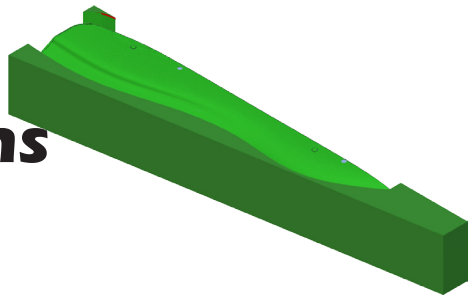
CO2 Rail Car Form
Body Toolpaths



A. Insert Blank File.

Step 1. Open your **BODY RAIL FORM** file.

Step 2. Click Data Panel in top left corner of display.

Step 3. **Right click BLANK** file and click **Insert into Current Design**, **Fig. 1**.

Step 4. Click OK in Move/Copy Panel, **Fig. 2**.

Step 5. Click **Close Data Panel**.

Step 6. **Right click Blank** in Browser and click **Ground**, **Fig. 3**.

Step 7. **Right click Blank** and click **Break Link** **Fig. 4**.

Step 8. **Right click Blank** and click **Opacity Control > 20%**, **Fig. 5**.

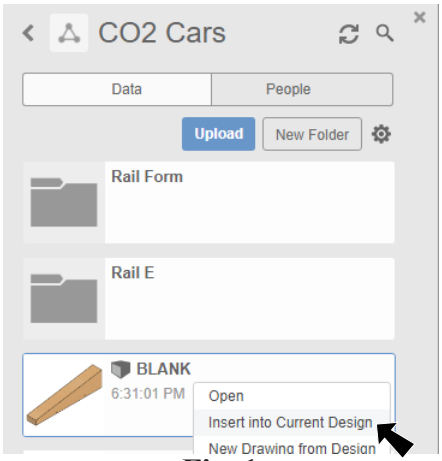


Fig. 1

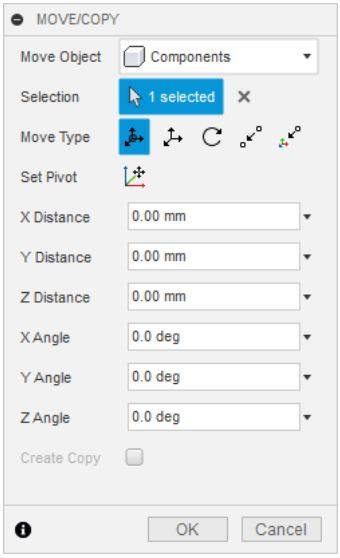


Fig. 2

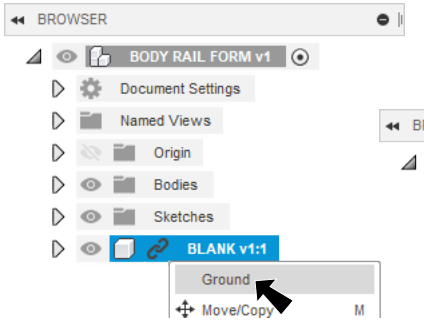
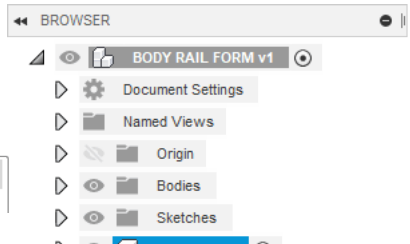


Fig. 3



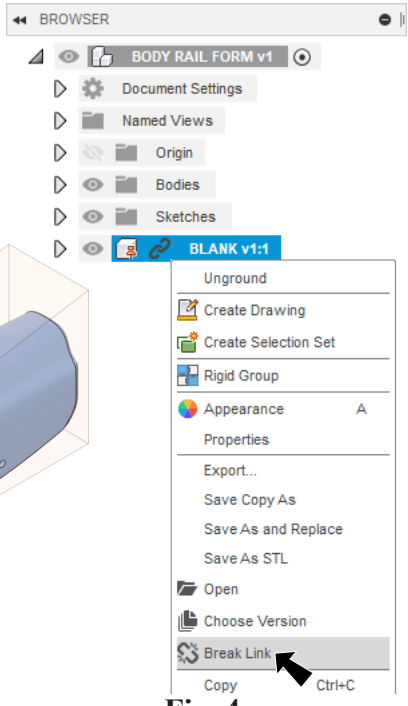


Fig. 4

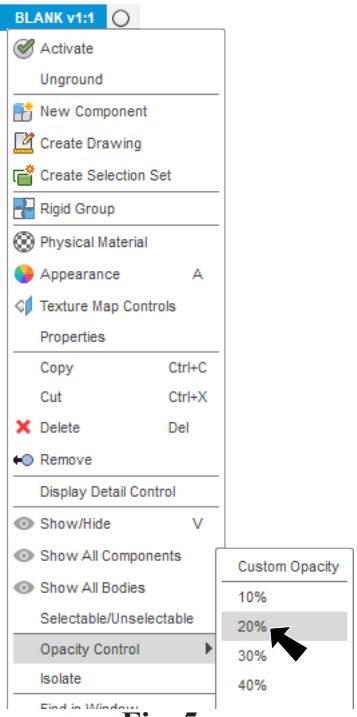


Fig. 5

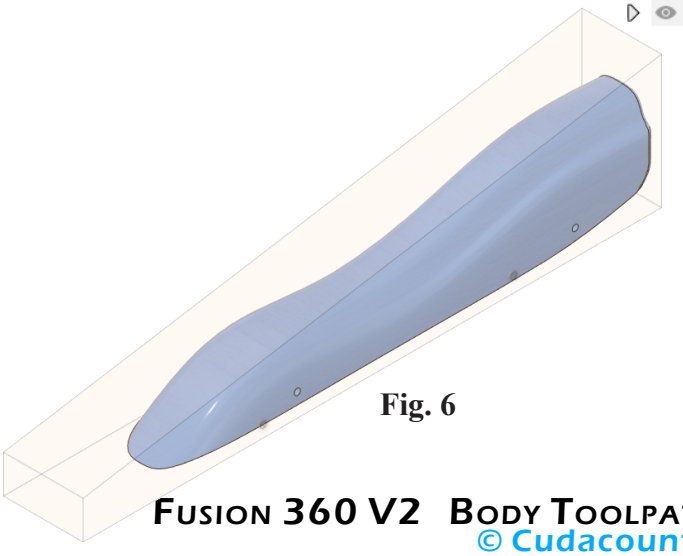


Fig. 6

B. Create WCS Sketch.

Step 1. Click **Back view** on View Cube 

, **Fig. 7**.

Step 2. On the Solid tab 

click **Create Sketch**  in toolbar and click **back face** of Blank body, **Fig. 7**.

Step 3. Click **Fit**  **(F6)** on the Navigation Bar at the bottom of the canvas.

Step 4. Click **Line**  **(L)** on the toolbar.

Step 5. Sketch a **horizontal line to the left from the centerpoint of the cartridge hole**, **Fig. 8**.

Step 6. Click **Dimension**  **(D)** on the toolbar.

Step 7. Dimensions line **34**, **Fig. 8**.

Step 8. Click **Finish Sketch**  on the toolbar.

Step 9. Save. Use **Ctrl-S** and press ENTER.

