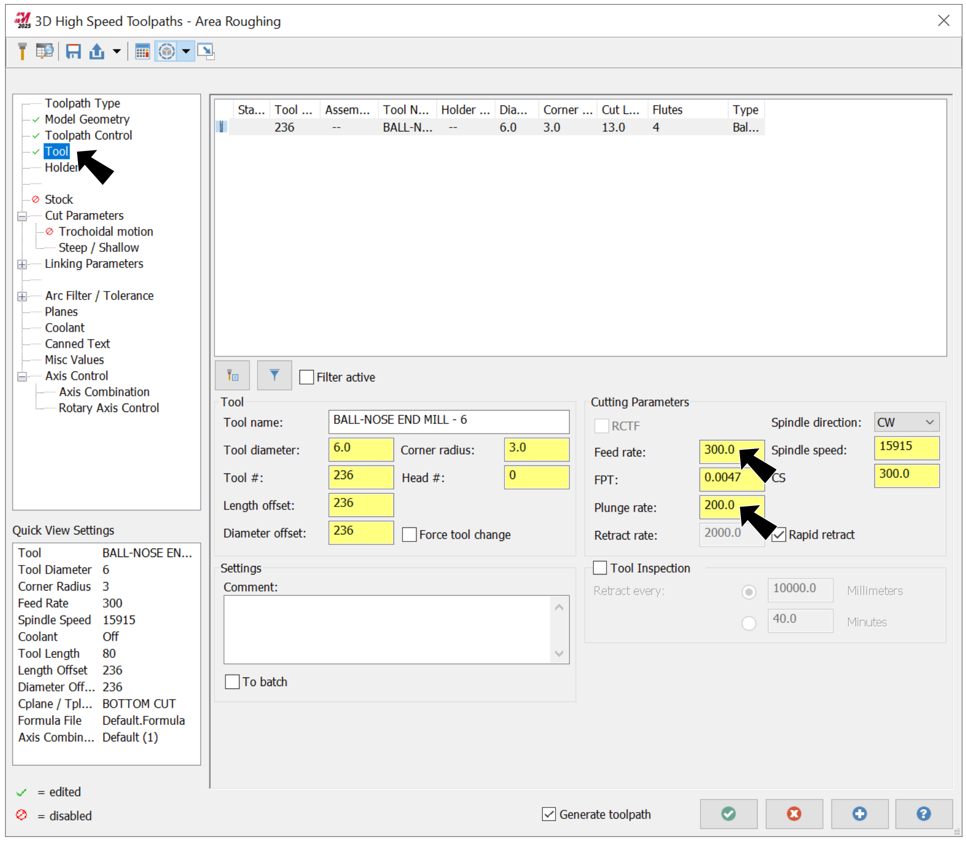


Fig. 17

Step 17. Select **Cut Parameters** from tree control and set:

Cutting method Climb

Stepdown 12.5

XY stepover 50%

Minimum 2
Maximum 3
Fig. 18.

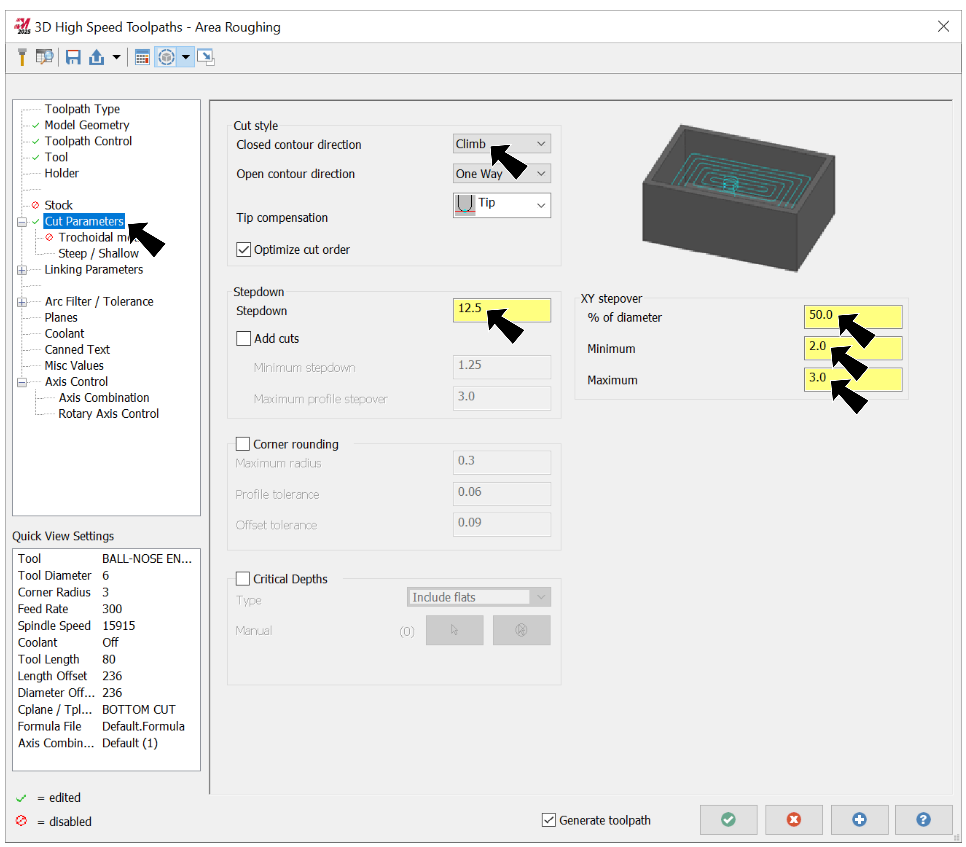


Fig. 18

Step 18. Select **Trochoidal motion** from tree control and set:

Minimize burial

Fig. 19.

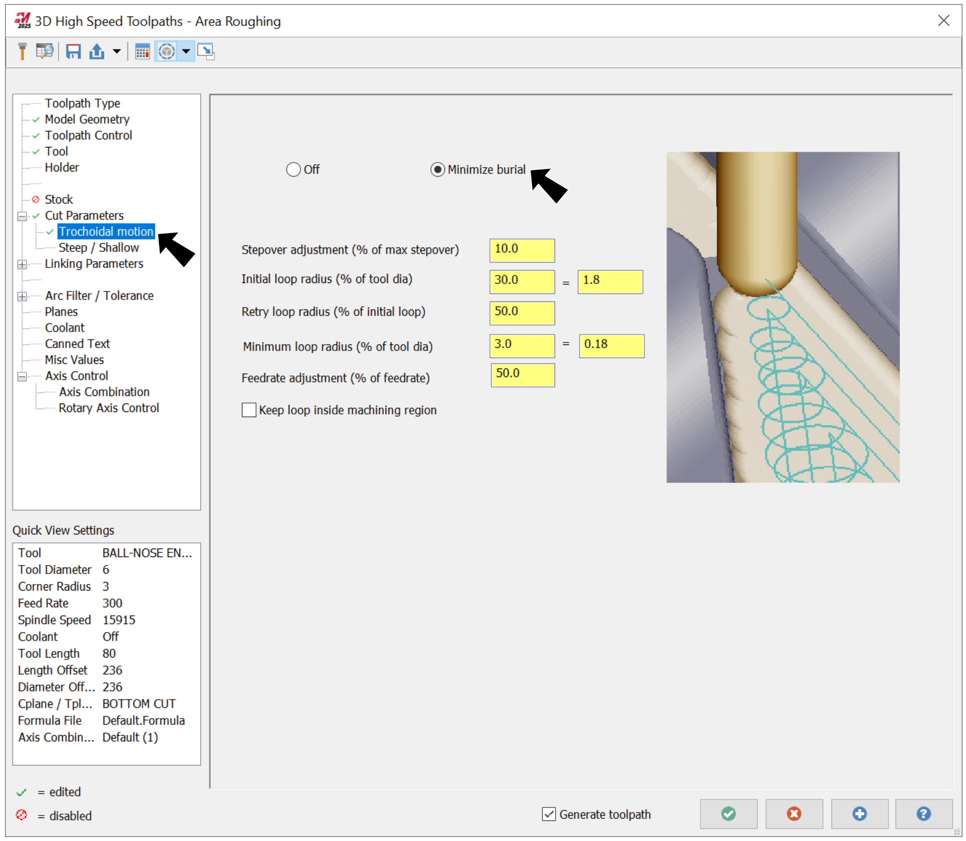


Fig. 19

Step 19. Select **Steep/ Shallow** from tree control and set:

Check **Minimum depth -9**

Check **Maximum depth -35**

Click **Apply**

Fig. 20.

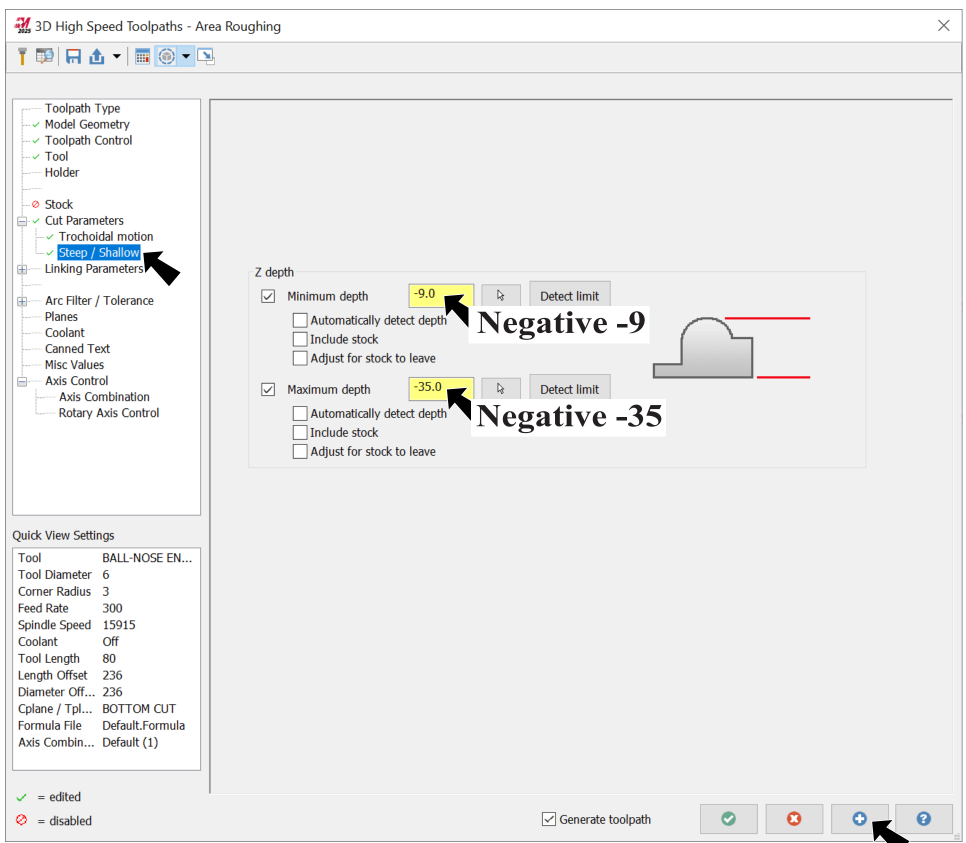


Fig. 20

Step 20. Select **Linking Parameters** and set:

Clearance plane 0

Select **Minimum Vertical Retract**

Part clearance 0

Keep tool down within % of tool diameter 500

Check **Same lead in and out All Leads 0**

Fig. 21.

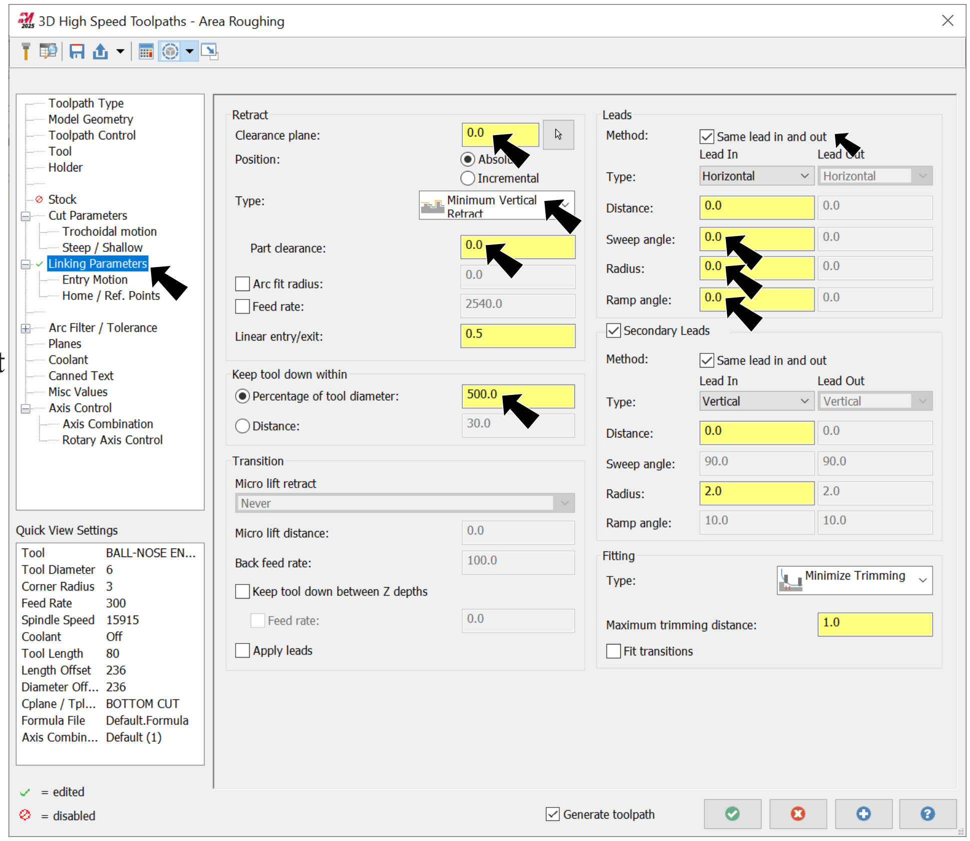


Fig. 21

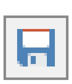
Step 21. Select **Entry Motion** from tree control and set:

Entry helix Radius 3

Fig. 22.

