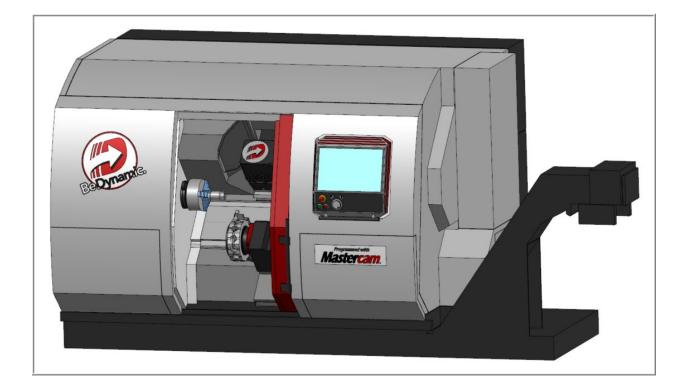
## *Mastercam* 2023 Training Guide



## MILL-TURN LESSON-1

## camInstructor

#### Objectives

This lesson will start with the initial setup of Mill-Turn for Mastercam 2023. Following the Mill-Turn setup this lesson will step you through a quick Mill-Turn workflow example with some basic turning on the main and sub spindles. We will use both the lower turret and upper B-axis head for turning and with be using a POCO routine to transfer the stock from the main to sub spindle.

#### Initial set up of Mill-Turn for MasterCam:

Importing .machine files to correct location. Add .machine file to Machine Type.

#### Job setup:

Make adjustments in the Job Setup for Mill-Turn.

#### Main spindle turning:

Face with lower turret. OD rough with upper B axis head. OD finish with lower turret.

#### **POCO (Pick off cut off):**

Transfer the part to the sub spindle.

#### Sub spindle turning:

Face with lower turret. OD rough with upper B axis head. OD finish with lower turret.

#### Syncing:

Syncing ops to create efficient programs and avoid crashes.

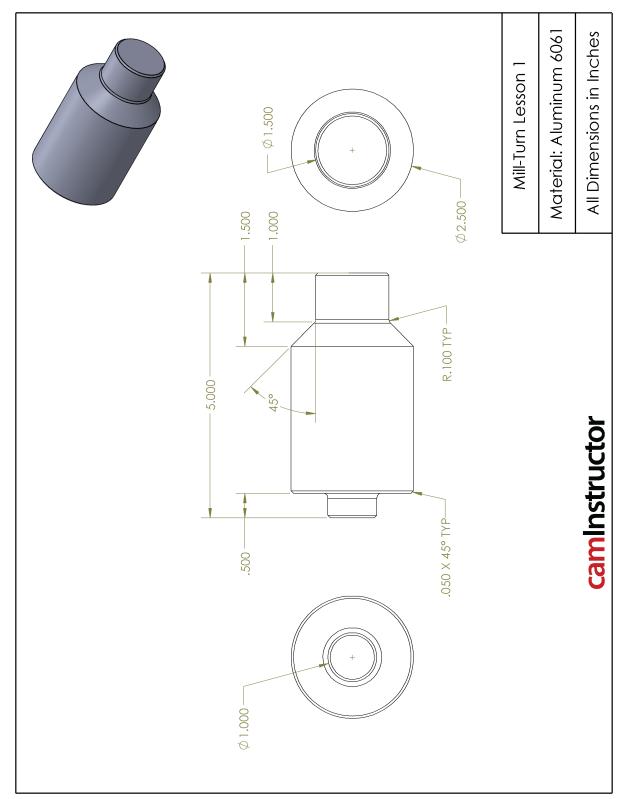
#### Simulation:

Final verification of the machining process using complete machine verification.

#### Posting:

Additional settings before posting and view code in dual stream

#### MILL-TURN LESSON-1 DRAWING



#### **INSTALLING A MACHINE FOR MILL-TURN**

- ➡ The Generic Fanuc Mill-Turn LTZ will be used in this lesson. You can use another suitable machine if desired.
- 1. Copy .machine file/files into the \shared Mastercam 2023\Mill Turn\machines folder if needed. Mastercam 2023 standard installation should include .machine files shown below.