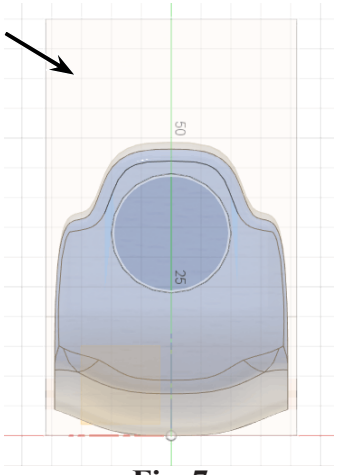


Fig. 7

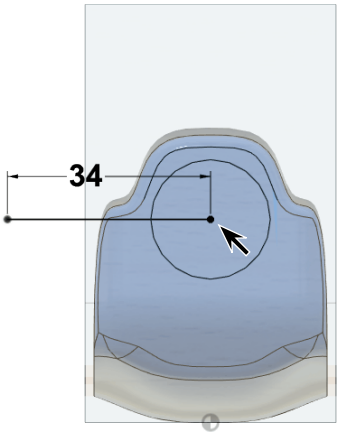


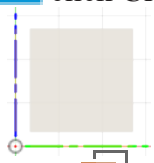
Fig. 8

D. Create Containment Sketch.

Step 1. Click **Right view** on View Cube 

.

Step 2. On the Solid tab 

click **Create Sketch**  in toolbar and click **Right plane**  in canvas (don't click Blank body), **Fig. 10** or **YZ Plane**  in Browser, **Fig. 10**.

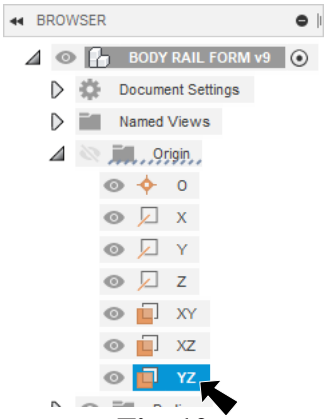


Fig. 10

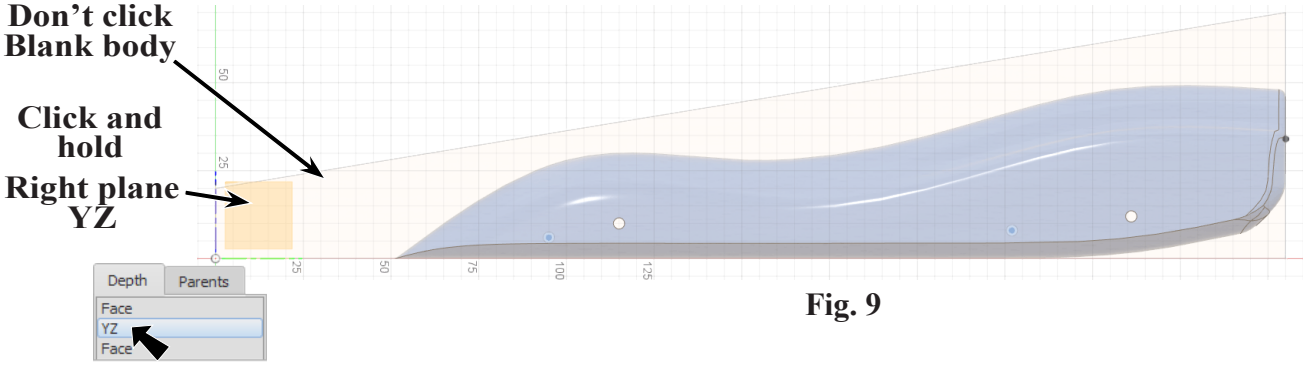


Fig. 9

Step 3. Click **Fit** (**F6**) on the Navigation Bar at the bottom of the canvas.

Step 4. Click **2-Point Rectangle** on the Sketch toolbar.

Step 5. Sketch **rectangle to right of front tip** of car body, **Fig. 11**.

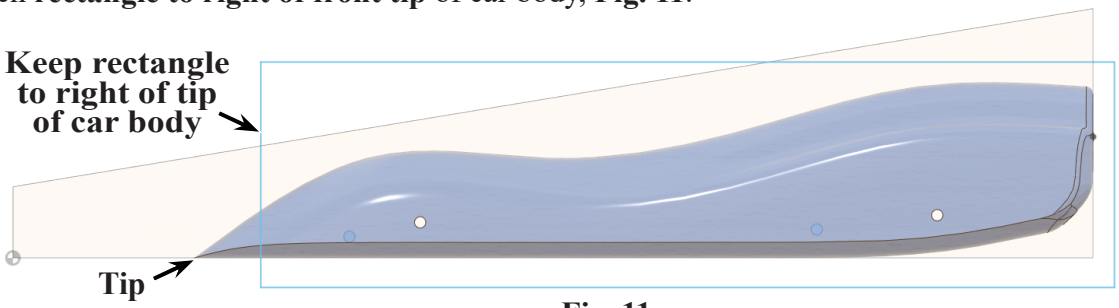


Fig. 11

Step 6. **Hide** **Blank** in the Browser, **Fig. 12**.

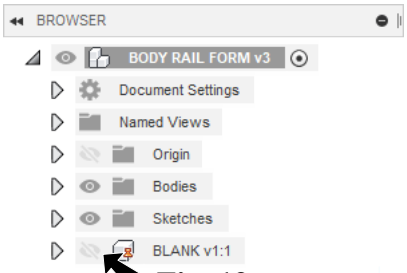


Fig. 12

Step 7. Click Create Menu > Project/Include > Project (**P**).

Step 8. Click the **forward most vertex on the car body (tip)** and click OK in Project panel, **Fig. 13**.

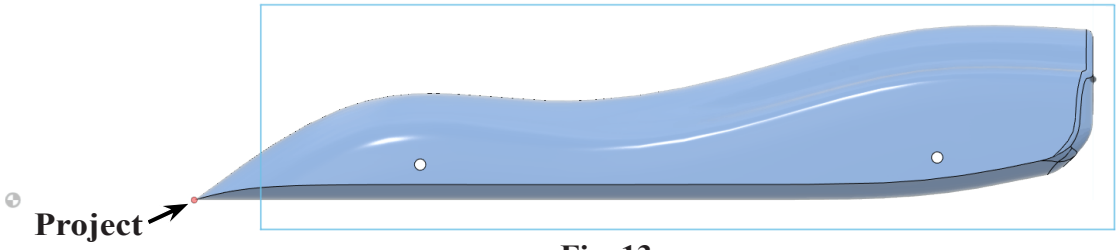


Fig. 13

Step 9. Click **Dimension** (**D**) on the toolbar.

Step 10. Add dimensions, **Fig. 14**. If necessary, drag top of rectangle at least 7mm above top of car body. 6mm cutter has to pass between rectangle and top of car body. Unselect Dimension tool to drag.

Step 11. Click **Finish Sketch** on the toolbar.

Step 12. Save. Use **Ctrl-S** and press ENTER.