Step 22. Click OK  in Area Roughing dialog box.

Step 23. Allow Mastercam to calculate toolpath.

Step 24. Save  **(Ctrl-S)**.

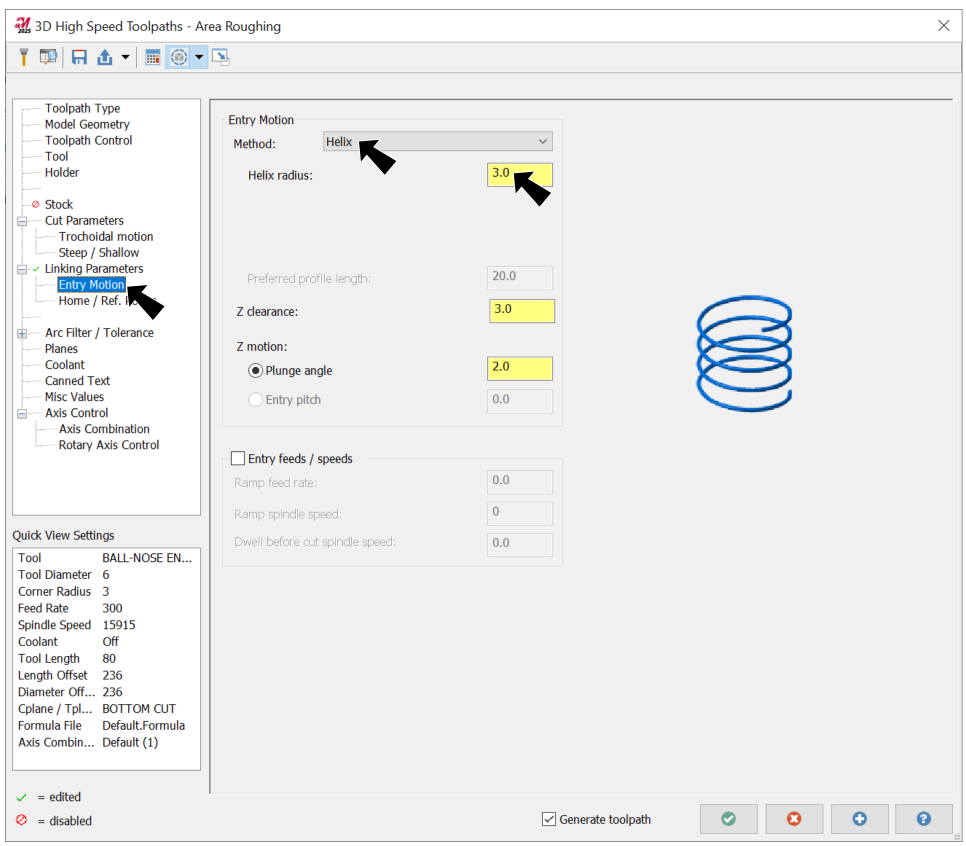
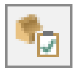


Fig. 22

D. Verify REAR SHELL Rough Area Roughing.

Step 1. Use **Alt-T** to toggle on toolpath display, **Fig. 23**.

Step 2. Click **Verify**  in the Toolpaths Manager, **Fig. 24**.

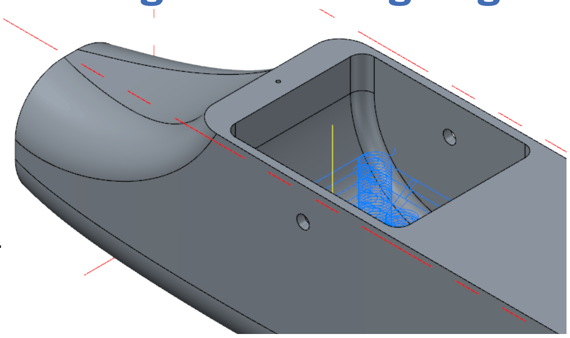


Fig. 23

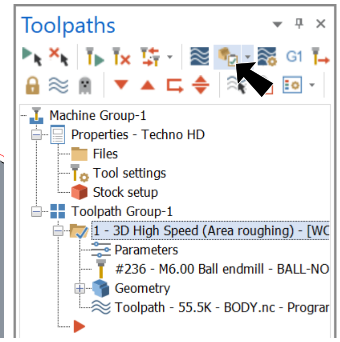


Fig. 24

Step 3. We like to **uncheck Wireframe** in the Visibility group on the Home tab, **Fig. 25**.

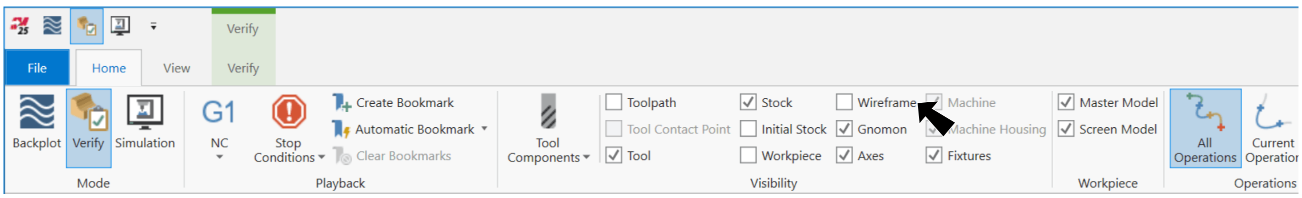


Fig. 25

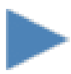
Step 4. Click **Play**  (**R**) in playback bar along bottom of the window, **Fig. 26**.

Fig. 26

Step 5. Note **Total Time** to run program under Toolpath Info in Move List panel (**7min 40.96s**), **Fig. 28**.

Step 6. Switch back to Mastercam (**Alt-Tab**).

Move Info

Move Info

Toolpath Info

Feed Length	2293.728
Feed Time	7min 40.84s
Rapid Length	23.833
Rapid Time	0.11s
Total Length	2317.561
Total Time	7min 40.96s
Min/Max X	61.286 / 94.714
Min/Max Y	-13.500 / 13.500
Min/Max Z	-26.333 / 0.333

Verbose

Fig. 28

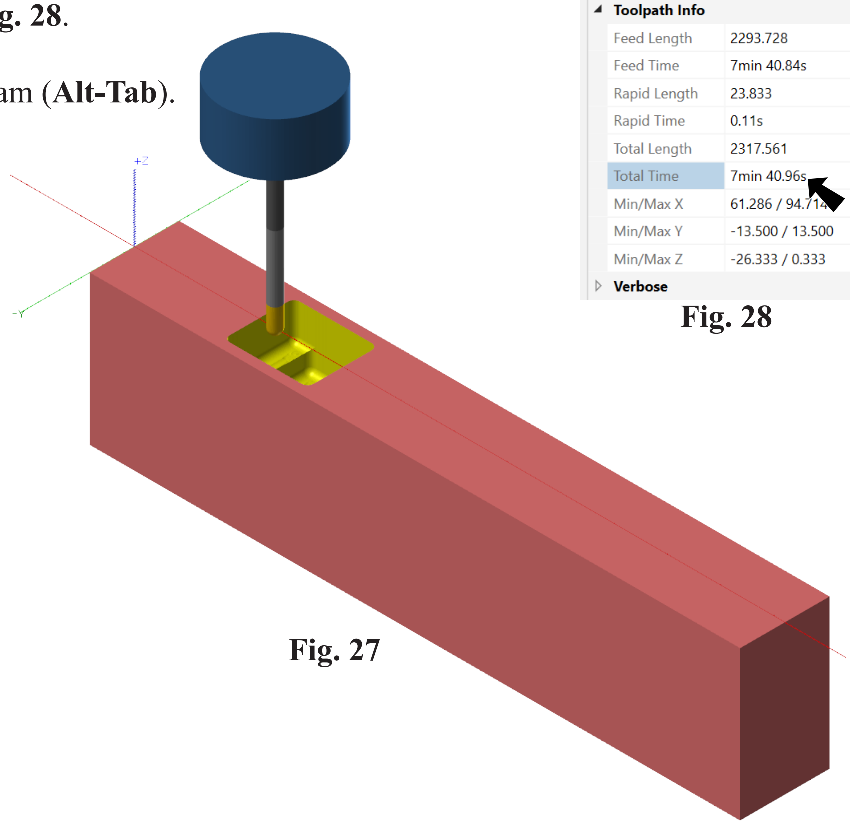


Fig. 27

E. FRONT SHELL Area Roughing Surface Toolpath.

Step 1. Use **Alt-T** to toggle off toolpath display.

Step 2. **Copy Roughing toolpath** in the Toolpaths Manager. To copy, click to select toolpath, **Fig. 29**. Then, use **Ctrl-C** and **Ctrl-V**, **Fig. 30**.

Step 3. Expand **copied 2-3D High Speed toolpath** and click **Parameters**, **Fig. 30**.

Step 4. Select **Toolpath Control** from tree control and set:

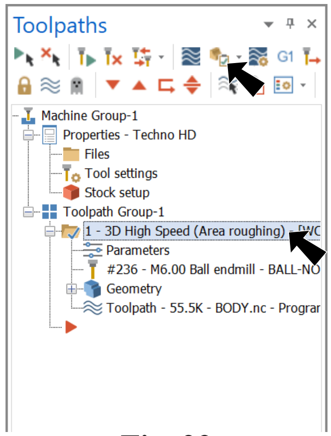


Fig. 29

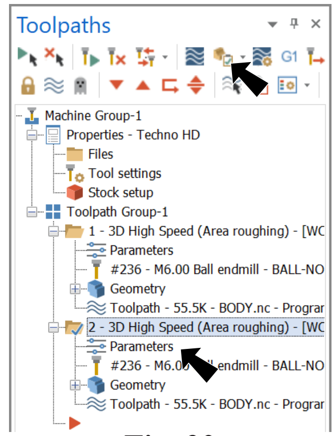


Fig. 30

Click **Remove selected containment boundaries** button

Click **Containment Boundaries** button **Fig. 31**.

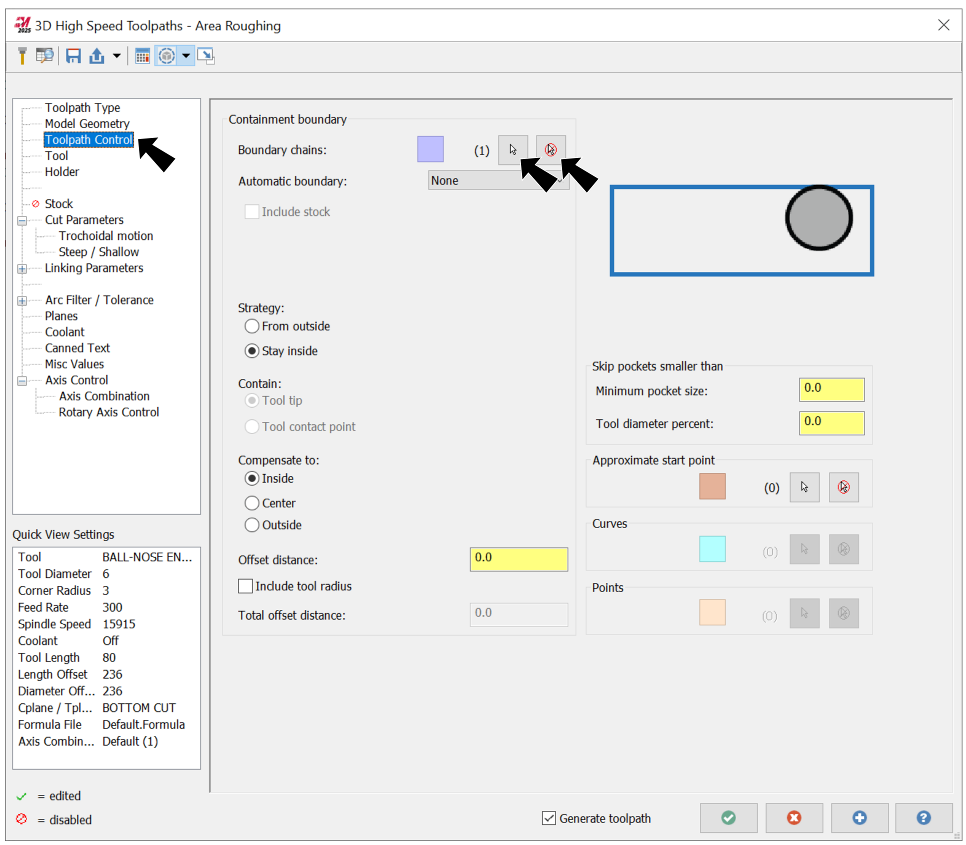
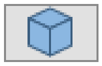


Fig. 31

Step 5. Select **Solids**  in the Chaining dialog box, **Fig. 32**.

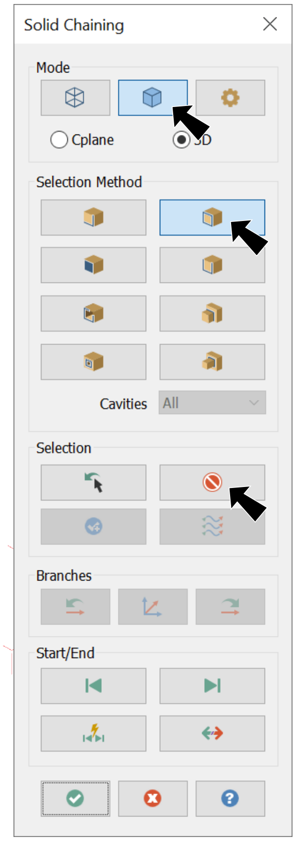


Fig. 32

Step 6. Under Selection Method in the Chaining dialog box, click **Loop**  and unselect all others.

