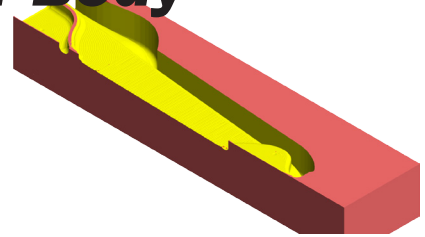


# Toolpaths for Rail Car Body

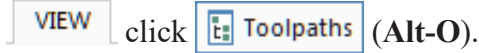
Cut Body (Hybrid)




## A. Machine Type and Stock Setup.

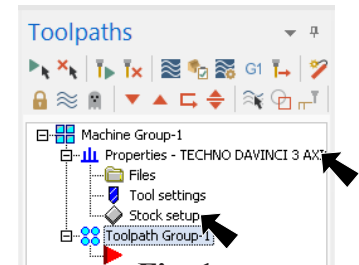
Step 1. If necessary, open your Body file from Chapter 2.

Step 2. If necessary, display Toolpaths Manager. On the View tab



Step 3. If Machine Group is **not** displayed in the Toolpaths Manager,

**Fig. 1** on the Machine tab **MACHINE**, click Mill  > **De-fault** from the menu.



**Fig. 1**

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

Step 5. Click **Stock Setup** in the Toolpaths Manager.

Step 6. Confirm Stock View is **LEFT CUT**, **Fig. 2**.

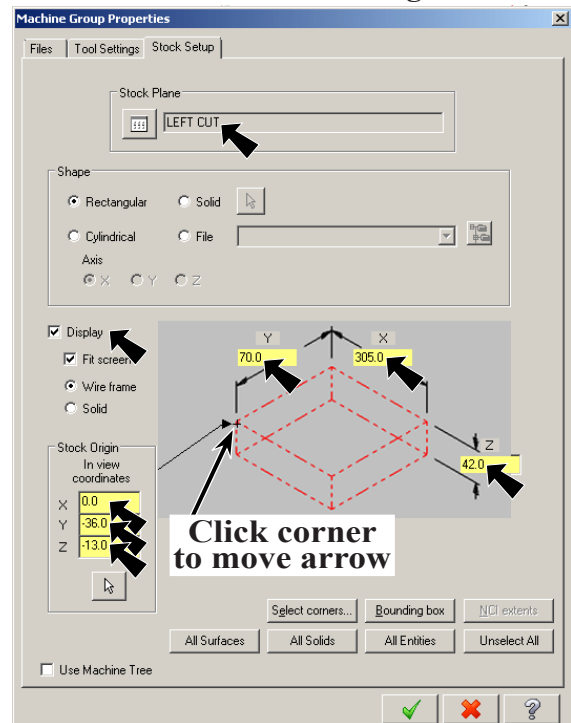
Step 7. Click the **left front top corner of the stock** to move the origin. After you click corner the arrow will point to corner.

Step 8. Key-in X, Y and Z stock dimension:

**X 305**  
**Y 70**  
**Z 42**

Step 9. Key-in Stock Origin coordinates:

**X 0**  
**Y -36**  
**Z -13**



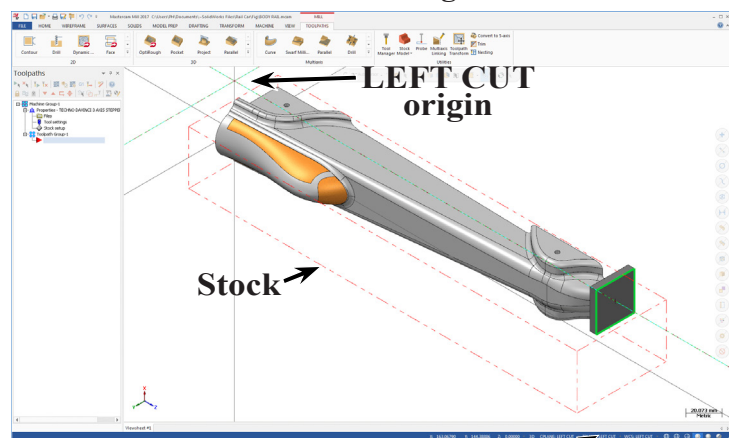
**Fig. 2**

Step 10. Click OK  in Machine Group Properties, **Fig. 3**.

## B. Confirm WCS LEFT CUT.

Step 1. In Status bar at bottom of display, confirm **CPLANE:LEFT CUT**, **Fig. 3**.

Step 2. Confirm **Left Cut Origin**. Use **F9** to toggle axes.



**Fig. 3**

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### C. Left Cut Finish Hybrid Toolpath.

Step 1. On the Toolpaths tab **TOOLPATHS** in the 3D group click **expand gallery** button and click

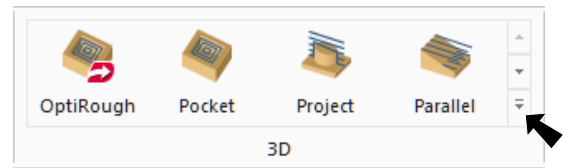


Fig. 4

**Hybrid**, Fig. 4.



Step 2. Click OK in NC name dialog, Fig. 5.

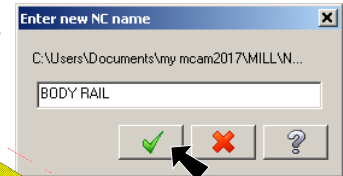


Fig. 5

Step 3. Click the **solid car body** to select as Drive Surfaces and click **End Selection** (ENTER), Fig. 6.