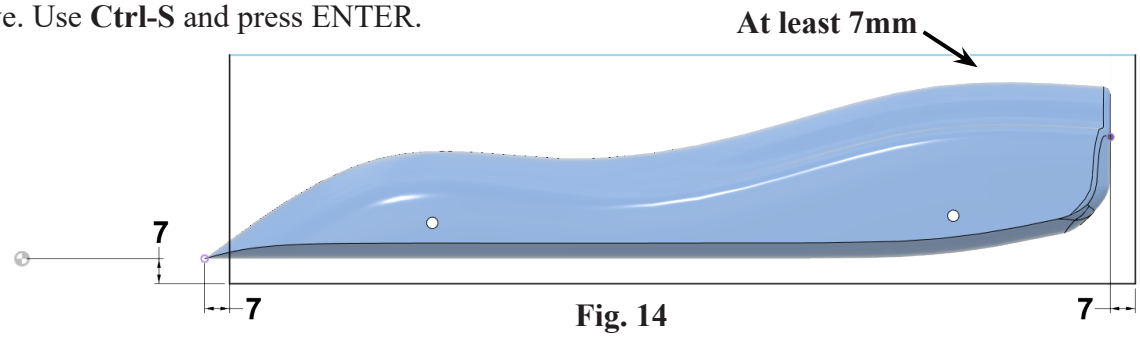


Fig. 14

C. Create Mirror Plane.

Step 1. Expand **Origin** in the Browser, **right click XY Plane** and click **Offset Plane**, **Fig. 15**.

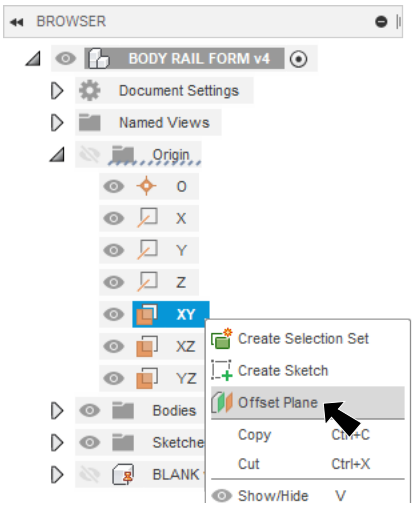


Fig. 15

Step 2. In the Offset Plane panel set, **Fig. 16**
Distance **34**
click OK.

Step 3. Save. Use **Ctrl-S** and press ENTER.

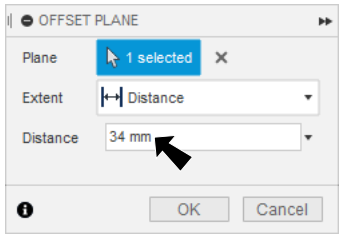


Fig. 16

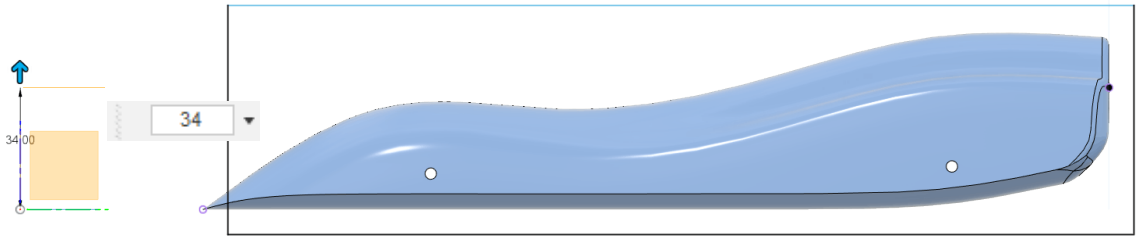


Fig. 17

D. Switch to the Manufacture Workspace.

Step 1. Switch to the Manufacture workspace. To switch, click Design DESIGN in the Change Workspace toolbar and click **Manufacture** MANUFACTURE from the menu.

E. Create Left Cut View.

Step 1. While still in Right view, on the View Cube 

click **triangle** **on left of cube**, **Fig. 18**.

Fig. 18

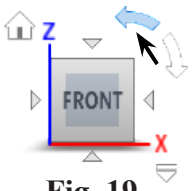


Fig. 19

Fig. 20

Step 2. On the View Cube 

click **CCW arrow**  , **Fig. 19**.

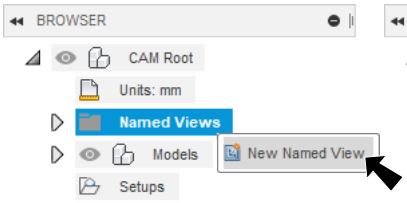
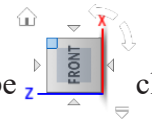


Fig. 21

Step 3. On the View Cube 

click **top left corner** **(vertex)**, **Fig. 20**.

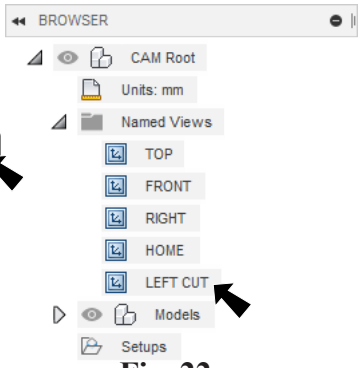


Fig. 22

Step 4. **Right click Named Views** in the Browser and click **New Named View**, **Fig. 21**.

Step 5. Rename the view **LEFT CUT**. To rename, slowly double click name and key-in LEFT CUT, **Fig. 22**.

F. Setup.

Step 1. On the Milling tab MILLING click **Setup** in the Setup area of toolbar.

Step 2. In the Setup panel set:

on **Setup tab** Setup **, Fig. 23**
under Work Coordinate System (WCS)
Orientation **Select Z axis/plane & X axis**
Z Axis click **red X axis at Origin, Fig. 24**
Origin **Selected point**
click **top endpoint of line in Sketch4, Fig. 25**