C:\Users\Public\Documents\S	nared Mastercam 2023\Mill Turn			~	С
Name	Date modified	Туре	Size		
📒 machines		File folder			
늘 tools		File folder			

^			1	
lame	Date modified	Туре	Size	
🧧 Generic Fanuc Lathe DS		File folder		
Generic Fanuc Mill-Turn LTZ		File folder		
🗓 Generic Fanuc Lathe DS.machine		Mastercam Machi	6,578 KB	
🗓 Generic Fanuc Lathe TC.machine		Mastercam Machi	6,509 KB	
🗓 Generic Fanuc Lathe.machine		Mastercam Machi	6,455 KB	
🗓 Generic Fanuc Mill-Turn LTX.machine		Mastercam Machi	6,878 KB	
🗓 Generic Fanuc Mill-Turn LTZ.machine		Mastercam Machi	9,011 KB	
🗓 Generic Fanuc Mill-Turn SR.machine		Mastercam Machi	7,038 KB	
🗓 Generic Fanuc Mill-Turn SR2.machine		Mastercam Machi	7,079 KB	
🗓 Generic Fanuc Mill-Turn SR-Tandem.mac		Mastercam Machi	7,151 KB	
🗓 Generic Fanuc Mill-Turn TC.machine		Mastercam Machi	6,935 KB	
🗓 Generic Fanuc Mill-Turn TT.machine		Mastercam Machi	9,115 KB	
🗓 System Inch.machine		Mastercam Machi	418 KB	
🗓 System MM.machine		Mastercam Machi	418 KB	

#### ADDING .MACHINE FILE

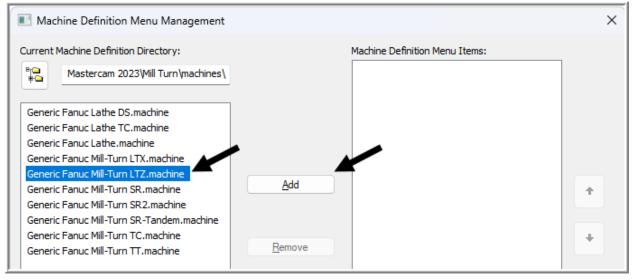
- For these lessons we will be using the Generic Fanuc Mill-Turn LTZ machine. The steps here will be the same no matter what machine you are using.
- 1. Open Mastercam and select Machine > Mill-Turn > Manage list

File	Ho	me W	/ireframe	Surfa	ces !	Solids	Model P	rep I	Mesh	Drafting	Trans	sfe	Mac	hine
Mill	Lathe	Mill-Turn	-	Router De	sign	Control			Mill Tool Manager		Verify	Simulate	G1 Generate	Create
		Mar	nage List	-			Job Se	tup		Si	mulator	Γy	Post	

2. Click the **folder** button in the top left corner and navigate to the **\shared Mastercam 2023\Mill Turn\machines** folder if you do not see the Generic Fanuc Mill-Turn LTZ machine on the list.

Browse For Folder	×
Select a new MD directory	
MATERIALS	
🗸 🚞 Mill Turn	•
> 🧰 machines	
tools	
NESTING	
Folder: machines	
Make New Folder OK Cancel	

#### 3. Select the machine file and click Add.



4. Click **OK**.

### MILL-TURN LESSON-1- THE PROCESS

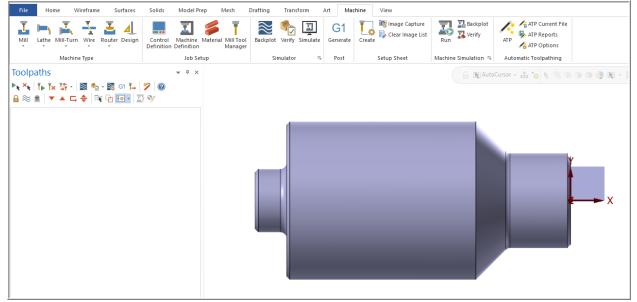
- **TASK 1:** Import the solid model and select the machine type
- TASK 2: Job setup
- **TASK 3:** Main spindle turning
- TASK 4: POCO (Pick Off Cut Off)
- **TASK 5:** Sub spindle turning
- TASK 6: Machine syncing
- **TASK 7:** Machine simulation
- TASK 8: Posting code