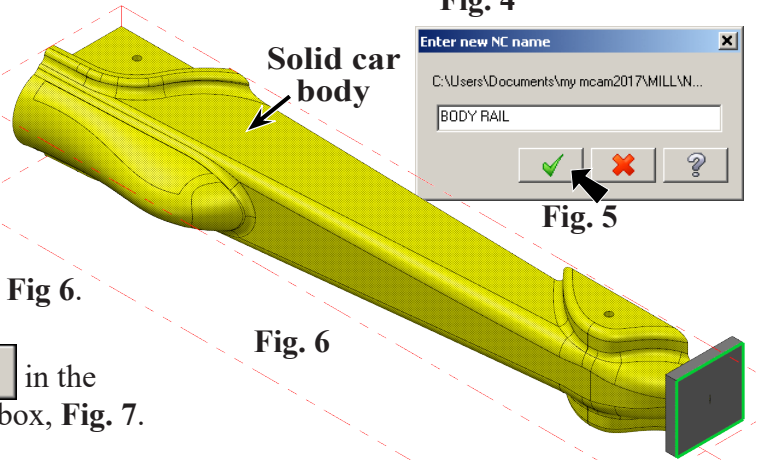


Fig. 6

Step 4. Click **Check Select** button in the Toolpath/surface selection dialog box, Fig. 7.

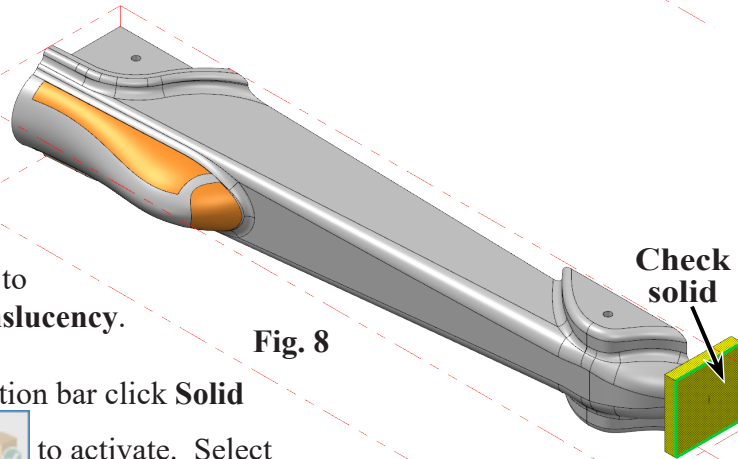


Fig. 8

Step 5. Click the **solid check body**, Fig. 8.

Step 6. Use **Ctrl-T** to toggle **Translucency**.

Step 7. In the Selection bar click **Solid Selection** to activate. Select **Select face** and **From Back**. Unselect **Select body**, Fig. 9.



Fig. 9

Step 8. Click **flat face surface at rear and bottom**, Fig. 10.

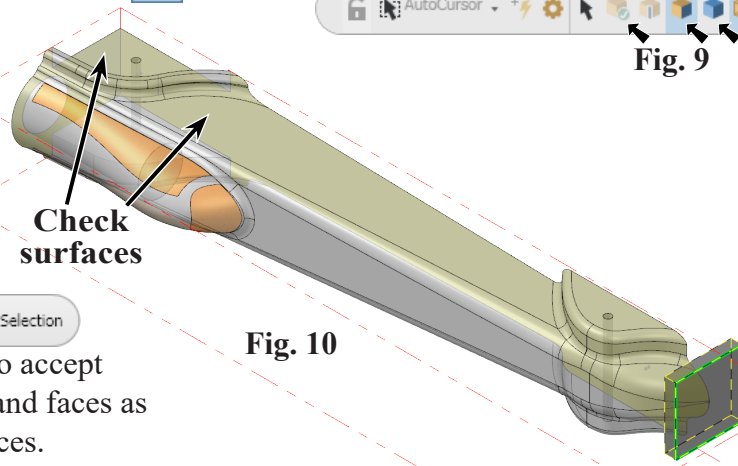


Fig. 10

Step 9. Click **End Selection** (ENTER) to accept solid body and faces as check surfaces.

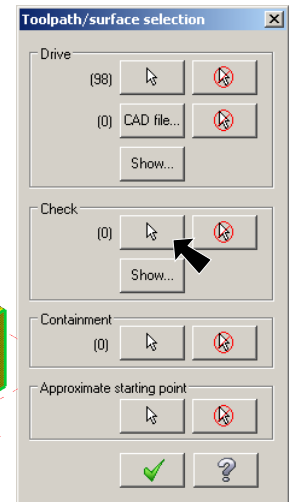


Fig. 7

Step 10. In the Toolpath/surface selection dialog box confirm **8 Check surfaces** and click OK, Fig. 11.

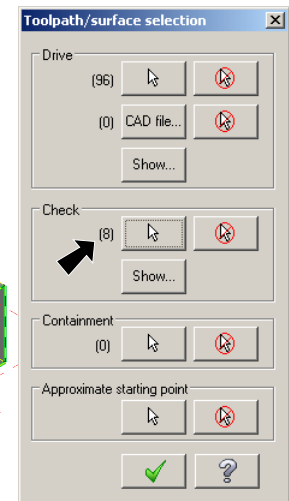


Fig. 11

Step 11. Select **Toolpath Type** from the tree control and confirm:

**Hybrid tool-path Drive** and

**Check surfaces**  
Fig. 12.

Step 12. Select **Tool** from tree control and:

Click **Select library tool**  
Fig. 13.