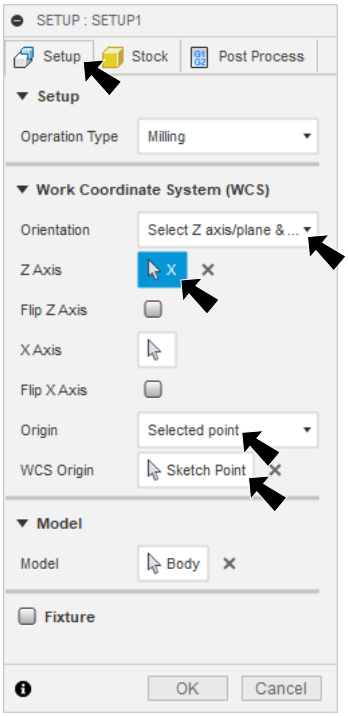


Fig. 23

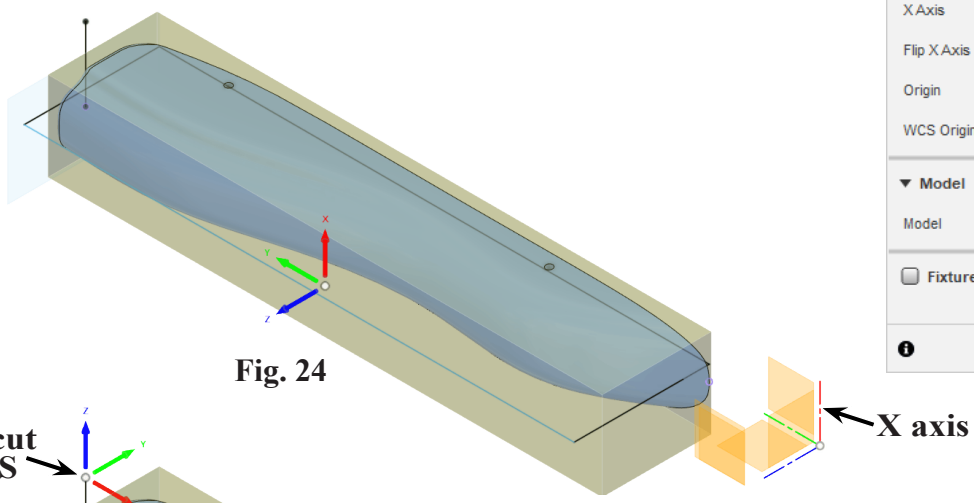


Fig. 24

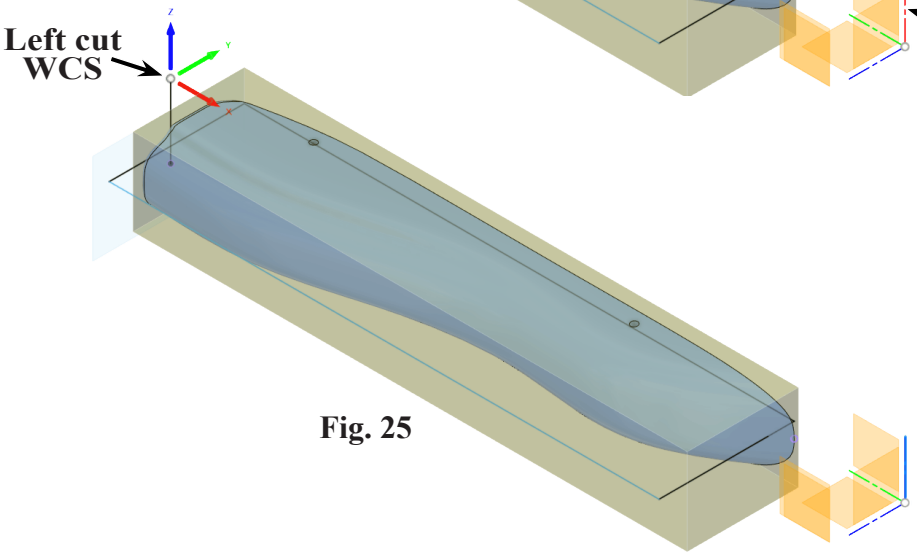


Fig. 25

Step 3. In the Setup panel set:

click **Stock tab** Stock, **Fig. 26**

under Stock

Mode **From solid**

Stock Solid **expand Models** in **Browser**, **expand Body Rail Form** and click **Blank**, **Fig. 27**

click OK.

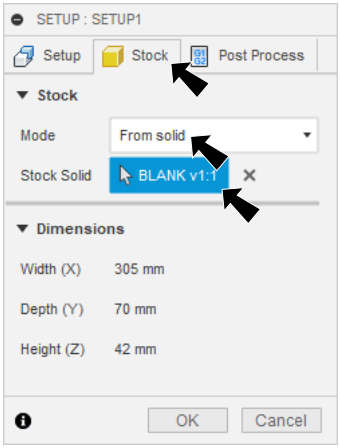


Fig. 26

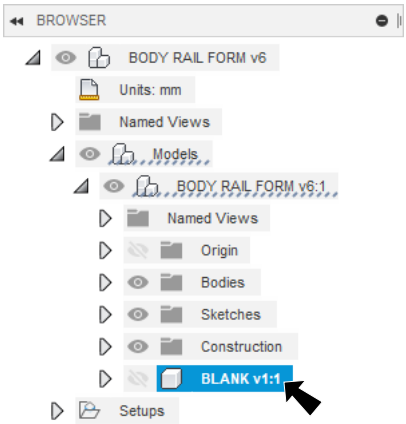


Fig. 27

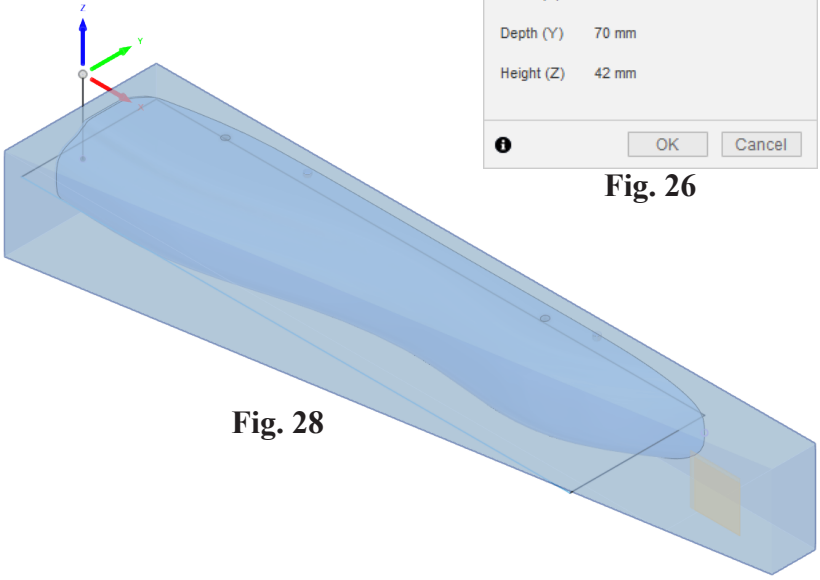


Fig. 28

Step 4. Save. Use **Ctrl-S** and press ENTER.

G. Left Cut Toolpath.

Step 1. On the Milling tab MILLING click Scallop in the 3D area of the toolbar.

Step 2. In the Scallop panel set:

on **Tools tab**, **Fig. 29**

under Tool

click **Select**

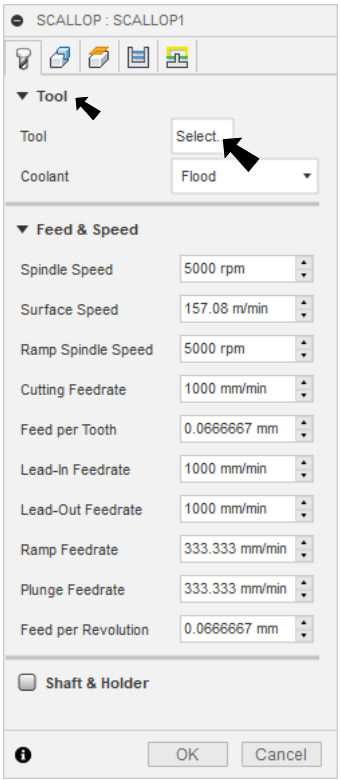


Fig. 29

Step 3. In the Select Tool dialog box:
under Libraries, **Fig. 30**
select **Metric - Aluminum**
click **Type** button at top
select **Ball** 

, **Fig. 31**
click OK
select **6 mm Ball Endmill**, **Fig. 32**
click OK.