#### TASK 1: IMPORT THE SOLID MODEL AND SELECT MACHINE TYPE

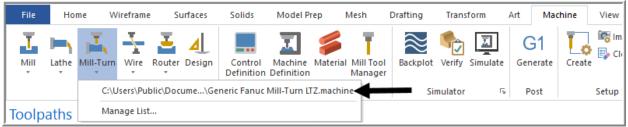
- We will start Mastercam in a **blank document** then open our solid model followed by selecting our Mill-Turn machine from the Machine Type menu.
- 1. Launch Mastercam.
- 2. Open the solid for Lesson 1. **militurn lesson1.x\_t** If you have the online course download this file from the website.

🔧 Open					×
$\leftarrow \  \  \rightarrow \  \   \land \  \   \land$	<mark></mark> «»	Mill-Turn Lesson 1 > Mastercam Files	~ C	Q Search Masterca	m Files
Organize 🔻 New f	folder			≣ •	
合 Home		Name	Date modified	Туре	Size
<ul> <li>Desktop</li> <li>Downloads</li> <li>Documents</li> <li>CamInstructor</li> <li>Mill2D</li> <li>Mill3D</li> </ul>	* * * * *	millturn lesson1.x_t		SldWorks 2022 Ap	7 КВ
Fi	le name:	millturn lesson1.x_t	Options	Parasolid Files (*.x_t;*. Open	x_b;*.xmt ∨ Cancel

Note: You should have just the solid in your file, no machine group.

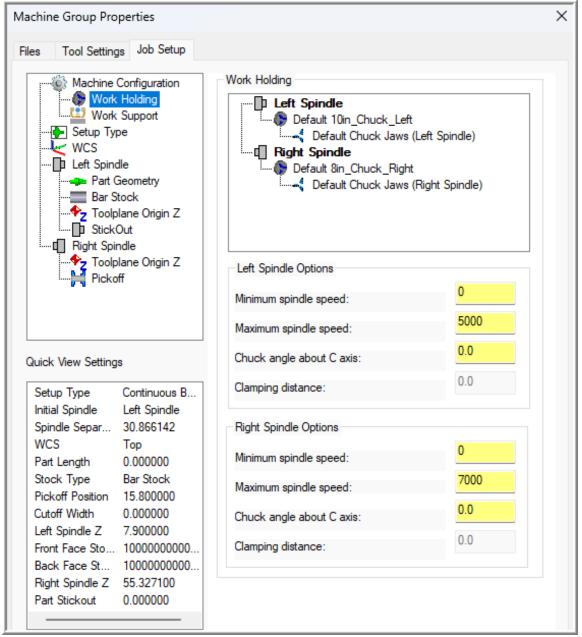


 Select the Mill-Turn machine. Machine > Mill-Turn > Generic Fanuc Mill-Turn LTZ.machine. Mastercam will now launch Mastercam Code Expert which we will be using later.



• If **Code Expert** opens, this can be minimized for now.

4. Mastercam will now automatically launch the Job Setup dialog box.



#### TASK 2: JOB SETUP

● In this task you will work through the Job Setup dialog.

To simplify job setup, Mastercam Mill-Turn uses a top to bottom series of steps. The order of these steps serves two main purposes.

- 1. Makes it easier to for the end user and guide them through the process.
- 2. Help Mill-Turn automate the display of appropriate and logical parameters based on previous settings.

This interface workflow reduces the chance that a user will enter a parameter that does not make sense and limits instances of error.