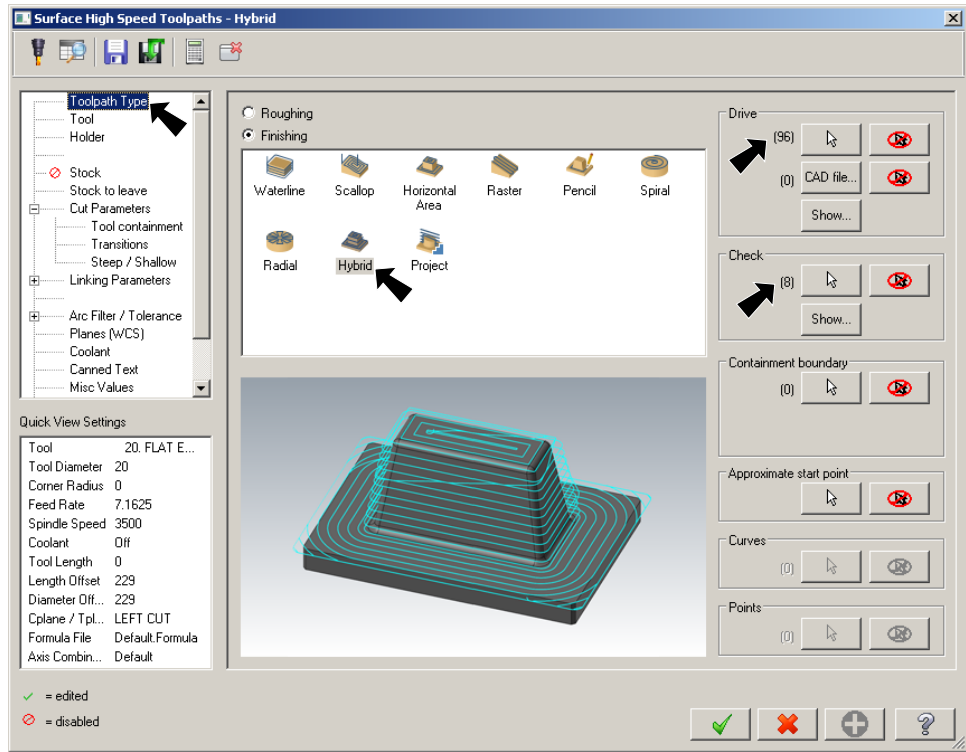


Fig. 12

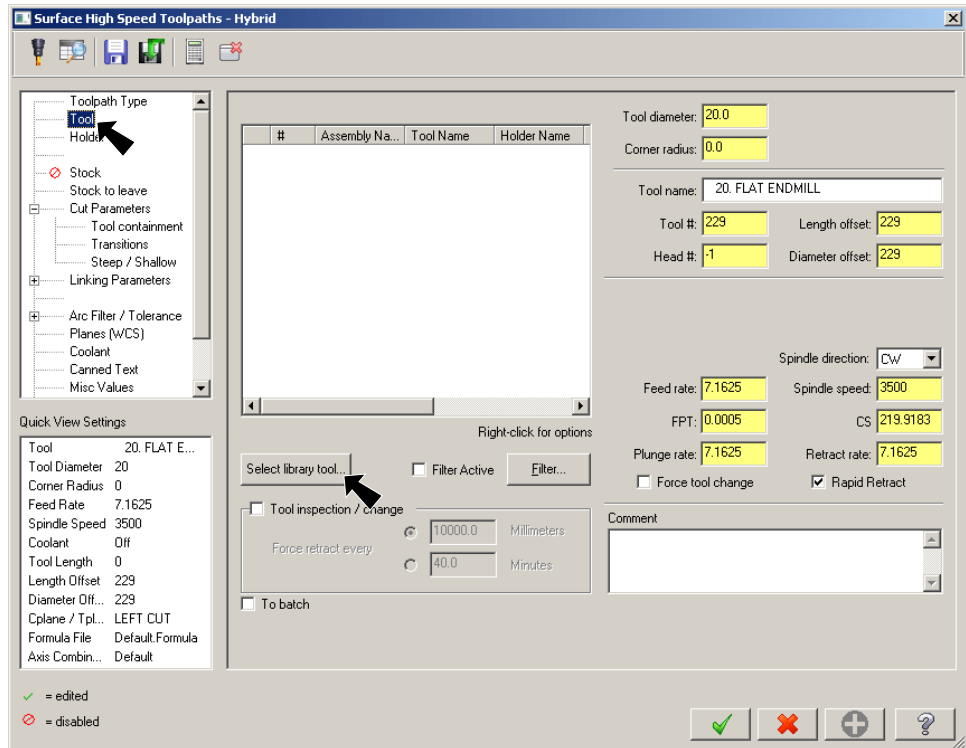
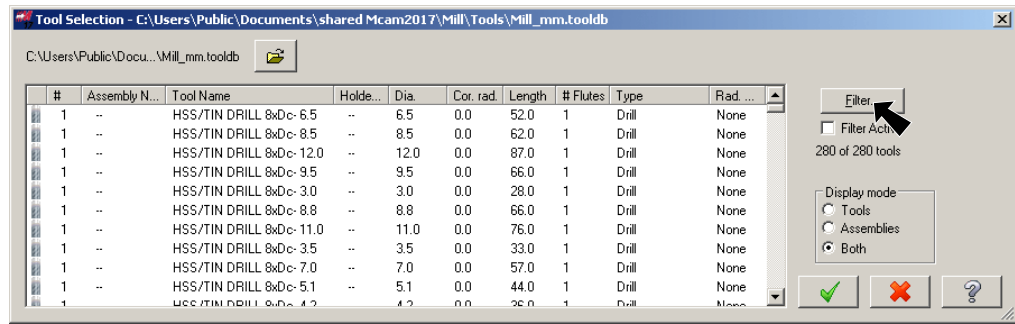