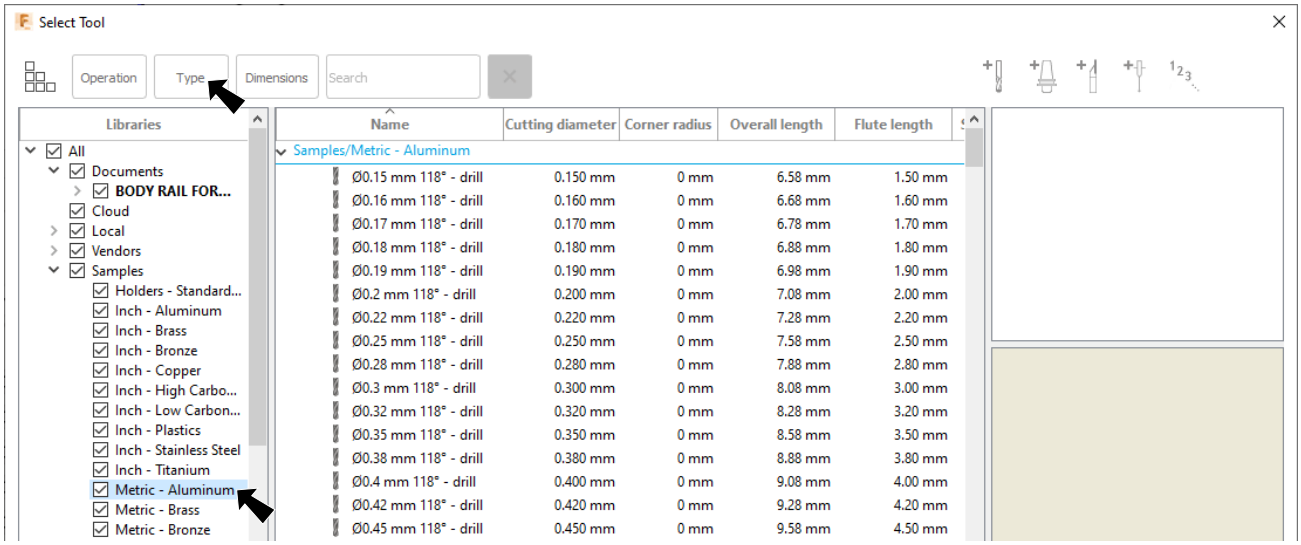


Fig. 30

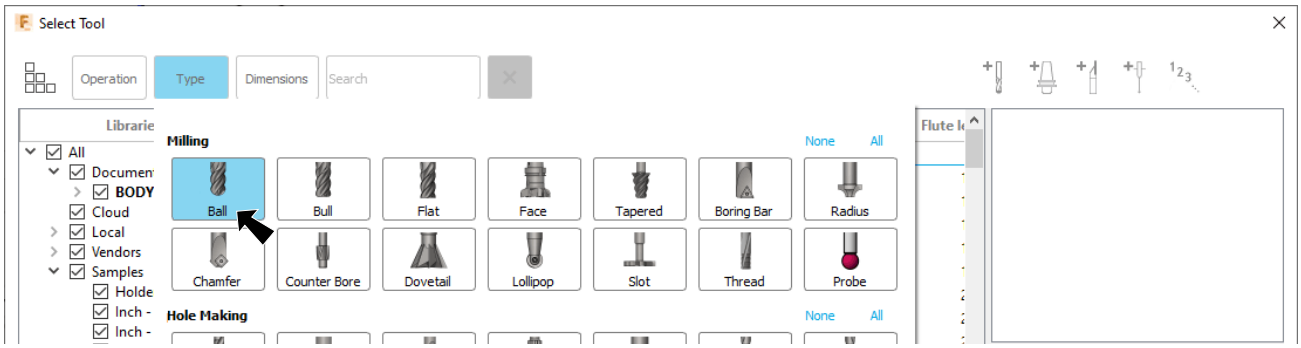


Fig. 31

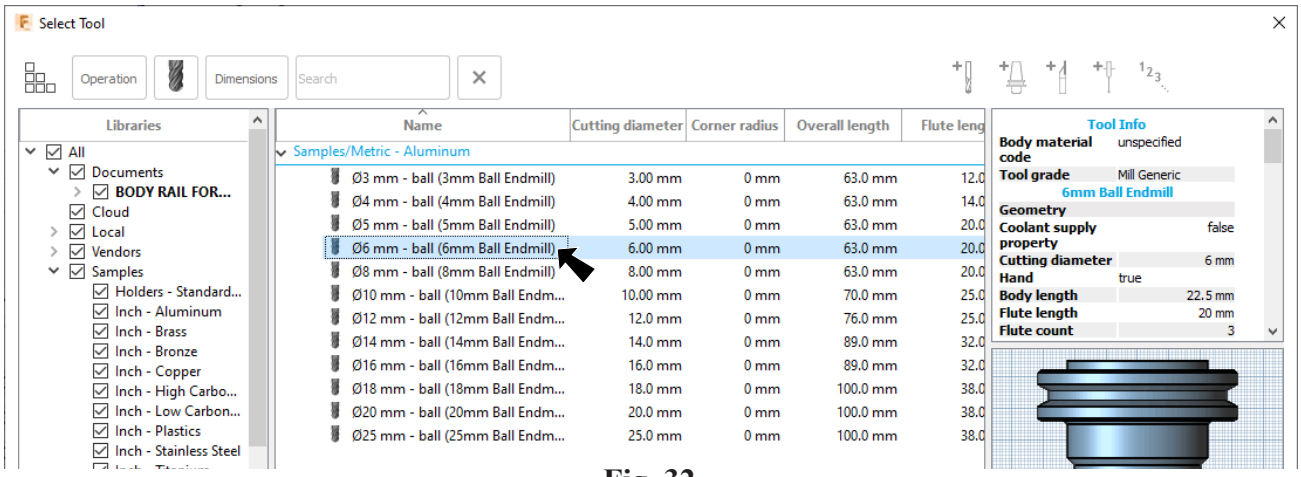


Fig. 32

Step 4. Back in Scallop panel set:

on **Tools tab** , **Fig. 33**
Coolant **Disabled**
under Feed & Speed
Cutting Feed rate **300**
Plunge Feed rate **200**

under Shaft & Holder
Shaft and Holder Mode **Detect tool length**
Holder Clearance **3**

Step 5. In the Scallop panel set:

on **Geometry tab** , **Fig. 34**
under Geometry
Machining Boundary **Selection**
click **rectangle sketch**, Sketch 5, **Fig. 35**

under Avoid/Touch Surfaces
Avoid/Touch Surfaces
select **cartridge hole cylindrical surface, to select, click** and **hold on car body over cartridge hole and select Face**, **Fig. 36**
Avoid/Touch Surface Clearance **3**