The general Job Setup workflow:

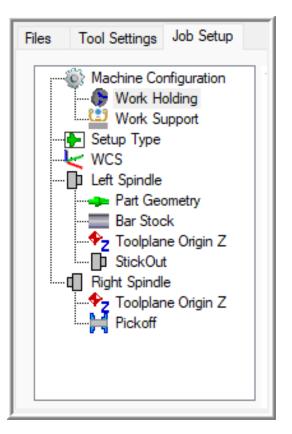
- Work Holding Select chucks, jaws, and collets
- Work Support Select steady rest when applicable
- Setup Type Assign the spindle the work will start in and part handling
- S WCS Sets the Work Coordinate System
- Left Spindle
  - Part Geometry Define your part
  - Bar Stock Define the type of stock

 $\circ$   $\,$  Toolplane Origin Z – Set toolplane origin based on part geometry

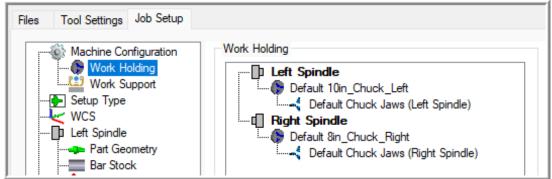
- Stick Out Define bar stock projection from chuck face or jaws
- Right Spindle

   Toolplane Origin Z Set toolplane origin based on part geometry
- Pickoff Set pickoff position and tool for cut off

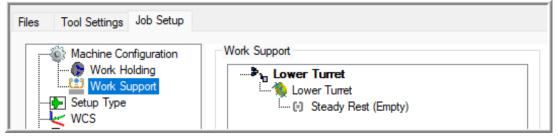
**Note:** Left spindle and right spindle order are determined by the initial spindle selection under Setup Type.



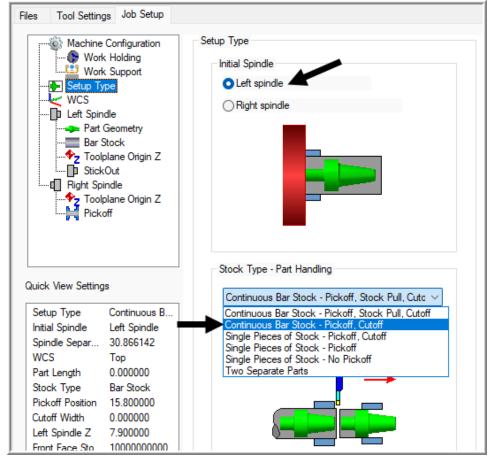
1. Work Holding – Use the default values for left and right spindle chucks.



#### 2. Work Support - Leave work support empty



3. Setup Type – Initial Spindle set to Left and Stock Type – Part Handling set to Continuous Bar Stock – Pickoff, Cutoff.



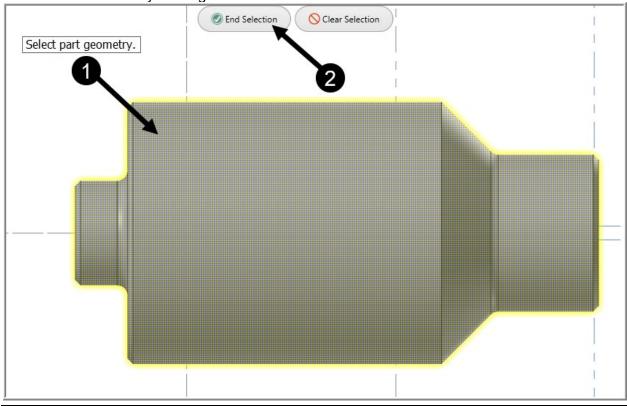
4. WCS - Ensure the work coordinate system is set to TOP

Files Tool Settings Job Setup			
Machine Configuration Work Holding Work Support Setup Type WCS Left Spindle Part Geometry Bar Stock	Group name: WCS Top	Machine Group-1	

5. **Part Geometry** – Select your part model. Mastercam will pull dimensions from the model for other Job Setup settings. The model will also be used in simulation and in the Sync Manager.

Files Tool Settings Job Setup	-
Machine Configuration	Part Geometry
Work Holding	Show
Setup Type	Delete previously created geometry
Left Spindle	
Part Geometry	Create Right Spindle Geometry

6. Select the solid by clicking on it. Hit End Selection.



Mill-Turn Lesson-1 - 10

7. Enable the options to Create Right Spindle Geometry and Create turn profiles. For the geometry, select Offset by and enter 100. This will put this model on the same level as the original model +100. So, if the original is on level 1 the created model will be on 101. For the turn profile, set computation method to Spin and set the Level to 20. Changing the color for the turn profile to something unique will help to distinguish it later.