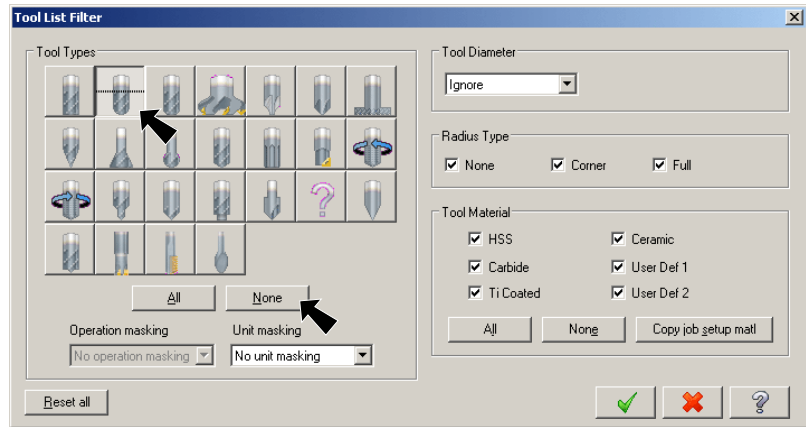
Fig. 13

Step 13. Click **Filter** button, **Fig. 14.**



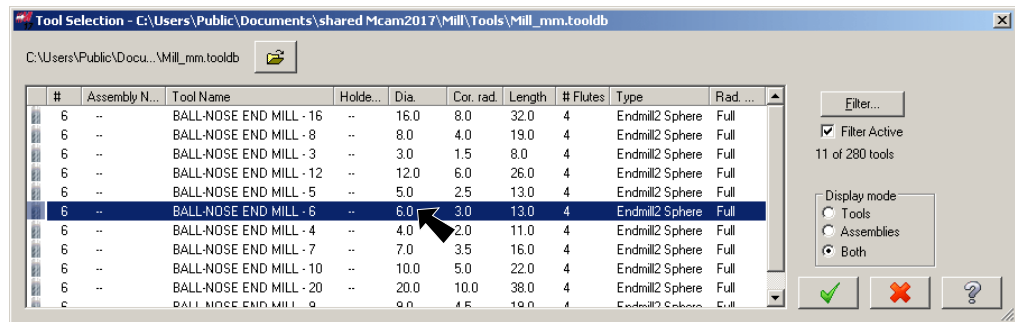
**Fig. 14**

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



**Fig. 15**

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



**Fig. 16**

Step 17. Back in Tool page set:

**Feed rate 300**

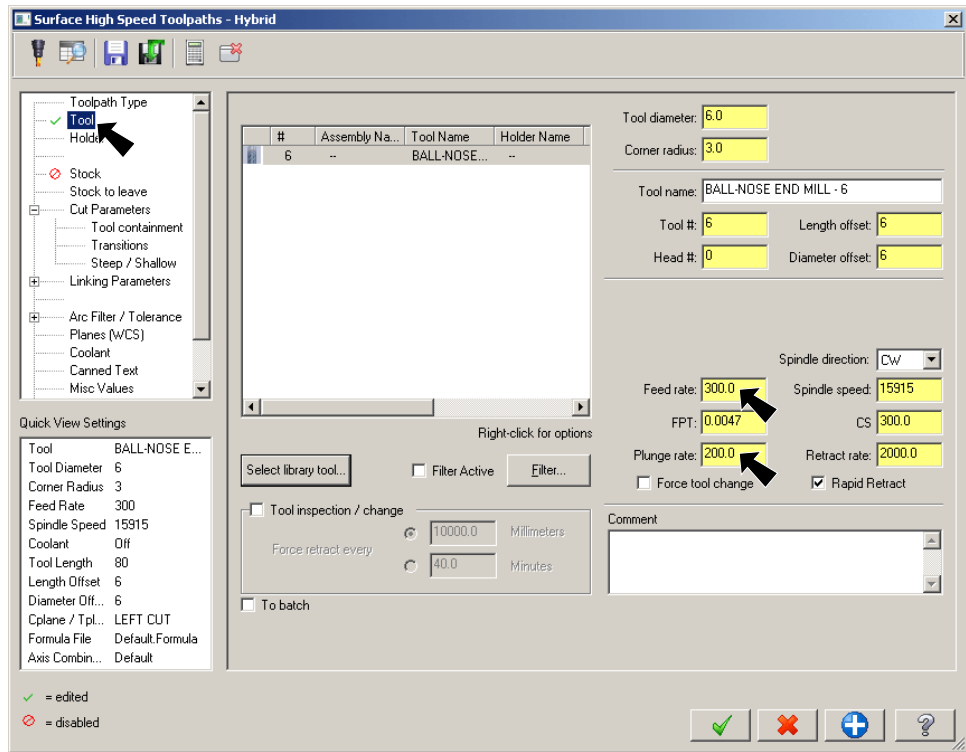
**Plunge rate 200**

**Fig. 17.**

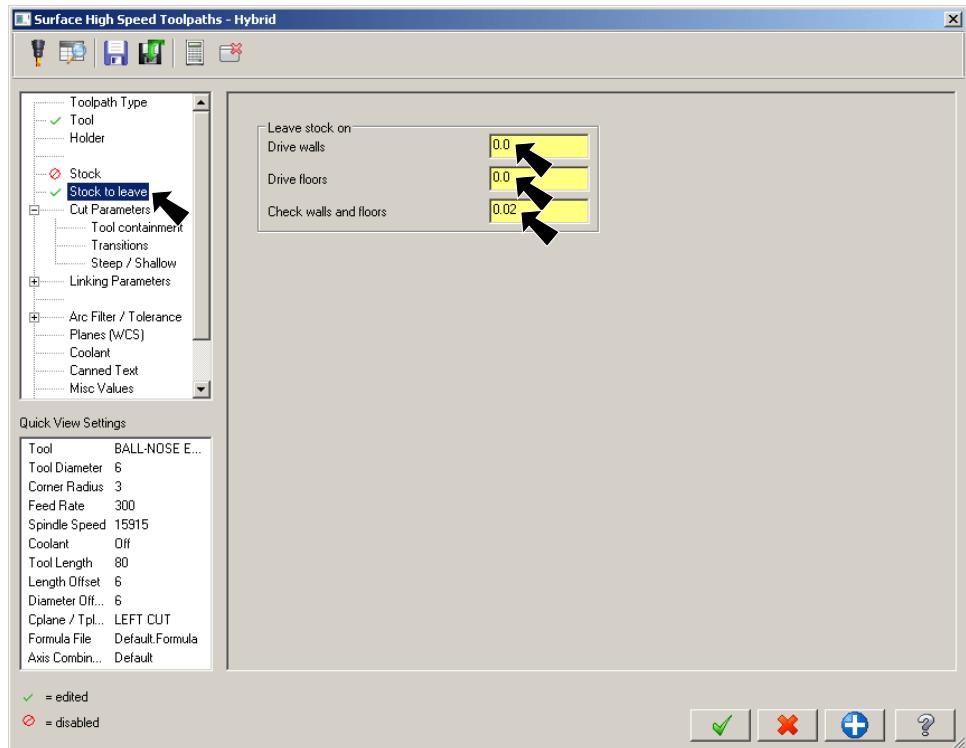
Step 18. Select Stock to leave from tree control and set:

**Stock to leave on Walls and Floors 0**

**Stock to leave on Check surfaces .2**  
**Fig. 18.**



**Fig. 17**



**Fig. 18**

Step 19. Select **Cut Parameters** from tree control and set:

**Open contour direction Zigzag**

**Z stepdown 3**

**Limiting angle 34**

**3D stepover 1.2**

Check **Preserve Z passes**

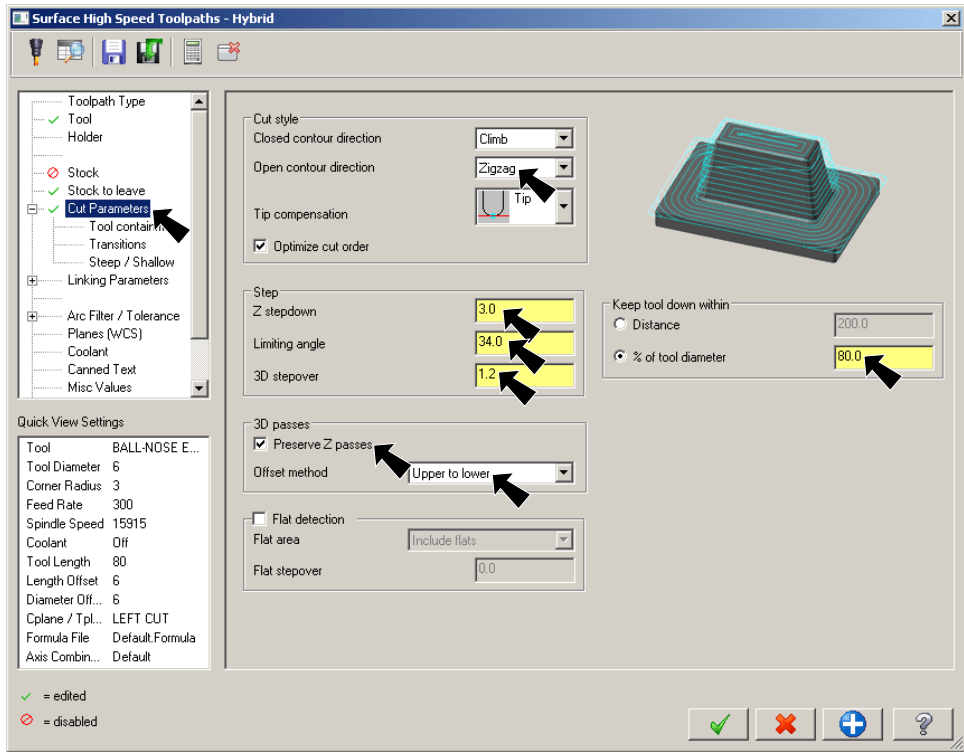


Fig. 19

**Offset method Upper to lower**

**Keep tool down within 80%**  
Fig. 19.

Step 20. Select **Steep/Shallow** from tree control and set:

Check **Use Z depths**  
**Minimum 0**  
**Maximum -37**

Click **Apply**



Fig. 20.