Step 7. Click **edge of front wheel shell**, **Fig. 33**.

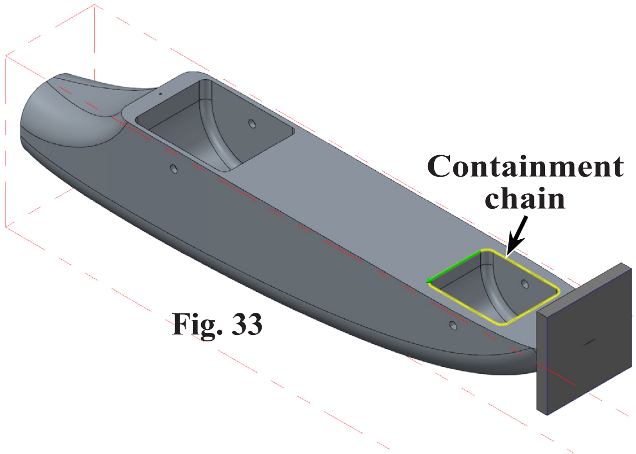


Fig. 33

Step 8. Click the OK  in the Chaining dialog box.

Step 9. Click OK  in Area Roughing dialog box.

Step 10. Click the **Toolpath Group-1** in the Toolpaths Manager to select **both** toolpaths, **Fig. 34**.

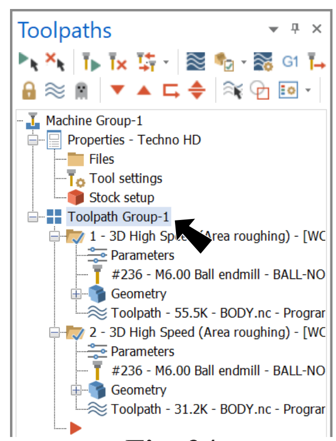
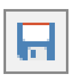


Fig. 34

Step 11. Use **Alt-T** to toggle toolpath display.

Step 12. Save  (**Ctrl-S**).

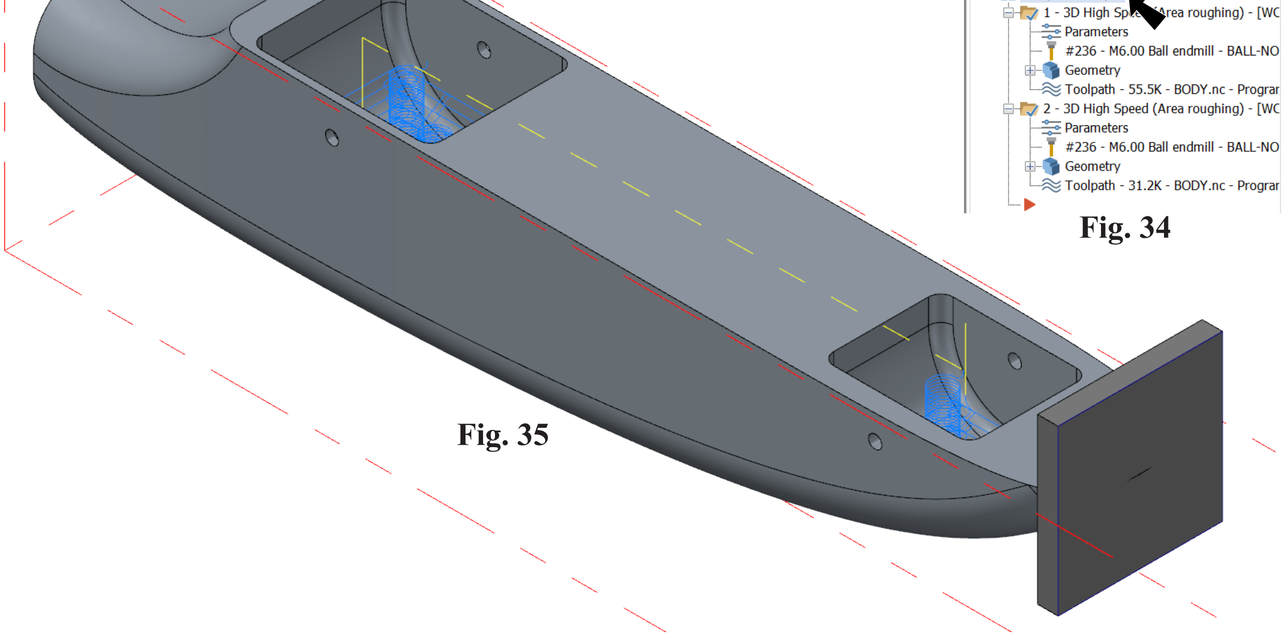


Fig. 35

F. BOTH SHELLS Finish Raster Toolpath.

Step 1. Use **Alt-T** to toggle off toolpath display.

Step 2. Copy the **2-3D High Speed Area Roughing toolpath** in the Toolpaths Manager. To copy, click to select 2nd toolpath, **Fig. 36**. Then, use **Ctrl-C** and **Ctrl-V**, **Fig. 37**.

Step 3. Expand the pasted **3-3D High Speed toolpath** and click **Parameters**, **Fig. 37**.

Step 4. Select **Toolpath Type** from the tree control and select:

Finishing

Raster
Fig. 38.

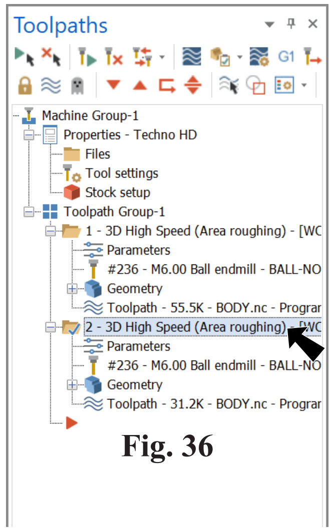


Fig. 36

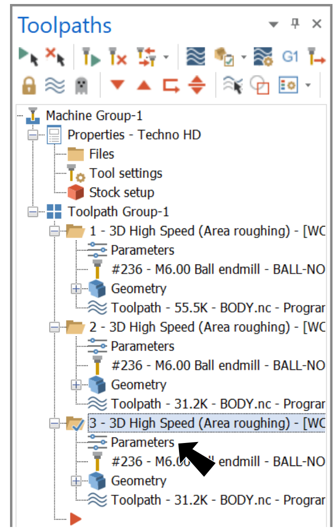


Fig. 37

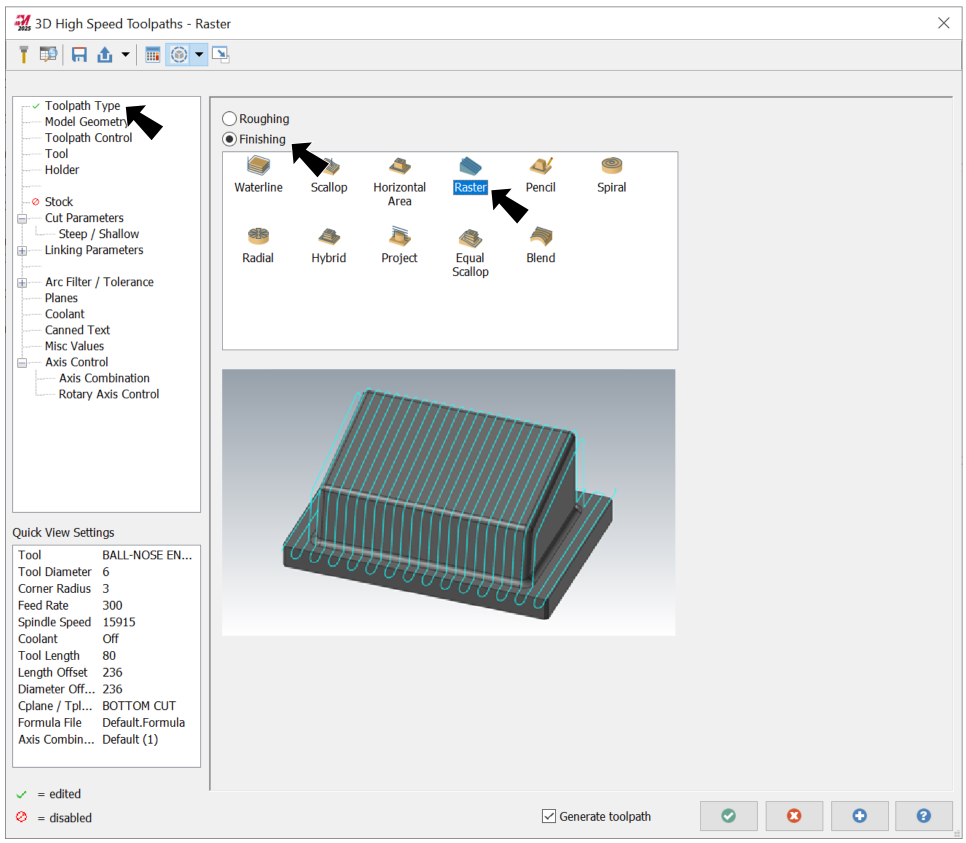


Fig. 38

Step 5. Select **Model Geometry** from the tree control and set:

Wall Stock 0
Floor Stock 0
Fig. 39.

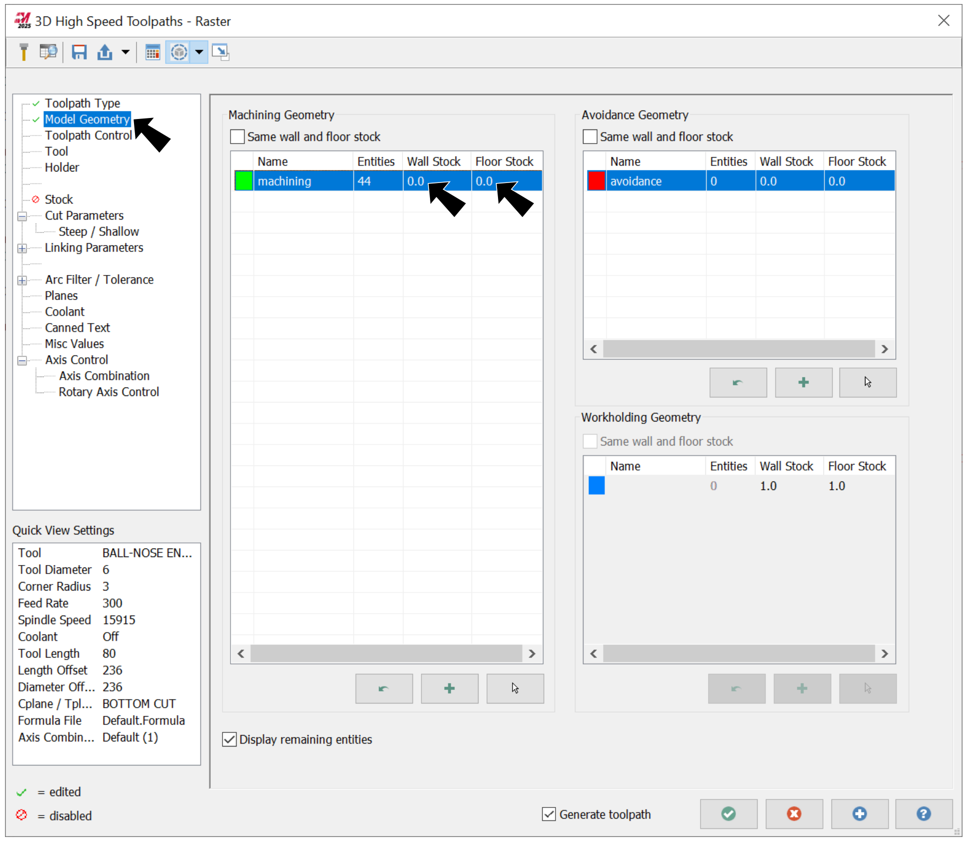


Fig. 39

Step 6. Select **Toolpath Control** from tree control and set:

Under Contain select **Tool contact point**

Click **Containment Boundaries** button
Fig. 40.

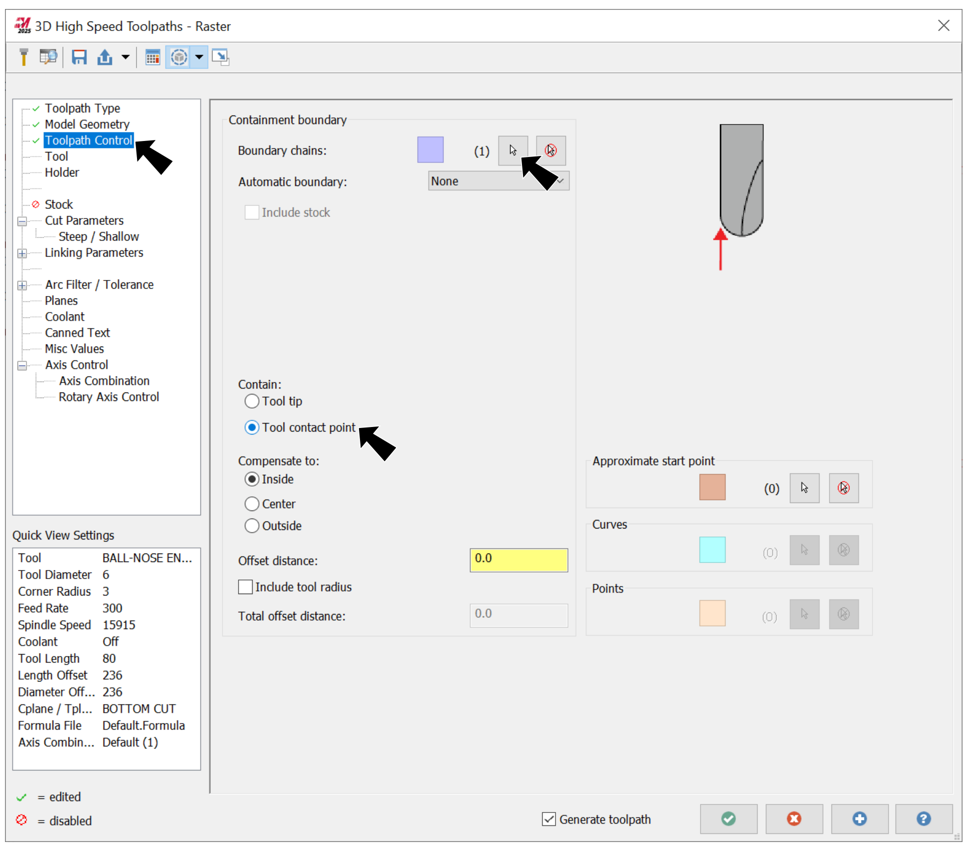


Fig. 40

Step 7. **Right click** in the Chain manager dialog box and click **Add** from menu, **Fig. 41**.