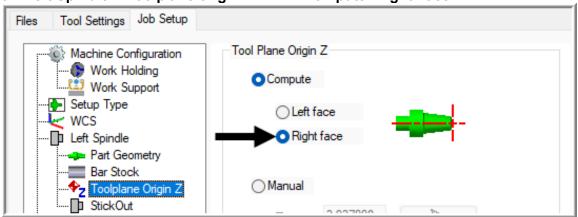
Files Tool Settings Job	Setup		
Machine Configur. Work Holding Work Support Setup Type WCS Left Spindle Part Geometry	Delete previously	Show	<b>Spin:</b> The part geometry is rotated around an axis. The profile is generated from the
Bar Stock 		1 Select	furthest extents of the spin.
	o Offset by:	100	<b>Slice:</b> The part geometry is sliced in the
Quick View Settings	Create tum profiles	Spin	lathe ZX (WCS XY) plane. The profile is limited to what the slice
Initial Spindle Left Spi Spindle Separ 30.866	142	Slice	encounters and may not include the full extents of
WCS Machin Part Length 5.0000 Stock Type Bar Sto Pickoff Position 15.800	00 ck Level: 20	Select	the part geometry.
Cutoff Width 0.0000 Left Spindle Z 7.9000	00 Attributes		

8. Bar Stock – You can set your stock type, number of parts, outside diameter, inside diameter and amount of extra stock here. Set the number of parts to 1. Mastercam will read the OD from the model and round up to the next closest stock size. We are not going to turn the OD so set it back to 2.50. Add 0.05 extra stock to the face and to the back.

Files Tool Settings Job Setup					
Machine Configuration	Stock				
Work Holding	Geometry:	Bar Stock	$\sim$		
WCS	Number of parts:	1			Geometry selection is based on previous
Part Geometry	Outside Diameter				choices made in Job
Bar Stock	Diameter:	2.5	Ø	Θ	Setup. Since we have
StickOut	Extra stock:	0.0			selected continuous bar stock – pickoff, cutoff in
Toolplane Origin Z	Inside Diameter				setup type we are limited to bar stock
	Diameter:	0.0	11	$\Theta$	geometry.
	Extra stock:	0.0			
Quick View Settings	5 (0.1				
Setup Type Continuous B	Face / Back	_			
Setup Type Continuous B Initial Spindle Left Spindle	Extra face stock:	0.05			
Spindle Separ 30.866142 WCS Machine Gro	Extra back stock	0.05			

us bar

Mill-Turn Lesson-1 - 11



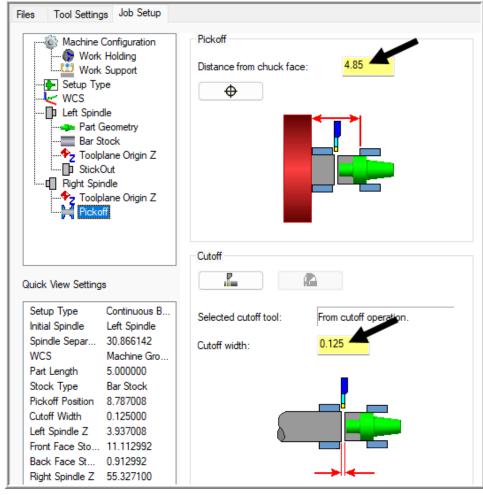
9. Left Spindle – Toolplane origin Z. Set to Compute>Right Face.

 Stickout is calculated from the face of the chuck or jaw. We want the entire part outside of the chuck so we can turn and part off in one setup (no additional pulls). Part length is 5.00, 0.05 stock on front and back face, 0.125 part off blade, 1.750 jaw length and 0.375 clearance results in a part Stickout of 7.35. Enter this value in the Chuck Face: box.