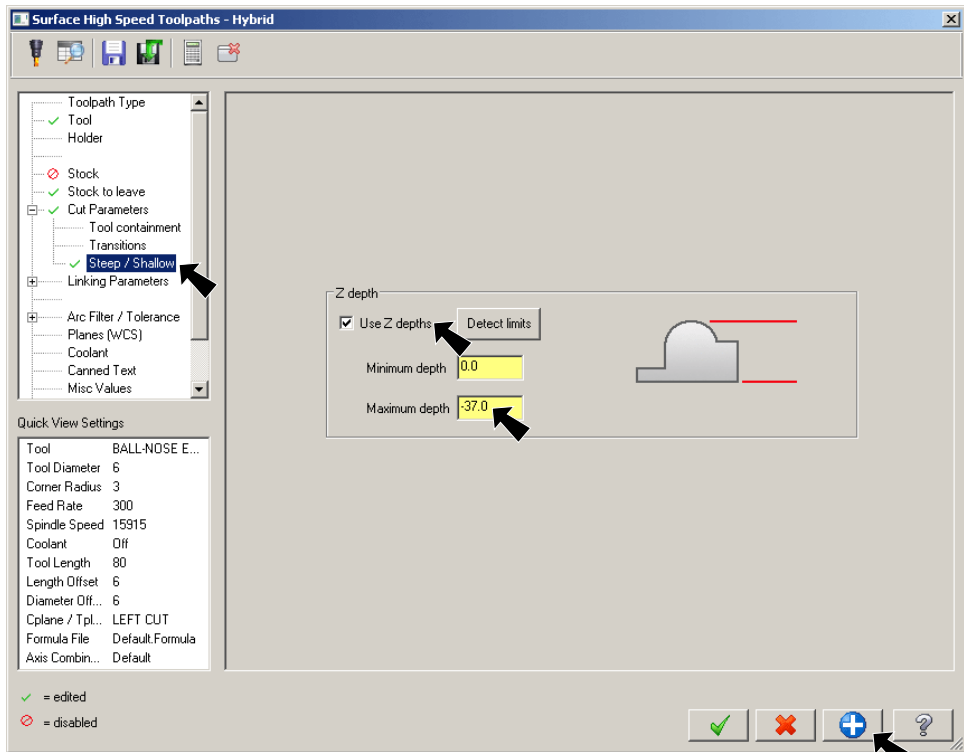


Fig. 20

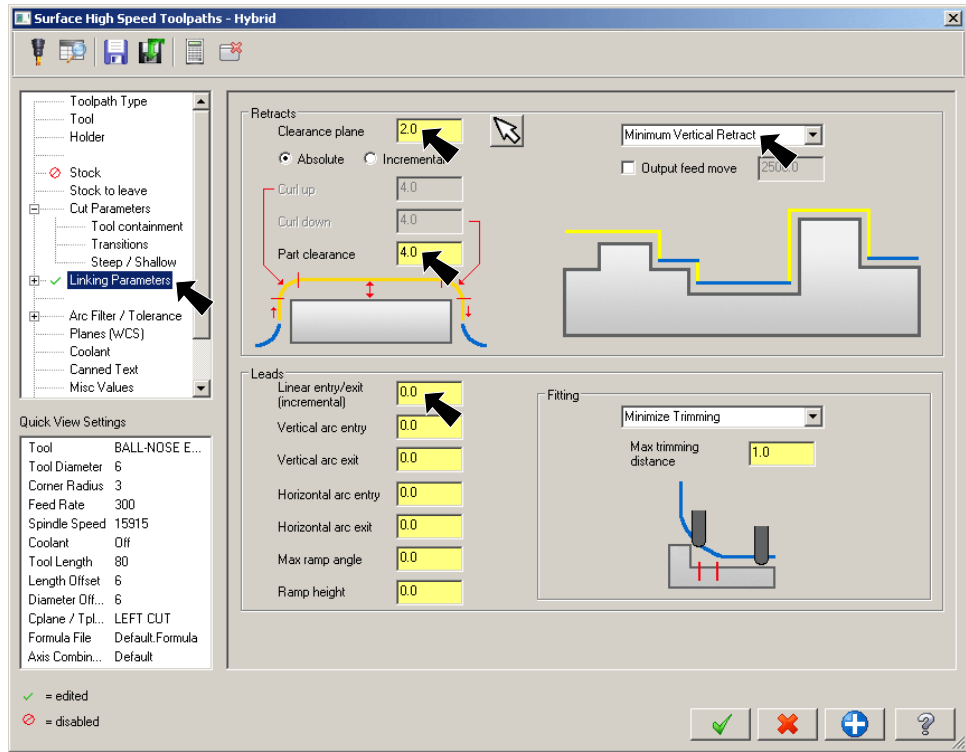
Step 21. Select **Linking Parameters** from tree control and set:

**Clearance plane 2**

select **Minimum Vertical Retract**

**Part clearance 4**

**All Leads 0**  
**Fig. 21.**



**Fig. 21**

Step 22. Select **Arc Filter/Tolerance** from tree control and set:

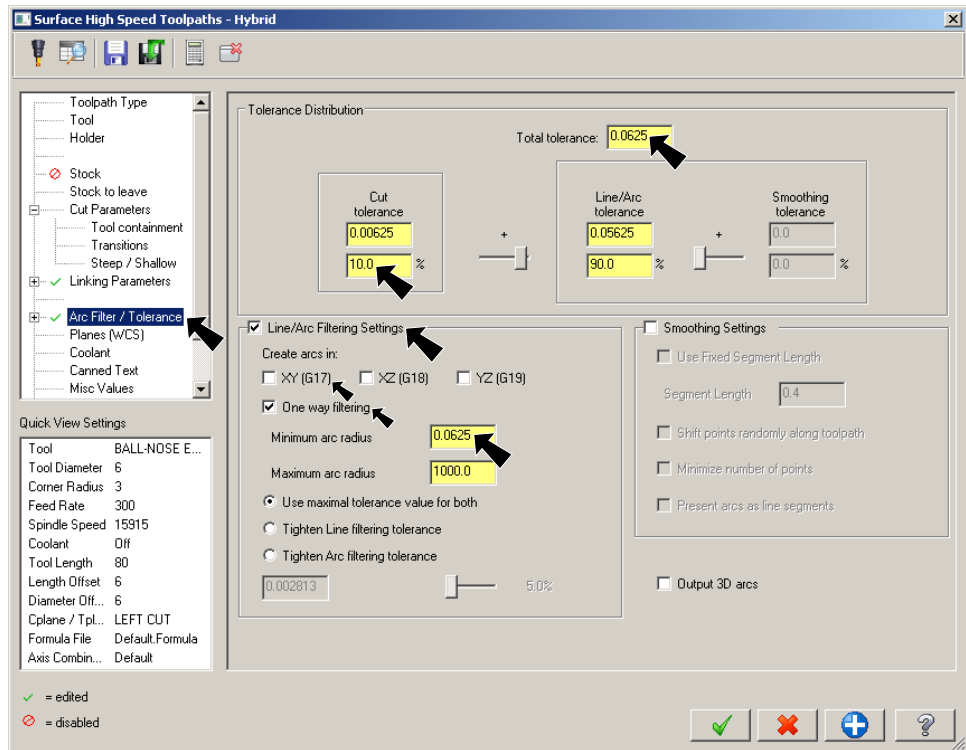
**Total tolerance .0625**

check **Line/Arc Filtering Settings**

uncheck **Create arcs in XY**




check **One way filtering**

set **Minimum arc radius .0625**




**Fig. 22**

**Cut tolerance 10%**  
**Fig. 22.**

Step 23. Click OK  in Hybrid dialog box and allow Mastercam to calculate toolpath  and Save  (Ctrl-S).