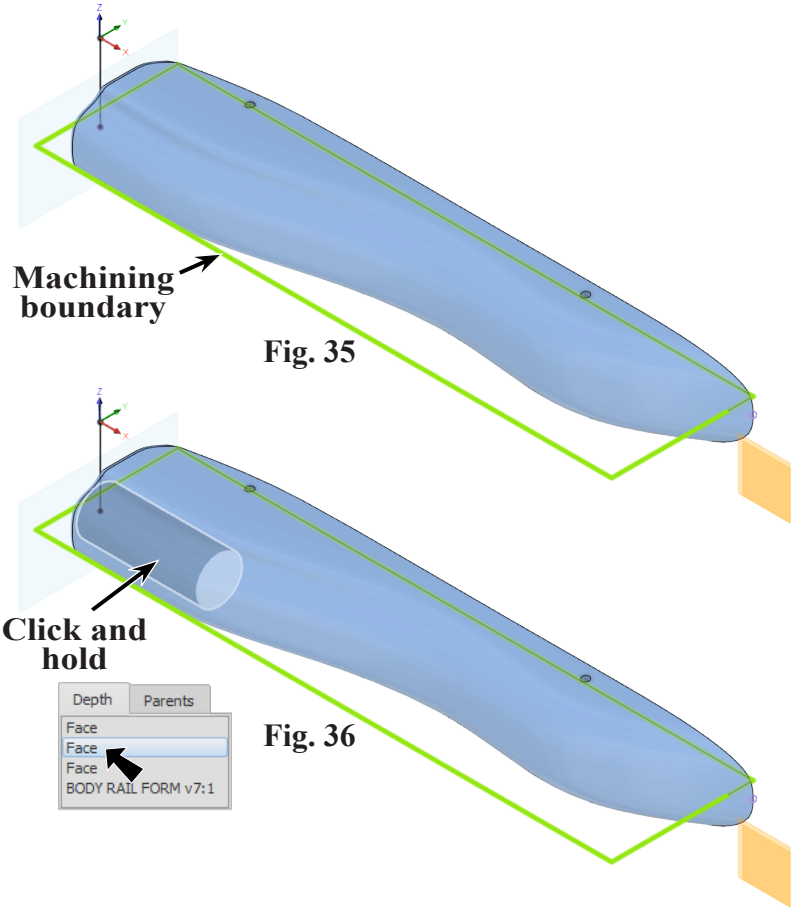


Fig. 35

Fig. 36

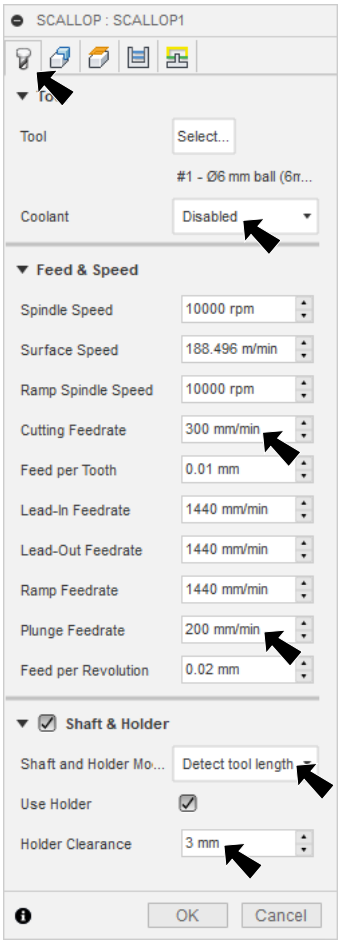


Fig. 33

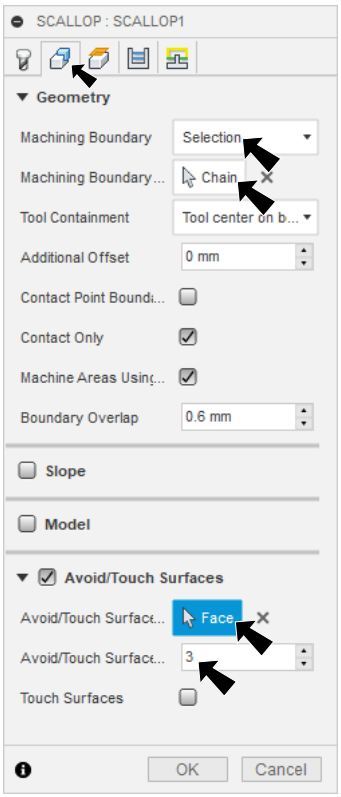


Fig. 34

Step 6. In the Scallop panel set:

on **Heights tab**  , **Fig. 37**

under Clearance Height
- From **Retract height**
- Offset **2**

under Retract Height
- From **Stock top**
- Offset **2**

under Top Height
- From **Stock top**
- Offset **0**

under Bottom Height
- From **Model bottom**
- Offset **18**

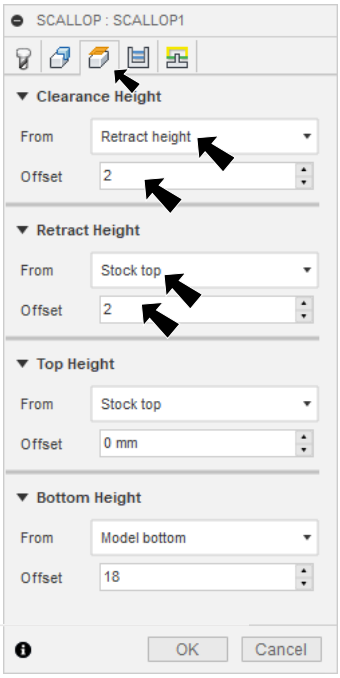


Fig. 37

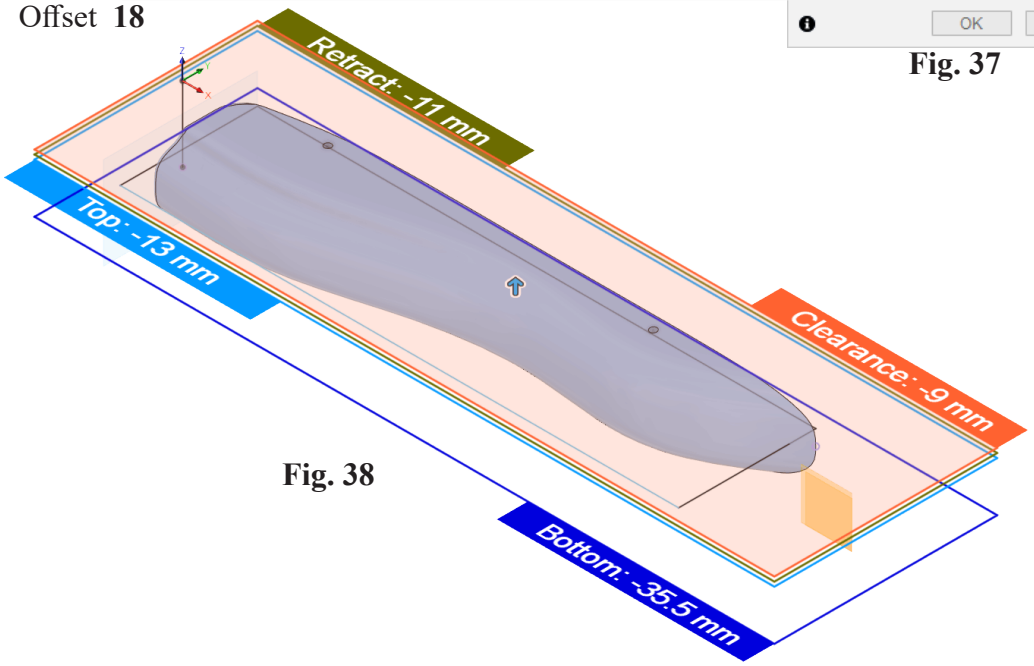


Fig. 38

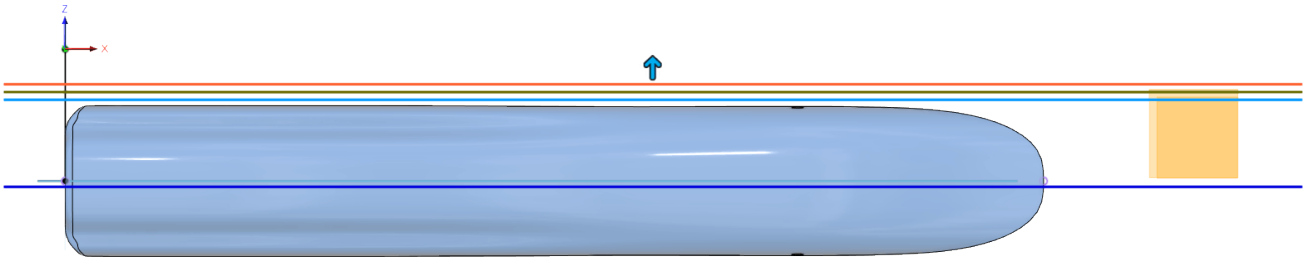


Fig. 39

Step 7. In the Scallop panel set:

on **Passes tab** , **Fig. 40**

under Passes

Inside/Outside Direction **Inside - Out**

Stepover **1**

Direction **Both ways**

Up/Down Milling **Down milling**

under Stock to Leave

0

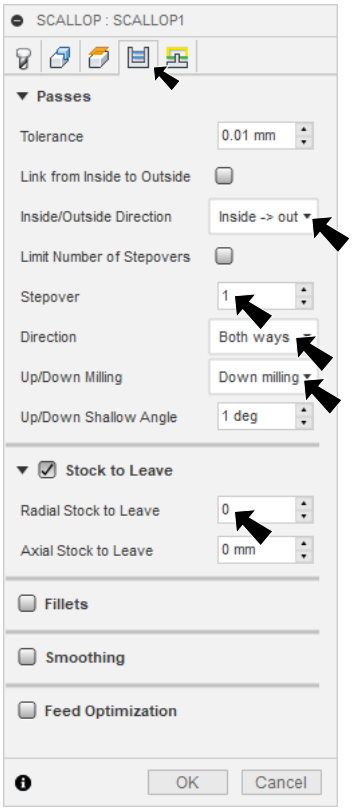


Fig. 40

Step 8. In the Scallop panel set:

on **Linking tab** , **Fig. 41**

under Linking

Retraction Policy **Minimum retraction**

under Leads & Transitions

0

click OK.

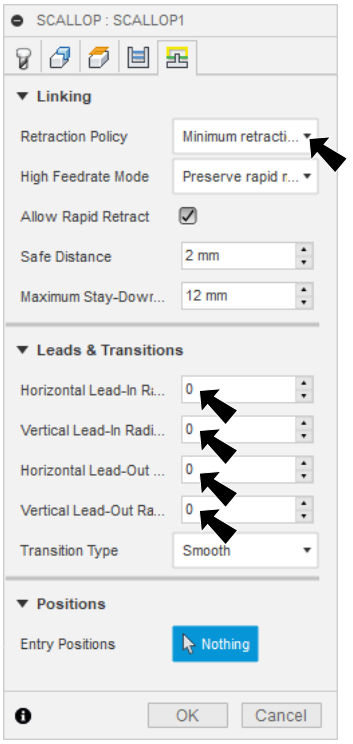


Fig. 41

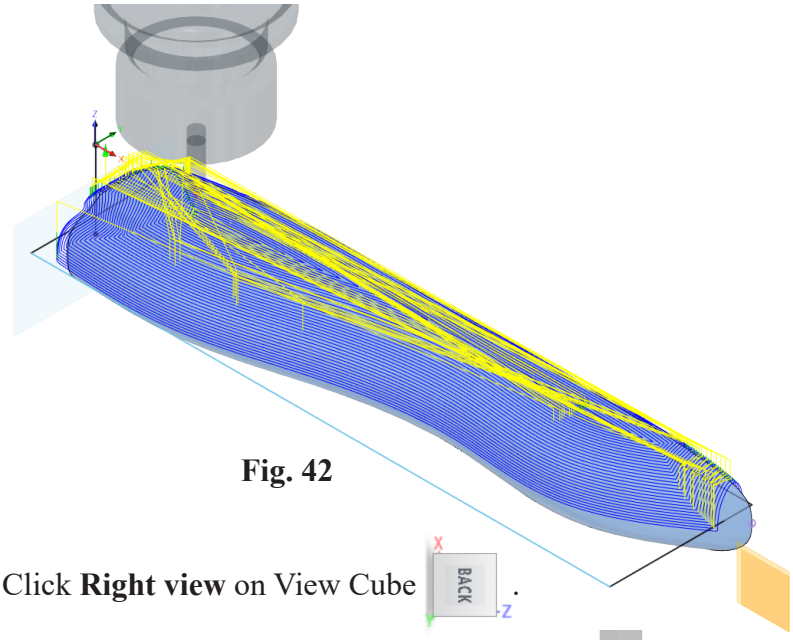


Fig. 42

Step 9. Click **Right view** on View Cube

.

Step 10. Confirm **toolpath avoids rear surface and does not pass across the cartridge hole**, **Fig. 43**.

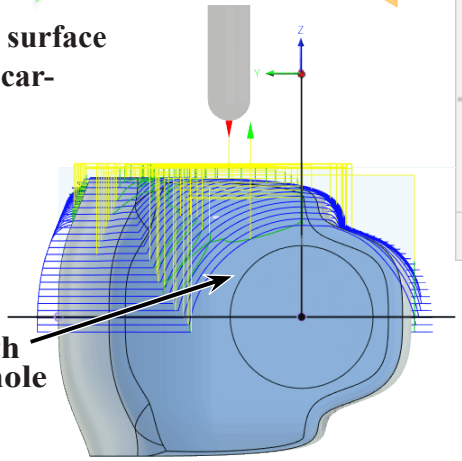


Fig. 43

H. Simulate.

Step 1. Switch back to **LEFT CUT view** and **select Scallop toopath** in the Browser, **Fig. 44**.

Step 2. On the Milling tab MILLING click **Simulate** in the Actions area of toolbar.

Step 3. In the Simulate panel set:
under Toolpath, **Fig. 45**
Mode **Tail**
under Stock
Mode **Standard**
click **Start** at bottom of canvas, **Fig. 46**
Close.