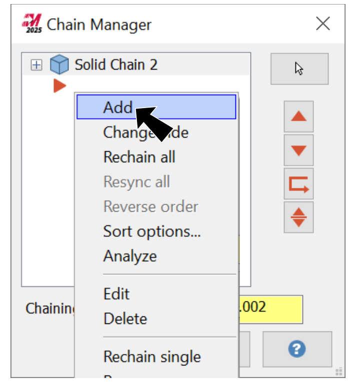


Fig. 41

Step 8. Select **Solids** in the Chaining dialog box and under Selection Method click **Loop** and unselect all others, **Fig. 42**.

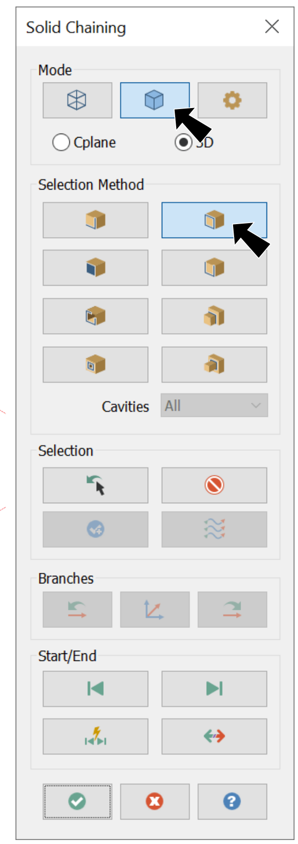


Fig. 42

Step 9. Click **edge of rear wheel shell**, **Fig. 43**.

Step 10. Click OK in the Chaining dialog box.

Step 11. Click OK in Chain Manager dialog box, **Fig. 44**.

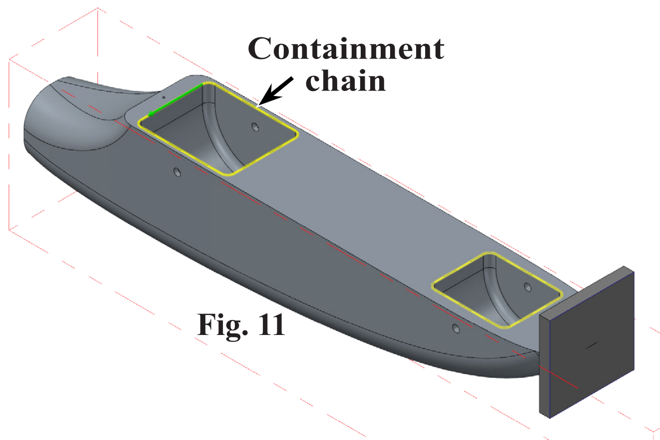


Fig. 11

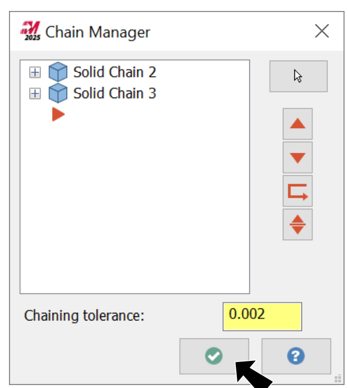


Fig. 44

Step 12. Select **Cut Parameters** from tree control and set:

Cutting method Zigzag

Stepover .5

Fig. 45.

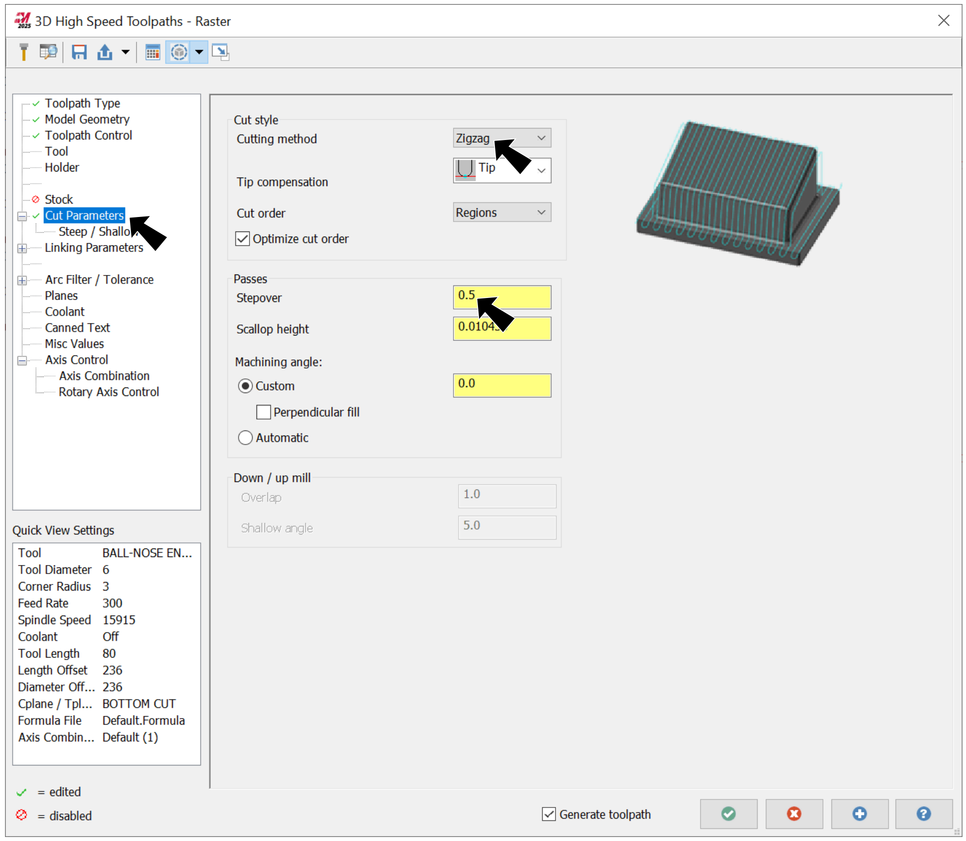


Fig. 45

Step 13. Select **Steep/ Shallow** from tree control and set:

Uncheck **Minimum**

Uncheck **Maximum**

Click **Apply**

Fig. 46.

Step 14. Click OK in Raster dialog box.

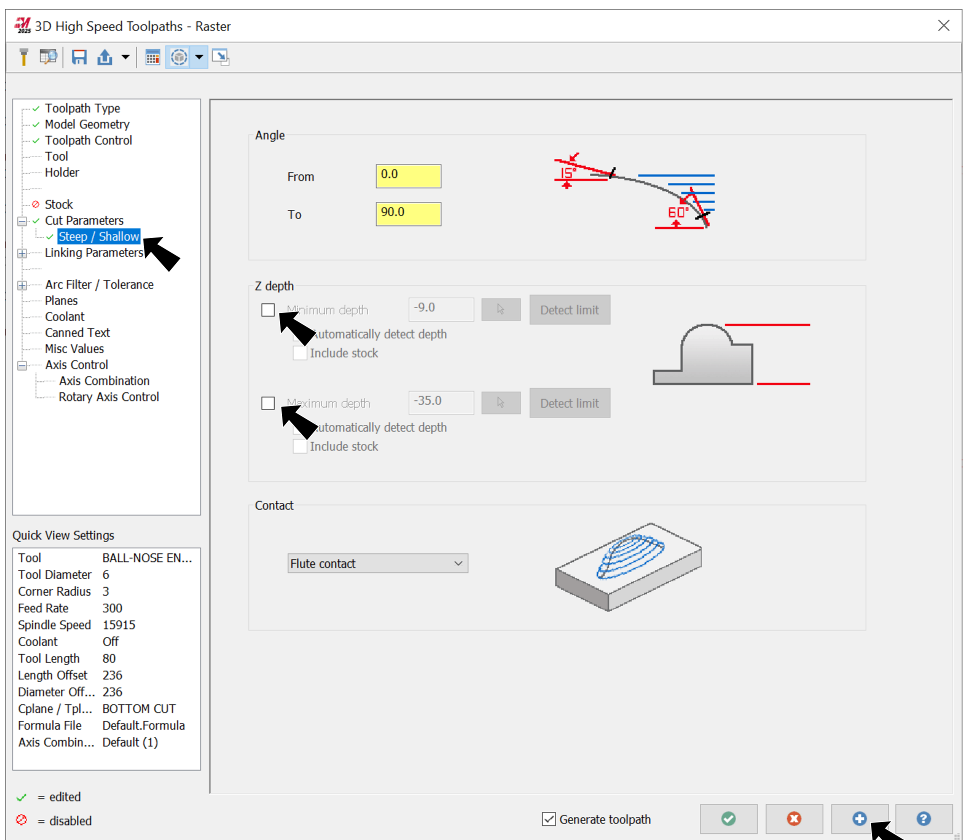


Fig. 46

Step 15. Save (**Ctrl-S**).

G. Verify Wheel Shells.

Step 1. Click **Toolpath Group-1** to select **all three** shell toolpaths, **Fig. 47**.

Step 2. Click **Verify** in the Toolpaths Manager.

Step 3. Click **Play** (**R**) in playback bar along bottom of the window.

Step 4. Note **Total Time** to run program (**29min 28.13s**), **Fig. 49**.

Step 5. Switch back to Mastercam (**Alt-Tab**).

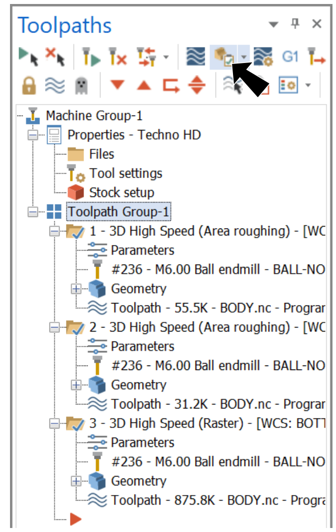


Fig. 47

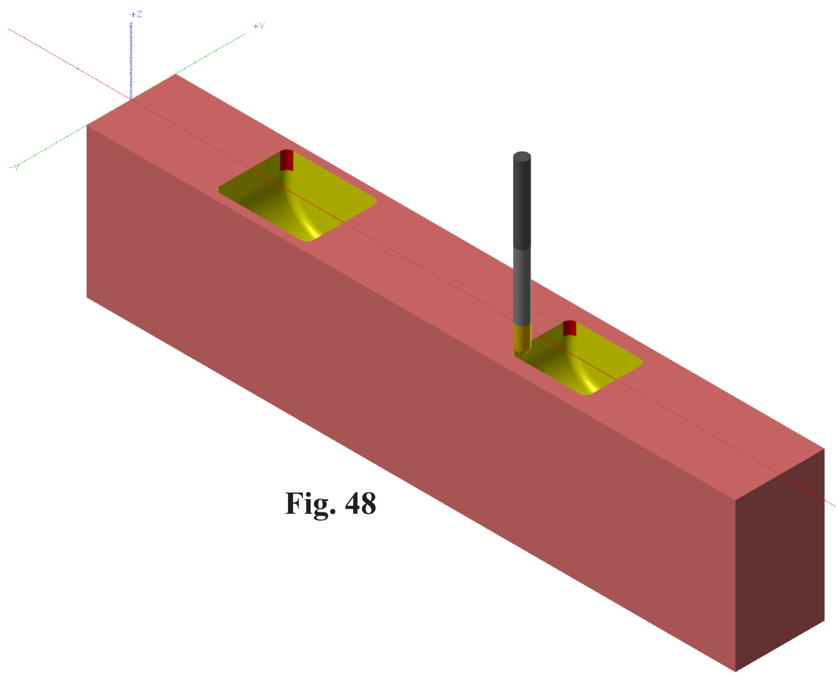


Fig. 48

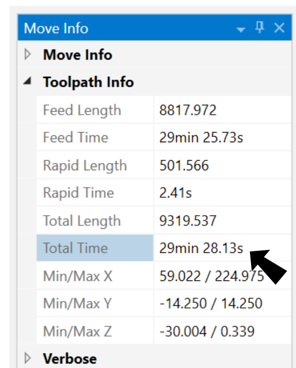


Fig. 49

H. Rename Toolpath Group WHEEL SHELLS.

Step 1. **Rename Toolpath Group-1 to WHEEL SHELLS** in the Ops Manager. To rename, click and hover over Toolpath Group-1 then key-in **WHEEL SHELLS**, **Fig. 50**.