## D. Verify Left Cut.

Step 1. In the Toolpaths Manager, click the **LEFT CUT** Toolpath group to select toolpath and click **Verify** , Fig. 23.

Step 2. Click **Play**  (R) in VCR bar, Fig. 24.

Step 3. Note **Total Time** to run program (38min 32.29s), Fig. 25.

Move List	
Move Info	
Toolpath Info	
Feed Length	11552.618
Feed Time	38min 30.52s
Min/Max X	-1.061 / 258.677
Min/Max Y	-19.933 / 36.754
Min/Max Z	-37.000 / 2.000
Rapid Length	2947.887
Rapid Time	1.77s
Total Length	14500.506
<b>Total Time</b>	<b>38min 32.29s</b>
Verbose	

Fig. 25

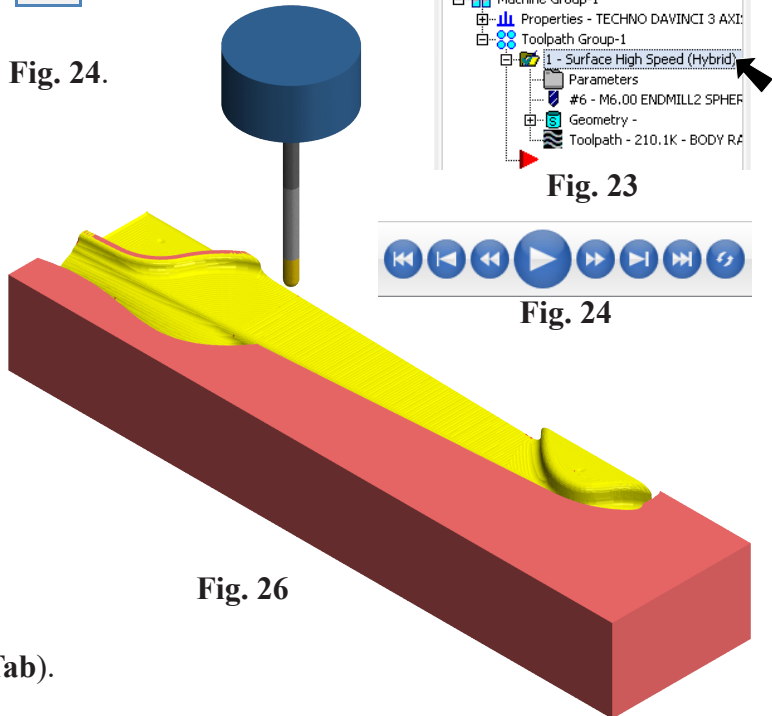


Fig. 26

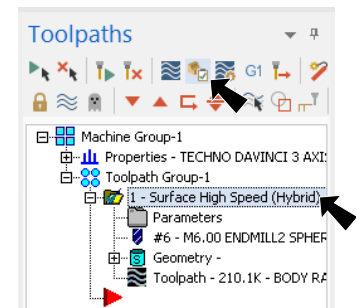


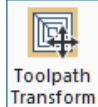
Fig. 23



Fig. 24

Step 4. Switch back to Mastercam (Alt-Tab).

## E. Mirror LEFT CUT to RIGHT CUT Toolpath.

Step 1. On the Toolpaths tab **TOOLPATHS** click **Toolpath Transform** .

Step 2. In the Transform Operation Parameters dialog box:  
under Type, Fig. 27

select **Mirror**  
under Source  
select **NCI**  
under Source  
operations  
select **Surface  
High Speed  
(Hybrid)**.