Fig. 46

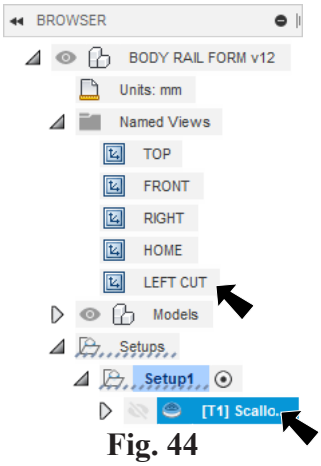


Fig. 44

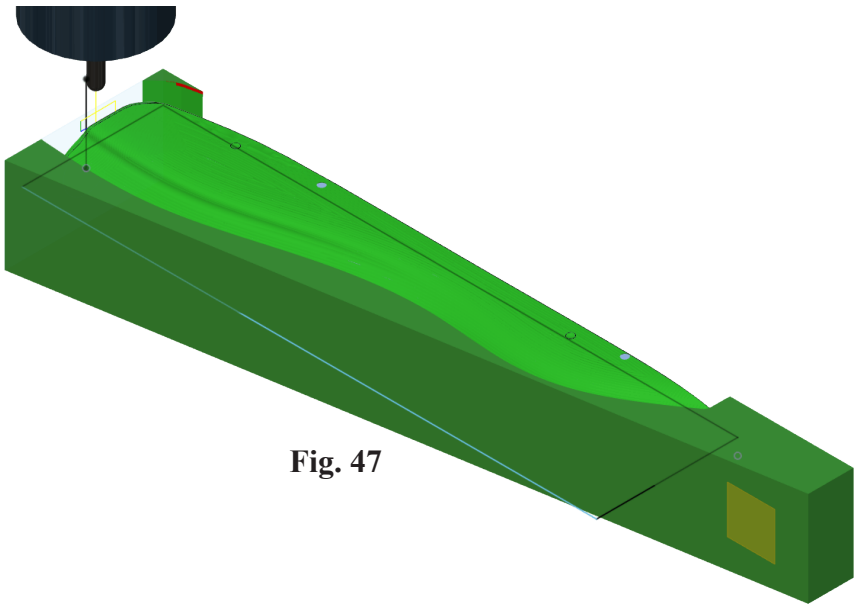


Fig. 47

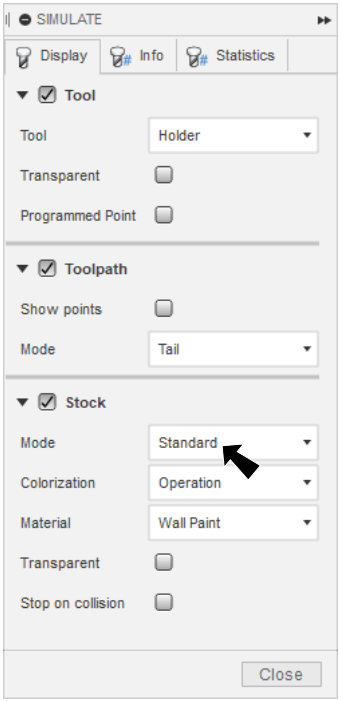


Fig. 45

I. Mirror Toolpath.

Step 1. **Right click Scallop1 Toolpath** in the Browser and click **Duplicate (Ctrl-D)**, **Fig. 48**.

Step 2. **Right click Scallop 1(2) Toolpath** and click **Add to New Pattern**, **Fig. 49**.

Step 3. In the Pattern panel set
under Pattern, **Fig. 50**
Pattern Type **Mirror pattern**
Mirror Plane **click the new Plane in canvas**, **Fig. 51**
uncheck **Keep Original**
click OK.

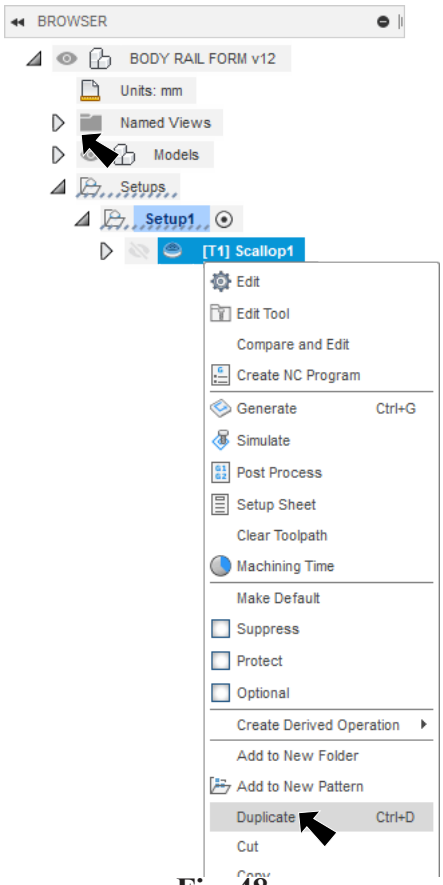


Fig. 48

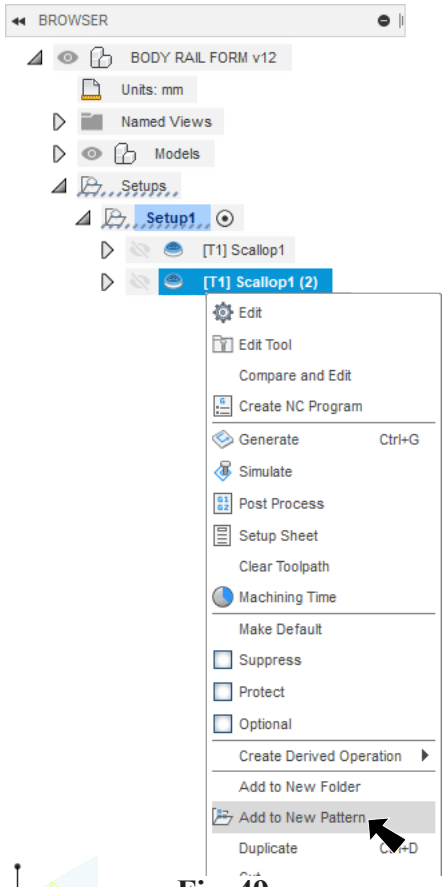


Fig. 49

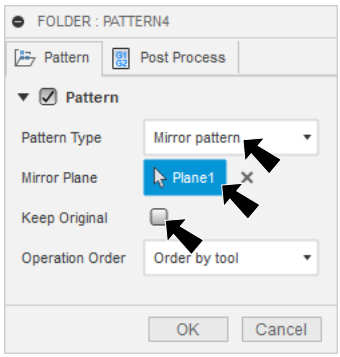


Fig. 50

Step 4. Save. Use **Ctrl-S** and press ENTER.

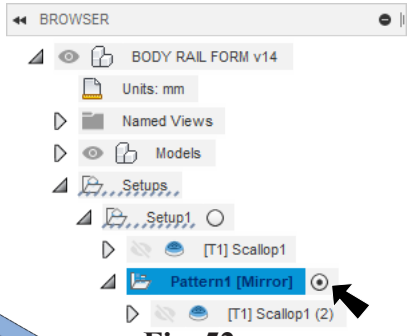


Fig. 52

Tip: For Mirror toolpath **Activate Pattern**, **Fig. 52**.

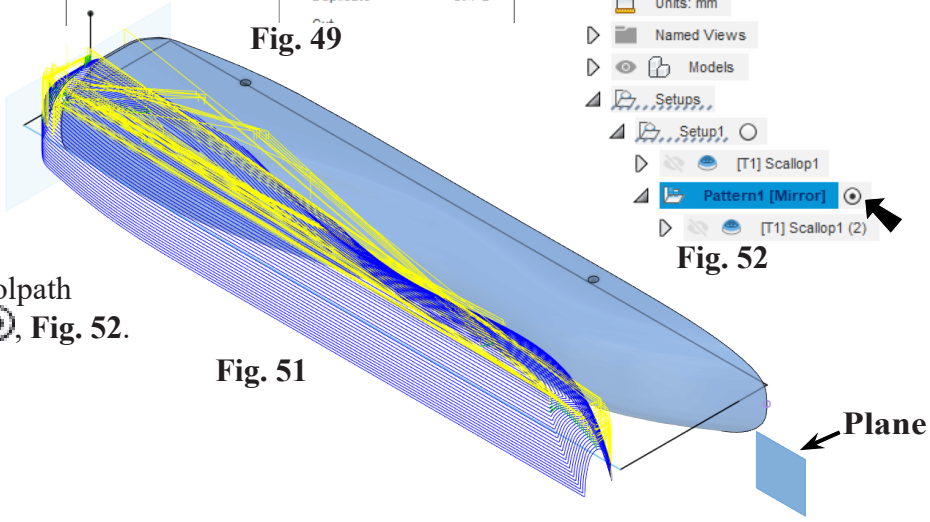


Fig. 51