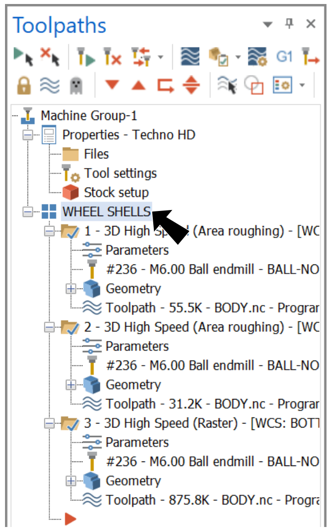


Fig. 50

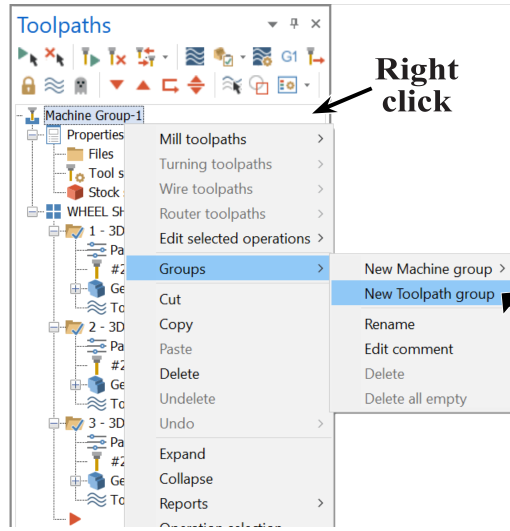


Fig. 51

I. Insert LEFT CUT Toolpath Group.

Step 1. Insert new **Toolpath group**. To insert group, **right click Machine Group 1** at the very top of Ops Manager and click **Groups > New Toolpath group**, **Fig. 51**.

Step 2. Rename new Toolpath Group to **LEFT CUT**. To rename, click and hover over Toolpath Group-1 and key-in LEFT CUT, **Fig. 52**.

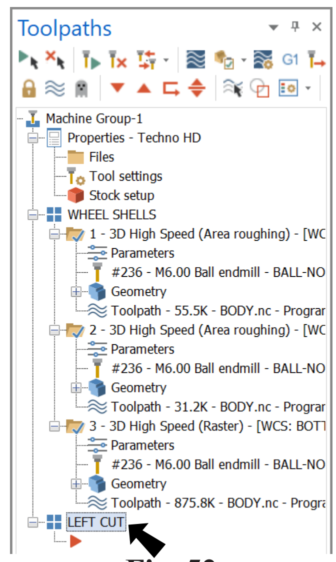


Fig. 52

J. Switch to LEFT CUT WCS.

Step 1. Display the **Planes Manager**. To display, click **Planes** tab Planes at the bottom of Ops Manager.

Step 2. In the Planes Manager set:
under Name, **Fig. 53**
Click **LEFT CUT**
Click **Set All** .

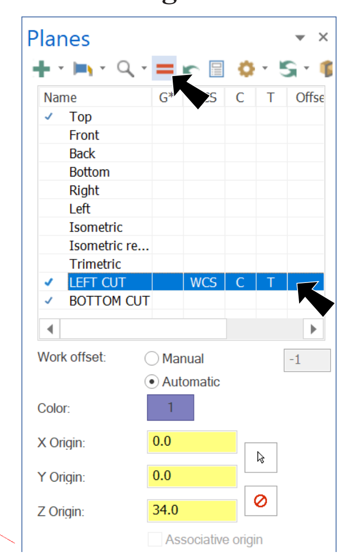


Fig. 53

Step 3. Change to the Isometric View. **Right click** in the graphics window and click Isometric (**Alt-7**).

Step 4. Confirm Left Cut Origin, **Fig. 54**. Use **F9** to toggle axes.

LEFT CUT Origin

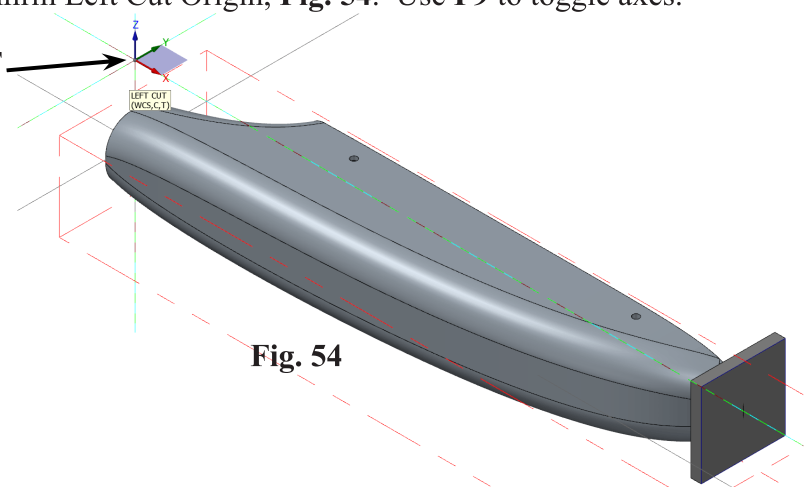


Fig. 54

K. Stock Setup2 LEFT CUT.

Step 1. Expand **Properties** in Toolpaths Manager and click **Stock setup**, **Fig. 55**.

Step 2. In the Machine Group Setup on Stock Setup page:

under Selection, **Fig. 56**

click **Add two corners**

sketch **a rectangular** in the graphics area

Right click Rectangular 2 in the Selection box and click **Set as active stock**, **Fig. 57**

under Stock Plane Transformation

Current **LEFT CUT**, **Fig. 58**

under Origin coordinates

key-in:

X 0

Y -36

Z -13

under Anchor point

click **top left corner**

key-in X, Y and Z stock dimension:

X 305

Y 70

Z 42

click OK.

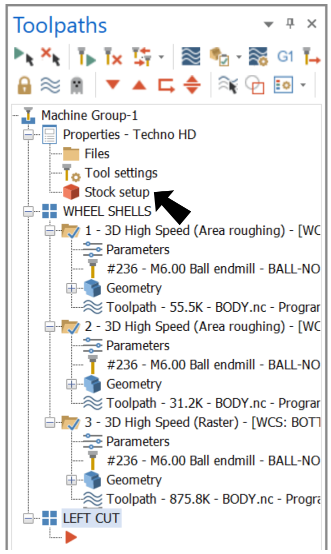


Fig. 55

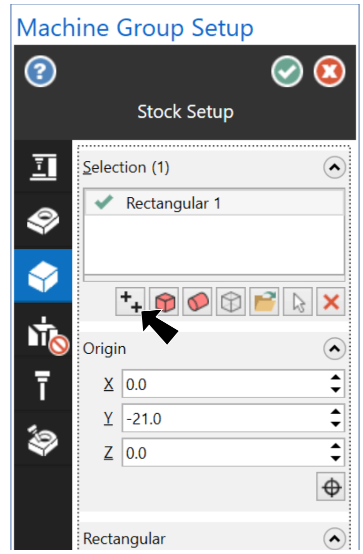


Fig. 56

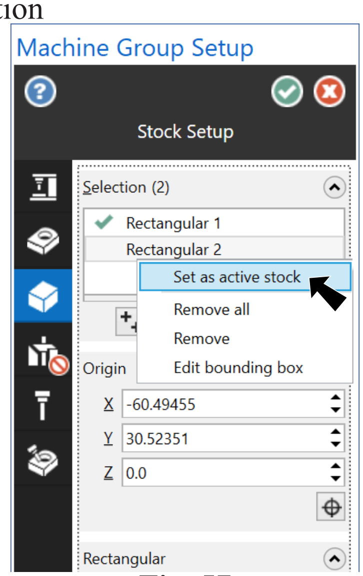


Fig. 57

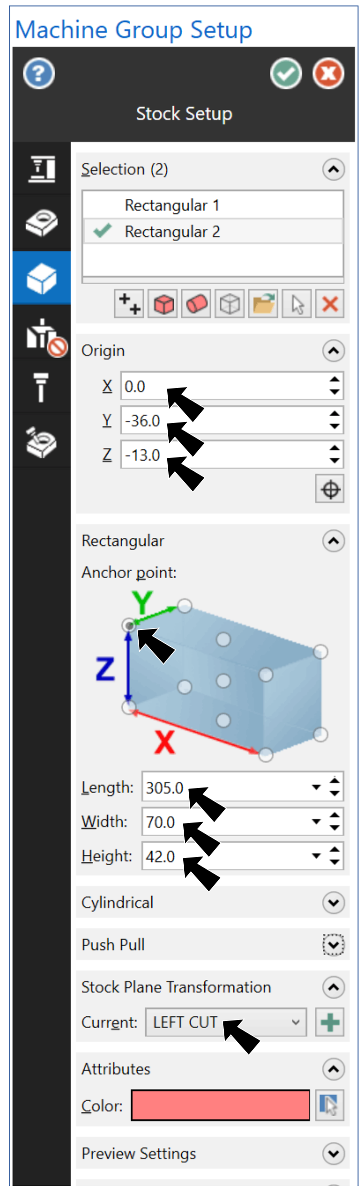


Fig. 58

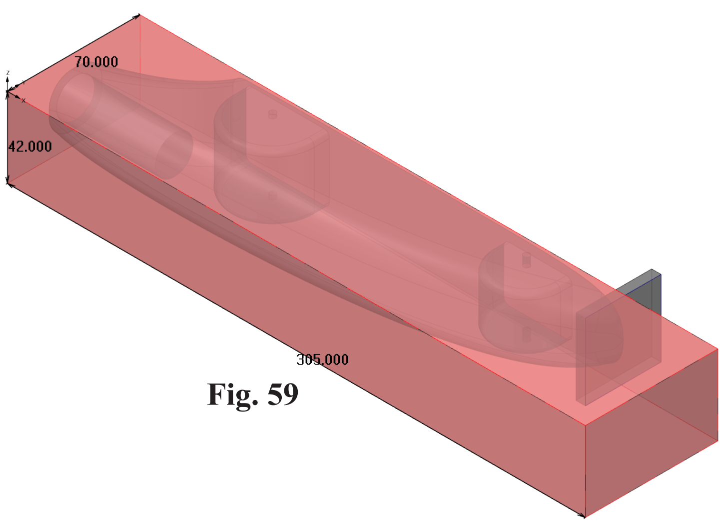


Fig. 59

L. Left Cut Finish Equal Scallop Toolpath.

Step 1. On the Toolpaths tab  in the 3D group click **expand gallery** button  and click **Equal Scallop** , **Fig. 60**.

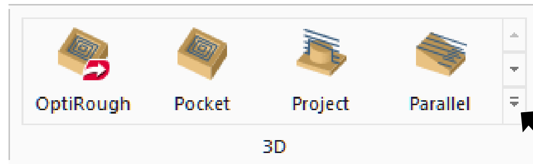


Fig. 60

Step 2. Select **Model Geometry** from the tree control and set:

Under **Machining Geometry** click **Select entities**  button **Fig. 61**.

Step 3. **Triple click** the **solid car body** to select as machine geometry and click **End Selection**  (ENTER), **Fig 22**.

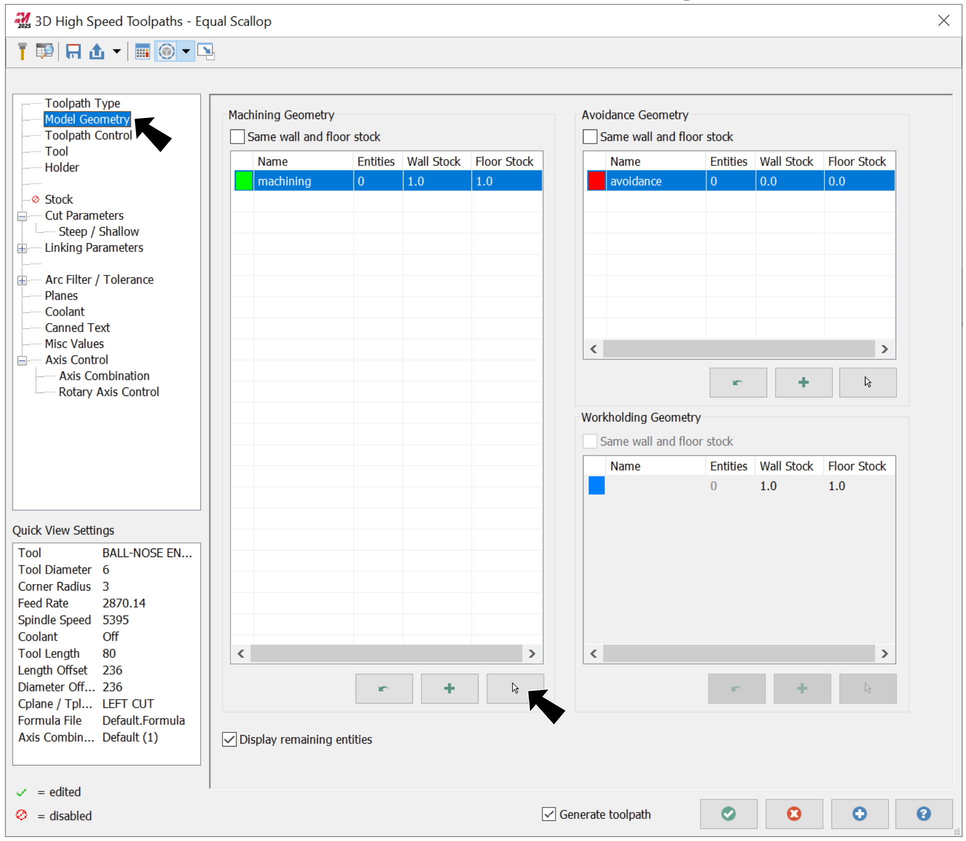


Fig. 61

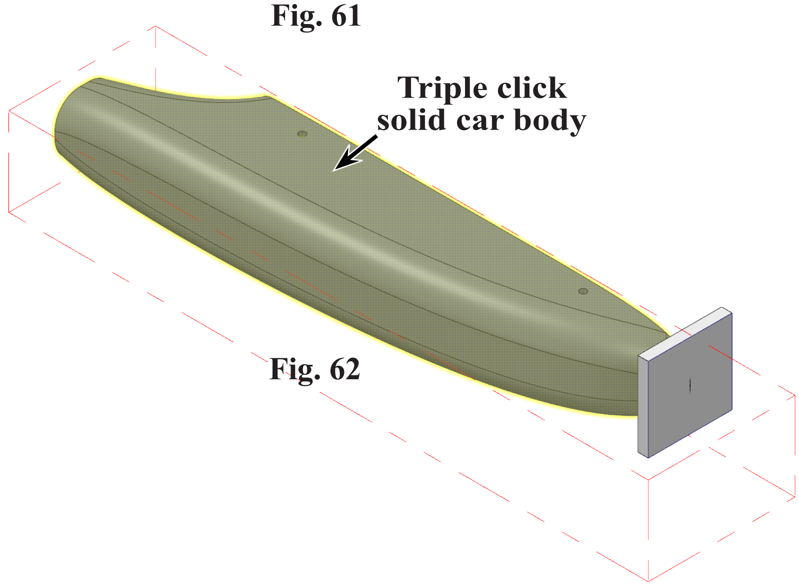
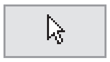

Triple click solid car body

Fig. 62

Step 4. Back in **Model Geometry** page set:

Wall Stock 0
Floor Stock 0
To set, double click and key-in.