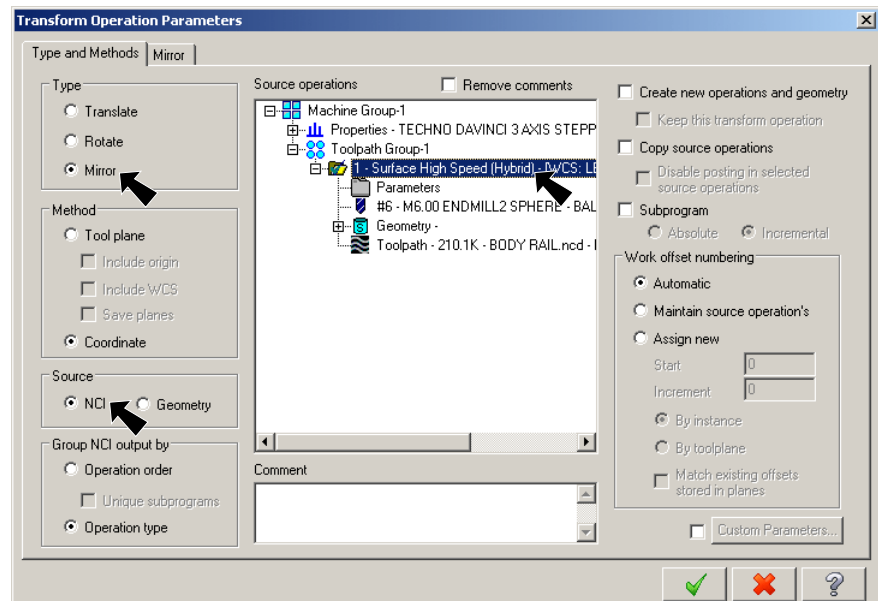


Fig. 27

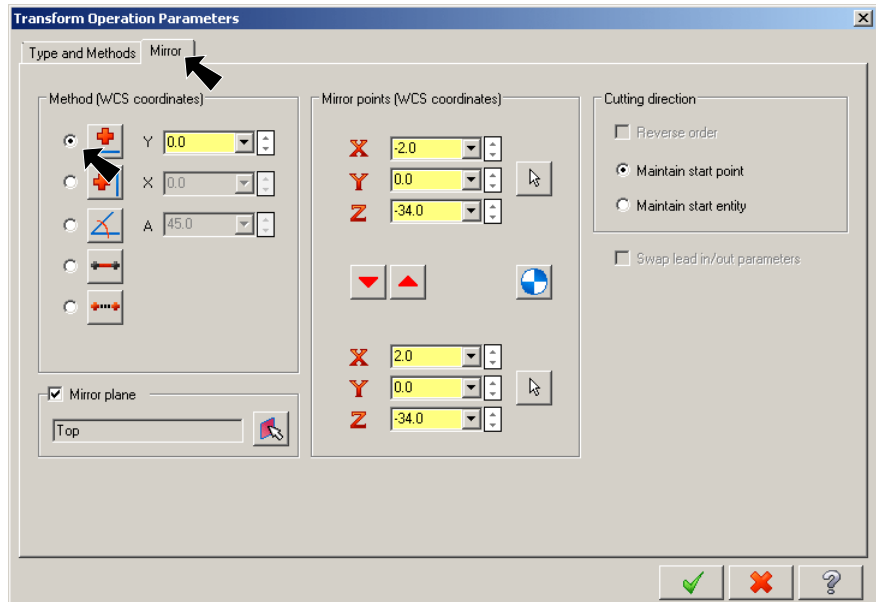
Step 3. Click the **Mirror** tab at the top of the dialog box, **Fig. 28**:  
 under Method

select **Mirror about X axis** 

Click OK .

Step 4. Allow Mastercam to calculate toolpath.

Step 5. Save  (Ctrl-S).




**Fig. 28**

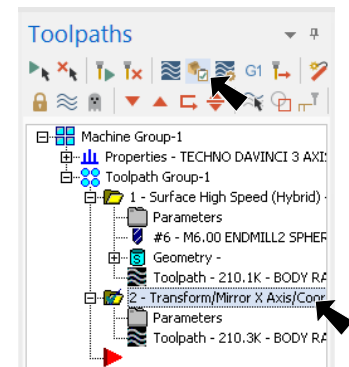
### F. Verify Right Cut.

Step 1. In Toolpaths Manager, click the **Transform/Mirror** toolpath, **Fig. 29**.

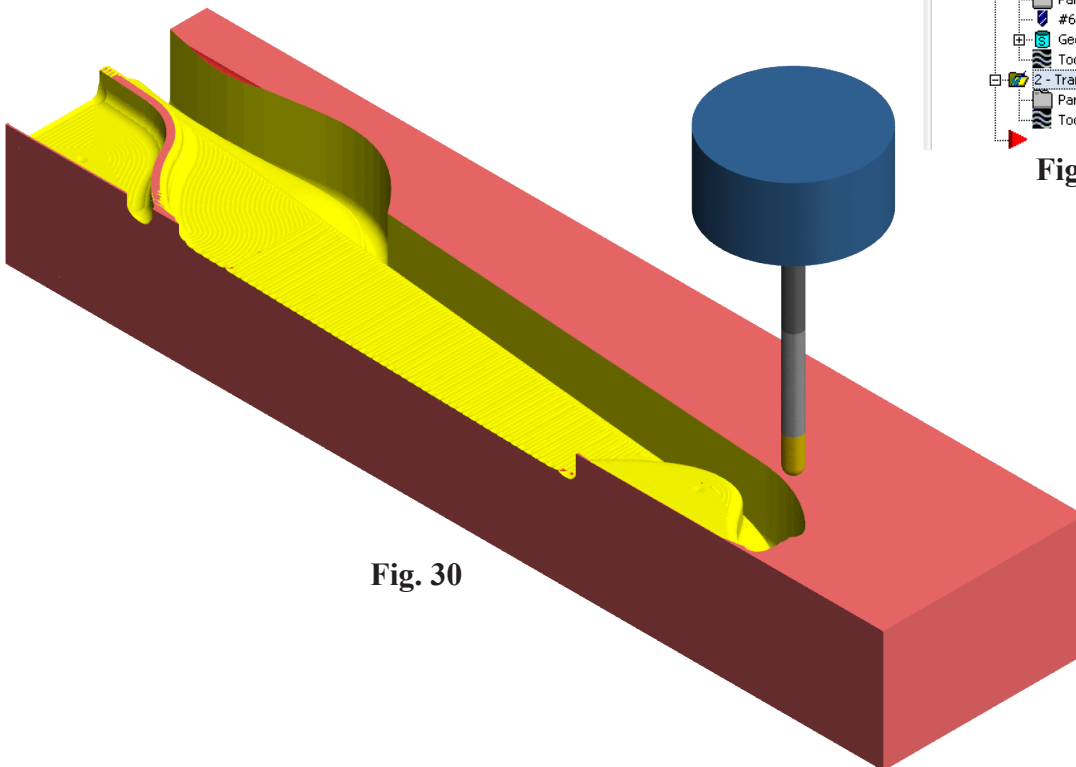
Step 2. Click **Verify**  in Toolpaths Manager, **Fig. 29**.

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

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



**Fig. 29**



**Fig. 30**