Under **Avoidance Geometry** click **Select entities**



button **Fig. 63**.

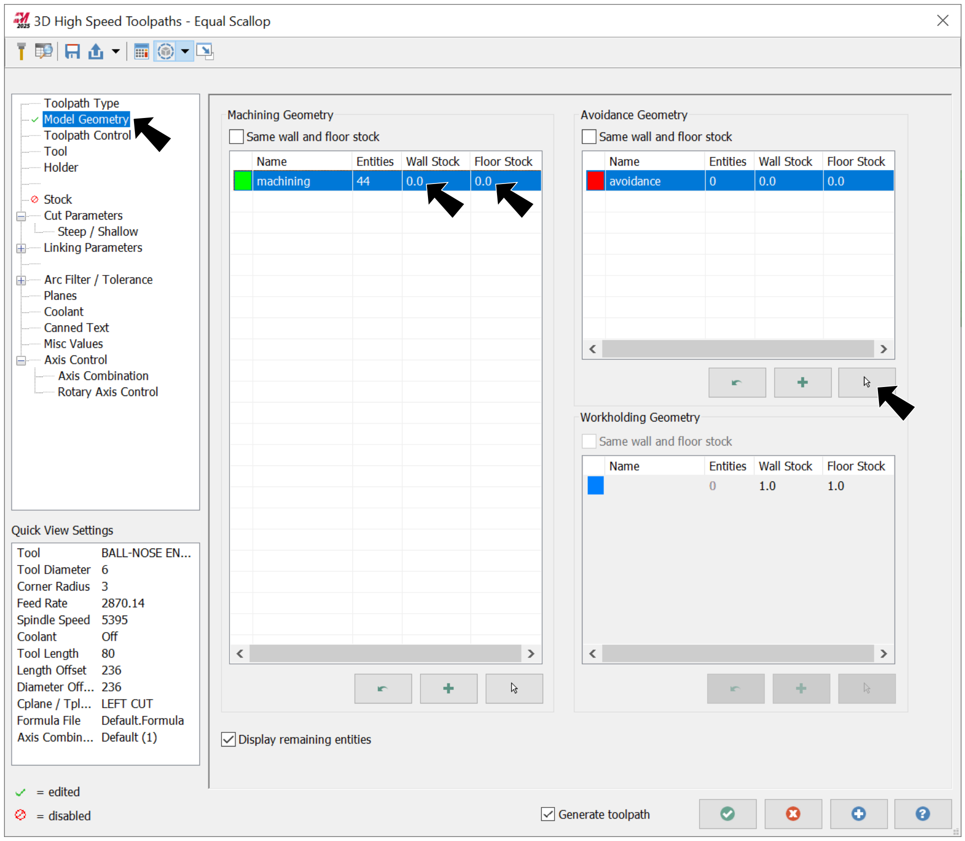


Fig. 63

Step 5. **Triple click the check body** to select as avoidance geometry, **Fig 64**.

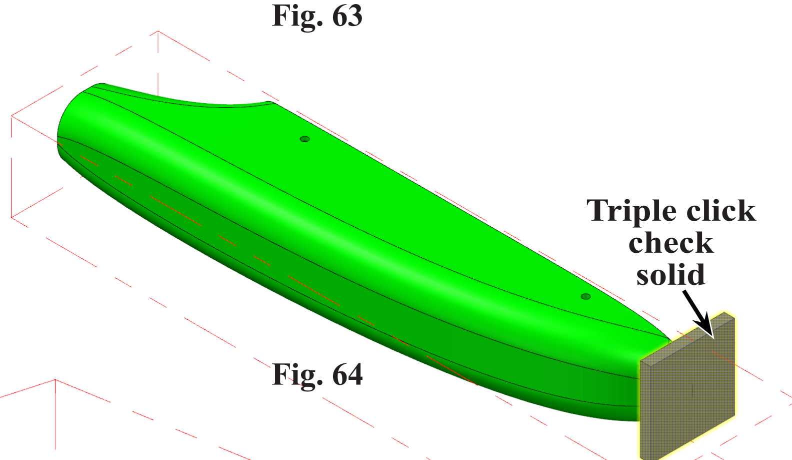


Fig. 64

Step 6. Rotate view to view **bottom and rear surfaces**, hold down middle mouse button (wheel) and drag to rotate view, **Fig. 65**.

Step 7. Click **bottom and rear surfaces** to select as avoidance geometry and click **End Selection**

(ENTER), **Fig 65**.

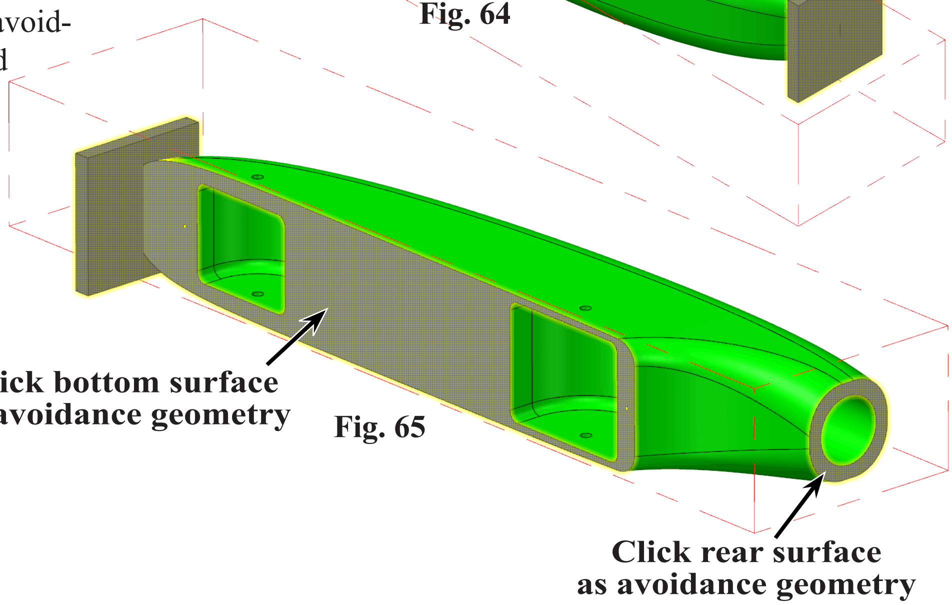


Fig. 65

Step 8. Back in **Model Geometry** page set:

Confirm **8 Avoidance entities** **Fig. 66**.

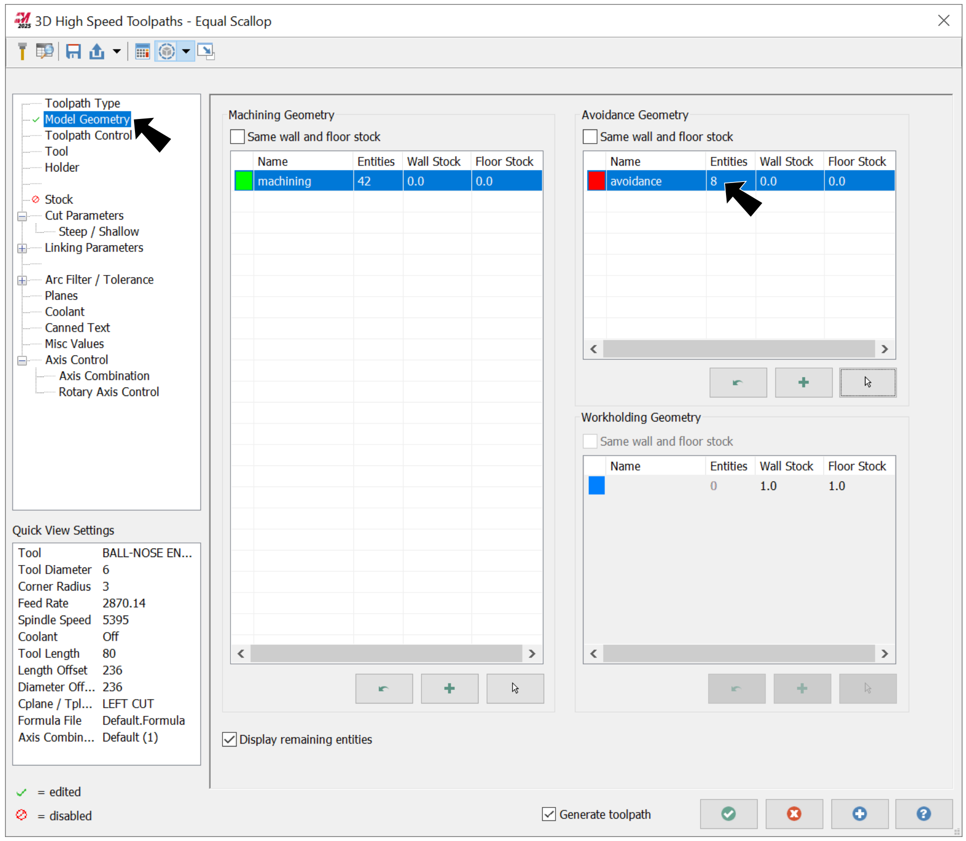


Fig. 66

Step 9. Select **Tool** from tree control and set:

Feed rate 300

Plunge rate 200
Fig. 67.

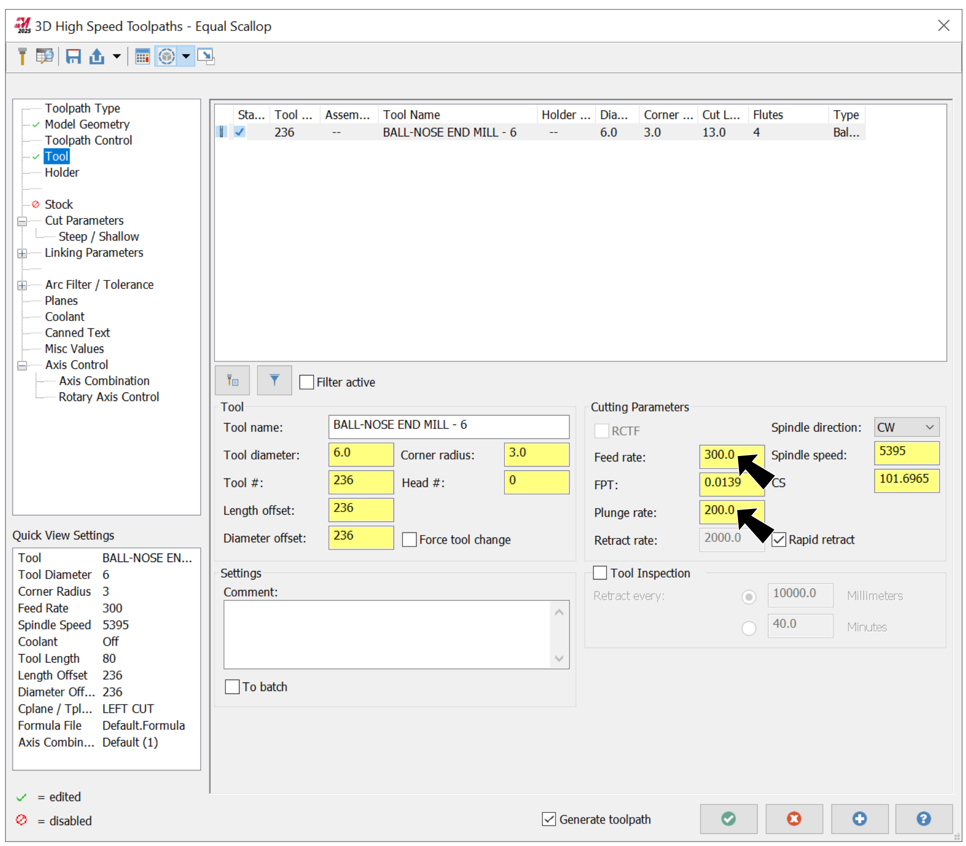


Fig. 67

Step 10. Select **Cut Parameters** from tree control and set:

Cut style
Closed
Other Way

Open
Other Way

Check
Optimize cut order

Stepover 1
Fig. 68.

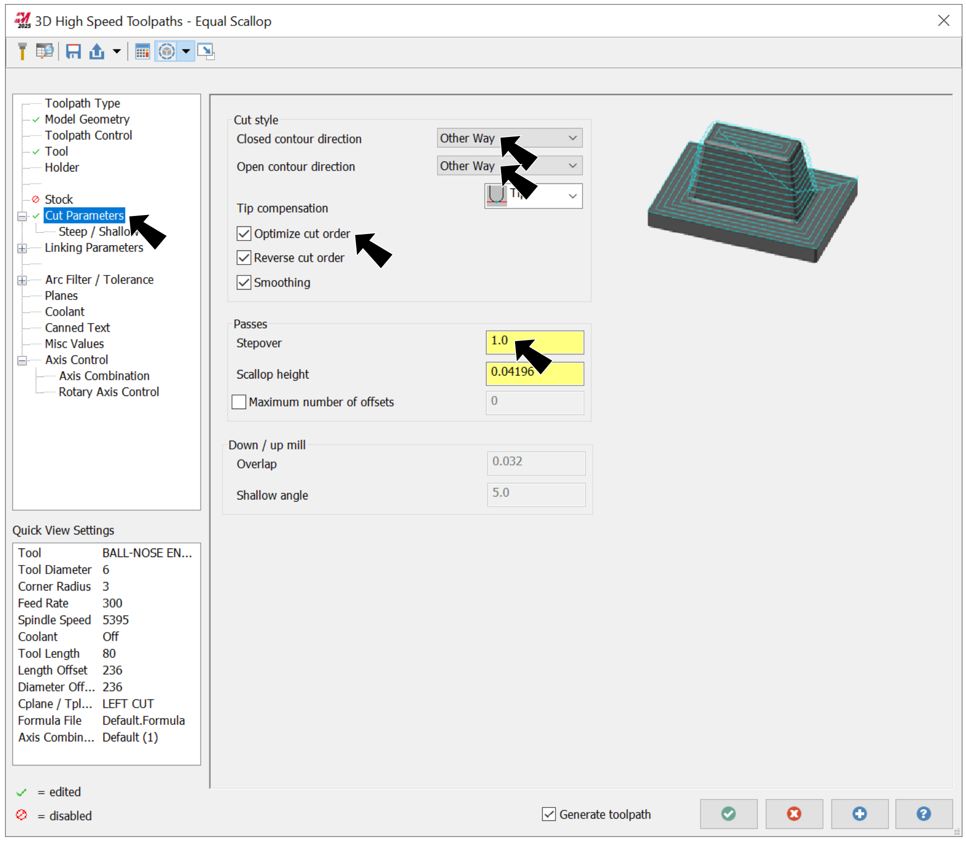


Fig. 68

Step 11. Select **Steep/ Shallow** from tree control and set:

Check
Minimum depth 0

Check
Maximum depth -37

Click **Apply**

Fig. 69.

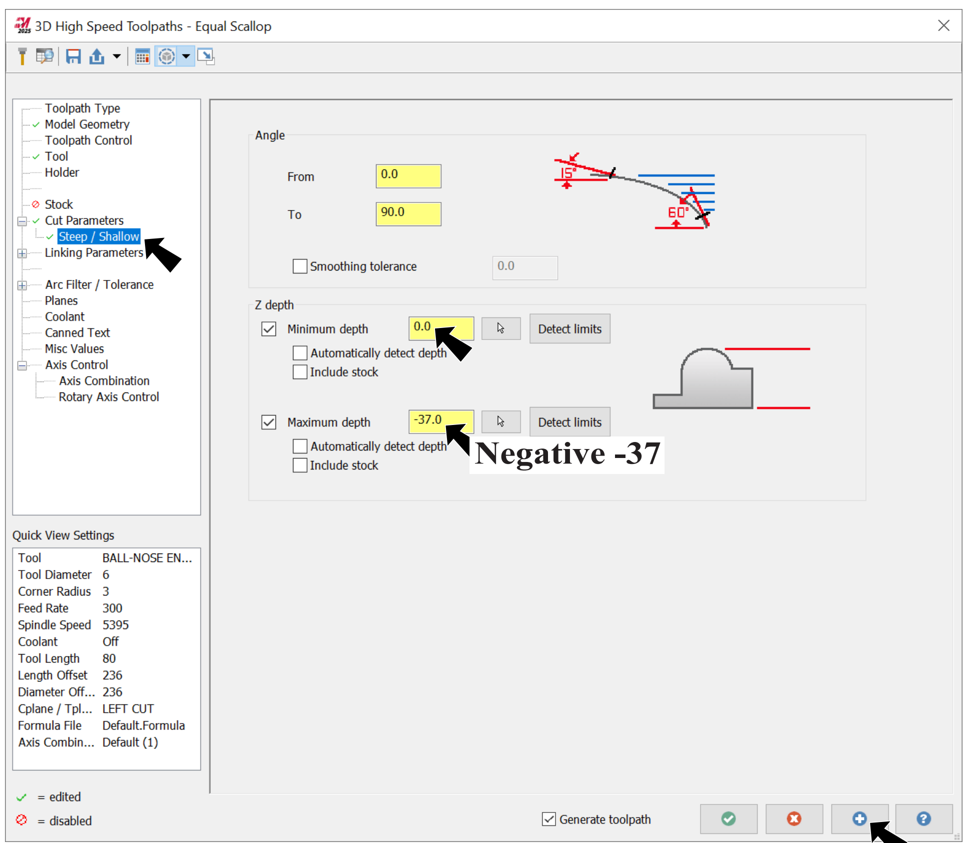


Fig. 69

Step 12. Select **Linking Parameters** from tree control and set:

Clearance plane 1

Select **Minimum Vertical Retract**

Part clearance 1

Keep tool down within 100%

All Leads 0 Fig. 70.

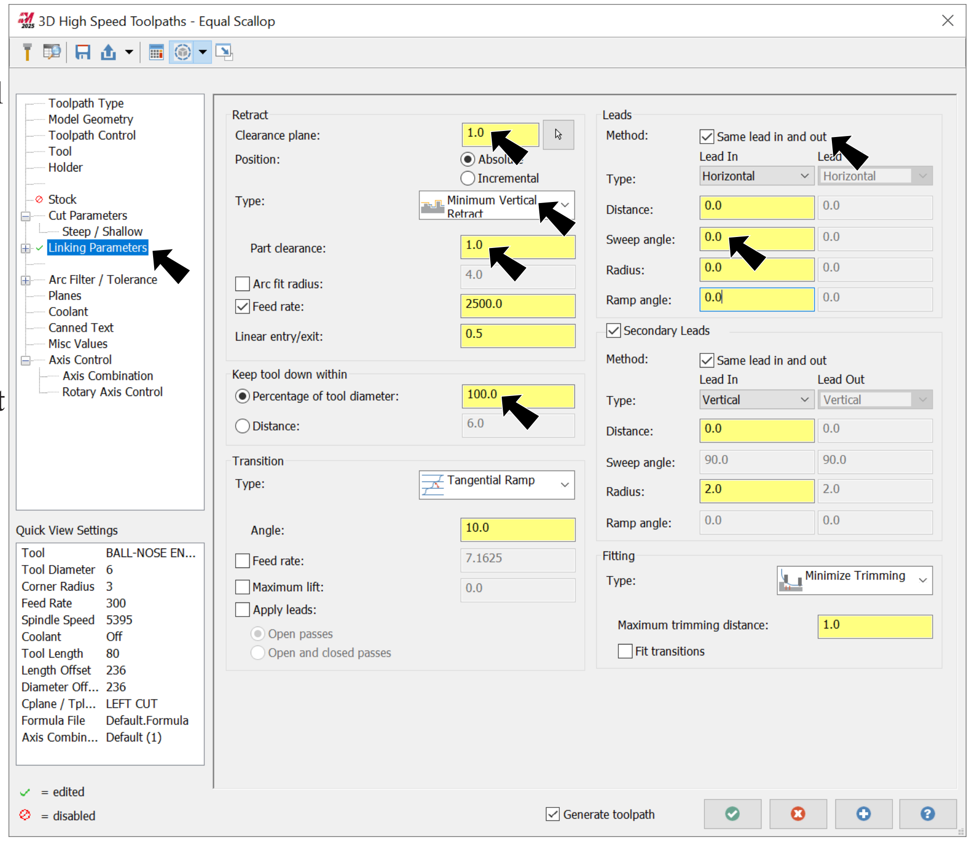


Fig. 70

Step 13. Select **Arc Filter/Tolerance** from tree control and set:

Total tolerance .0625

Check **Line/ Arc Filtering Settings**

Uncheck **Create arcs in XY**

Check **One way filtering**

Set **Minimum arc radius .0625**

Cut tolerance 10% Fig. 71.

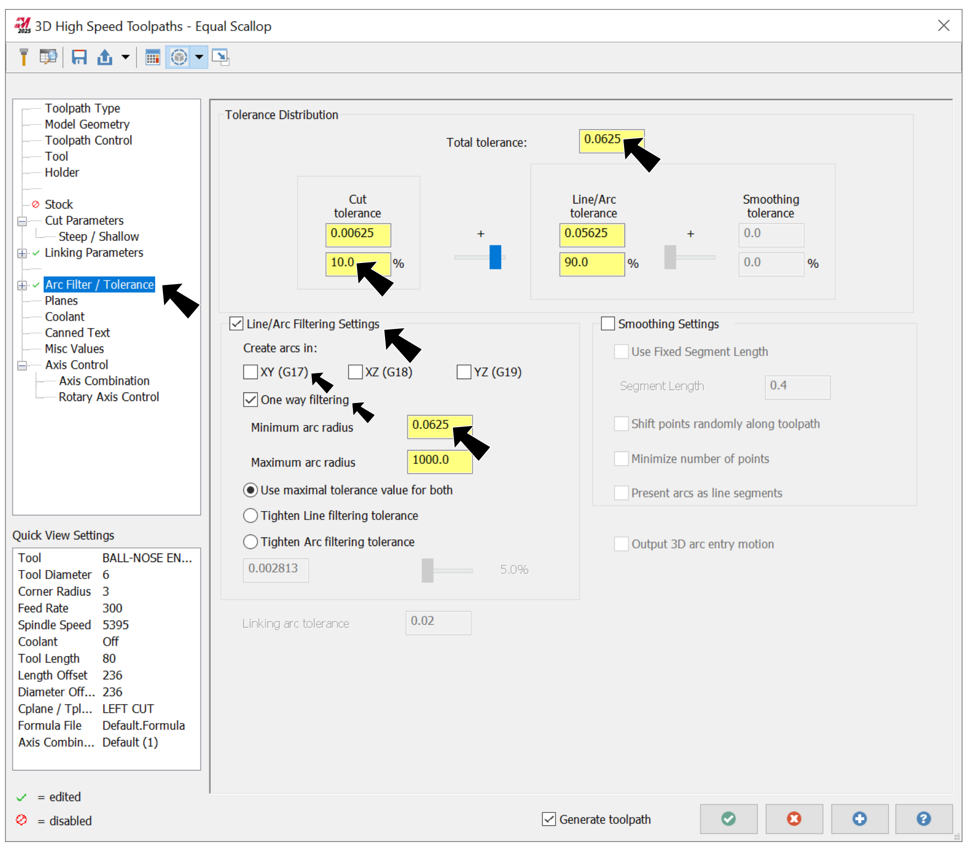


Fig. 71

Step 14. Click OK in Equal Scallop dialog box. Save **(Ctrl-S)**.

M. Verify Left Cut.

Step 1. In the Toolpaths Manager click the **LEFT CUT Toolpath group** to select toolpath and click **Only Display Selected Toolpath** , **Fig. 72**.

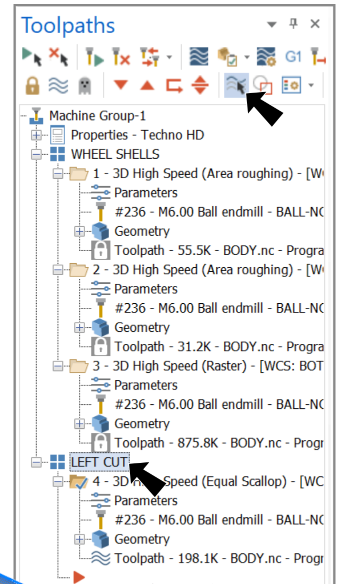


Fig. 72

Step 2. Confirm **toolpath avoids bottom and rear surfaces, Fig. 73**. Use **Alt-T** to toggle on toolpath display.

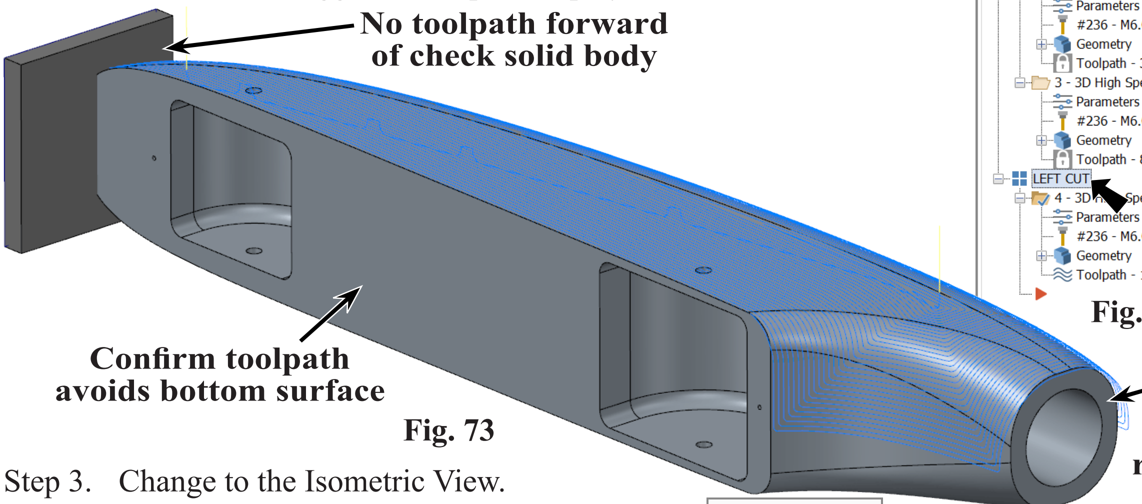
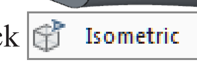


Fig. 73

Confirm toolpath avoids rear surface

Step 3. Change to the Isometric View. **Right click** in the graphics window and click  (**Alt-7**).

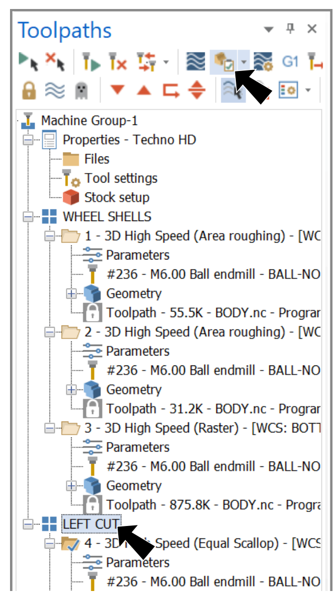
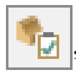
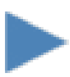


Fig. 74

Step 4. In the Toolpaths Manager click the **LEFT CUT Toolpath group** to select toolpath and click **Verify** , **Fig. 74**.

Step 5. Click **Play**  (**R**) in playback bar.

Step 6. Note **Total Time** to run program (**51min 35.01s**), **Fig. 76**.

Step 7. Switch back to Mastercam (**Alt-Tab**).

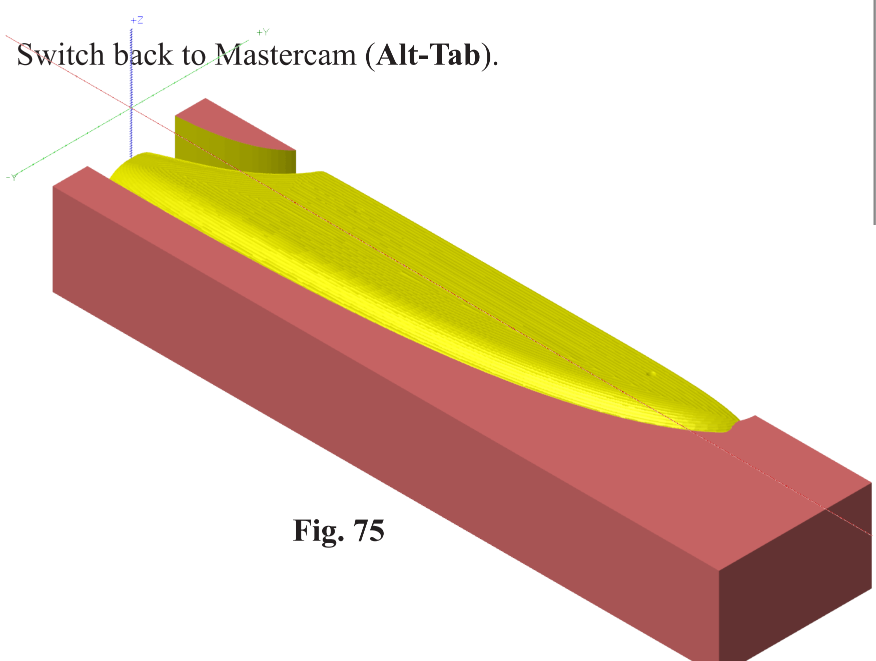


Fig. 75

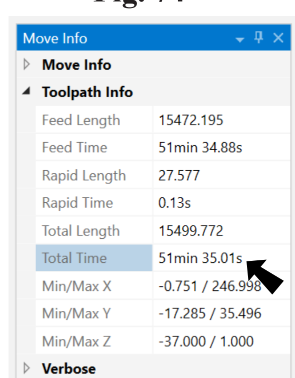


Fig. 76

N. Insert RIGHT CUT Toolpath Group.

Step 1. Insert another **Toolpath group**. To insert group, **right click Machine Group 1** at the very top of Ops Manager and click **Groups > New Toolpath group**, **Fig. 77**.

Step 2. Rename new Toolpath Group **RIGHT CUT**, **Fig. 78**.

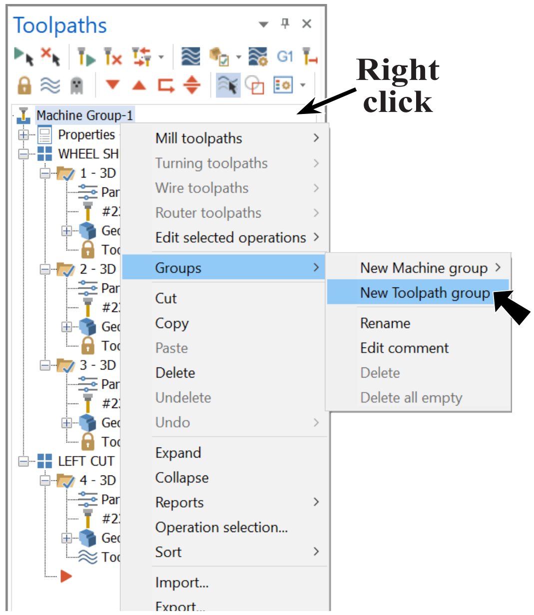


Fig. 77

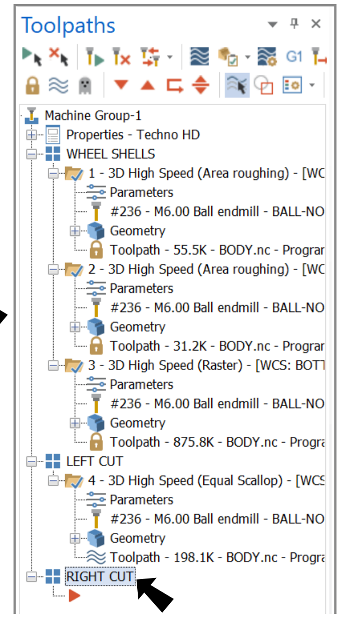
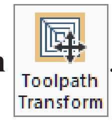


Fig. 78

O. Mirror LEFT CUT to RIGHT CUT Toolpath.

Step 1. On the Toolpaths tab 

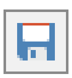
click **Toolpath Transform** 

.

Step 2. In the Transform Operation Parameters dialog box:
under Type, **Fig. 79**
select **Mirror**
under Source
select **NCI**
under Source operations
in **LEFT CUT** toolpath group select **Surface High Speed (Equal Scallop)**.

Step 3. Click the **Mirror tab** at top of dialog box, **Fig. 80**
under Method
select **Mirror**
about X axis 
Click OK .

Step 4. Allow Mastercam to calculate toolpath.

Step 5. Save  **(Ctrl-S)**.

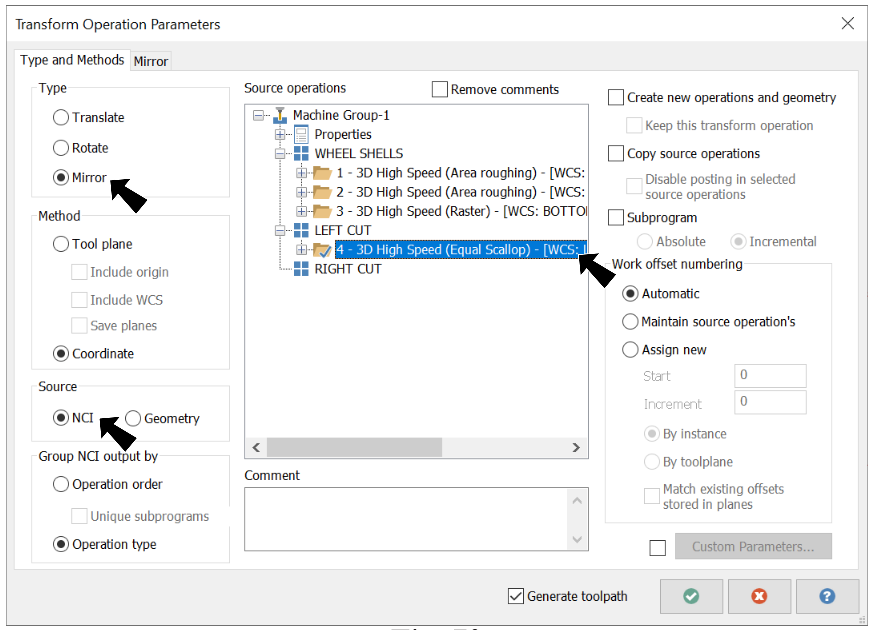


Fig. 79

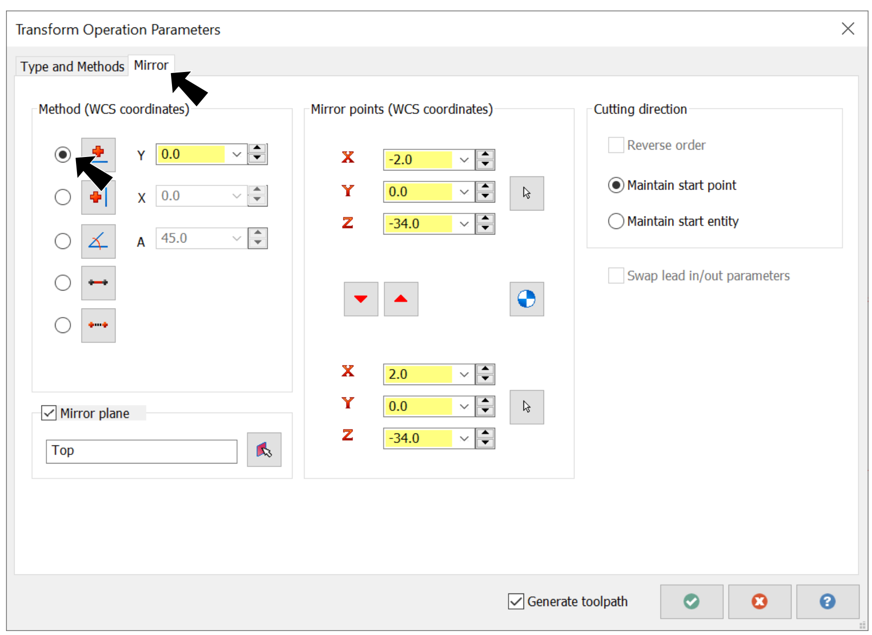


Fig. 80

P. Verify Right Cut.

Step 1. In Toolpaths Manager, click the **Transform/Mirror** toolpath, **Fig. 81**.

Step 2. Click **Verify** in Toolpaths Manager.

Step 3. Click **Play** (**R**) in playback bar.

Step 4. Click **Close** to close Mastercam Simulation.

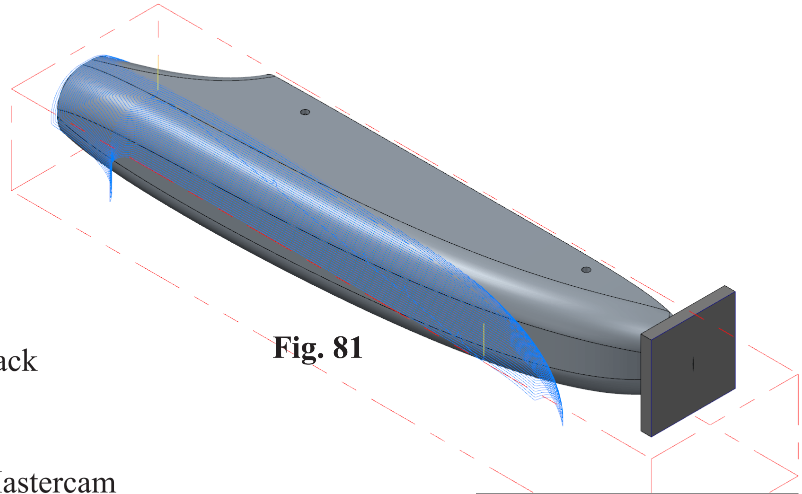


Fig. 81

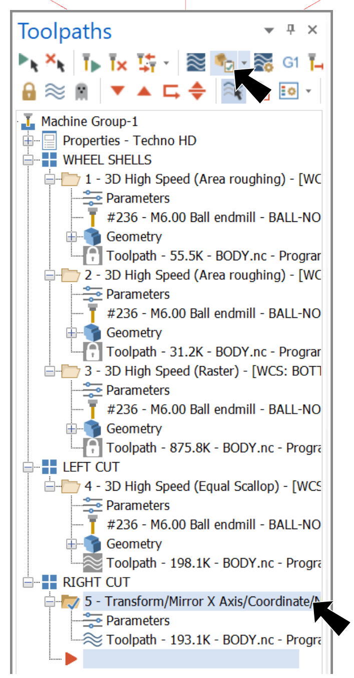


Fig. 82

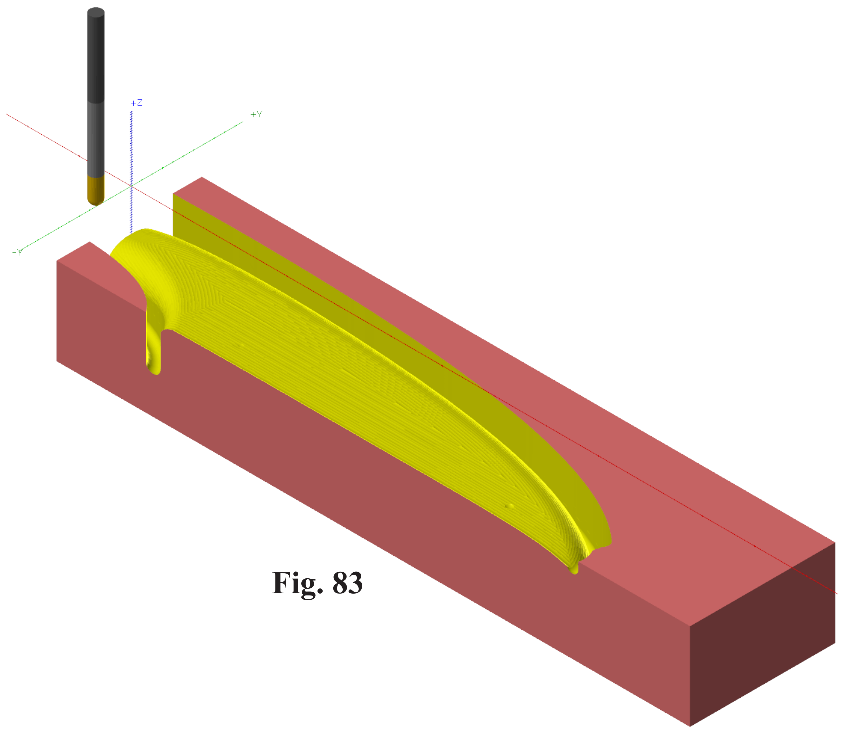


Fig. 83