Files Tool Settings Job Setup	
Machine Configuration	Part stickout Distance from
Work Support	Chuck face: 7.35
Left Spindle	Jaws: 5.224016
Bar Stock	•

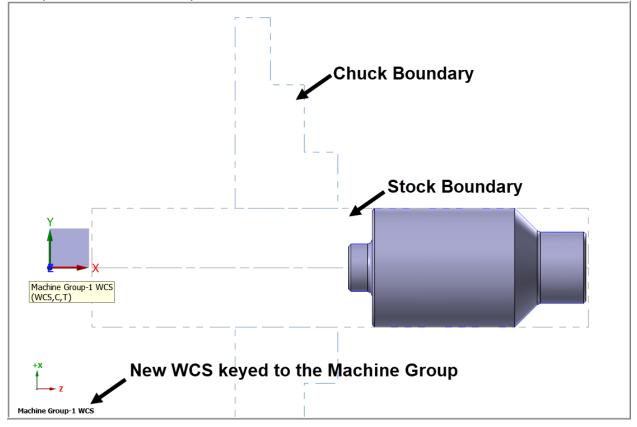
11. **Pickoff** – We need to calculate our pick off point. The diameter on the left is 0.50 long, plus the chamfer of 0.050 so we need to be sure to stay clear of that. We should be safe grabbing the part close to the mid-point. The left face is at 7.35 (our previous setting) and if we subtract half the length of our part (7.35 - (5.0/2) = 4.85). Enter this value in the **Distance from chuck face**.

Cutoff – set the cutoff width to 0.125 (the width of our part off tool).



12. Click **Ok** to complete the Job Setup.

13. **Review of Job Setup Results.** Look at what Mastercam has done so far because of the Job Setup inputs. Mastercam creates a **new WCS** which is a copy of WCS-Top and has the origin set at machine zero as defined in your machine setup. You can also see **chuck** and **stock boundaries** on **both spindles** as well as the new solid. These are generated using inputs from the Job Setup.



14. Mastercam will also **create view sheets** for each spindle. You may need to turn viewsheets on. To do so, **View > Viewsheets > On/Off** 

View 🗲	di Mil	ling										
Advanced Display +	L::       Toolpaths         L::       Solids         L::       Planes		E Groups	Show	Show Gnomons*	Show Tool *	Show Grid	Snap to Grid	Rotation Position	On/Off	Restore Bookmar <b>≩</b> Restore Booki	
Toolpaths 🕫		Managers			Display	Гъ	Gri	d 🖙	Controller	Vie	ewsheets	Γ <sub>3</sub>

Machine Group-1 WCS	elect tab to change Viewsheet
Viewsheet-1 TMachine Group-1.Left	📜 Machine Group-1.Right 📜 Machine Group-1.Both +
	SECTION VIEW: OFF SELECTED ENTITIES: 0

15. Mastercam also **creates planes** that relate to standard programming orientations for both the main (left) and sub (right) spindles. The origins of these planes are keyed to the locations selected in the Job Setup.

Image: Second	Planes 🔹							
✓       Top         Front       Back         ✓       Bottom         Right       Left         Isometric       Isometric         Isometric reverse       ✓         ✓       Tool Spindle - Machine Orient.         ✓       Machine Group-1 WCS         ✓       Machine Group-1.Turning.Left.Upper 1         ✓       Machine Group-1.Turning.Left.Lower 1         ✓       Machine Group-1.Face Mill.Left 1         ✓       Machine Group-1.Face Mill.Left 1         ✓       Machine Group-1.Axis Sub.Left 1         ✓       Machine Group-1.Turning.Right.Upper 1         ✓       Machine Group-1.Face Mill.Right 1         ✓       Machine Group-1.Axis Sub.Right 1	÷-1	🖦 - Q - 🚍 🗠 🗐 🔅 - 🖏 - 🕼	- t2	2 • 🖉				
Front         Back         ✓         Bottom         Right         Left         Isometric         Isometric reverse         ✓         Tool Spindle - Machine Orient.         ✓         Machine Group-1 WCS         3       WCS         C       T         Machine Group-1.Turning.Left.Upper 1         ✓       Machine Group-1.Face Mill.Left 1         ✓       Machine Group-1.Face Mill.Left 1         ✓       Machine Group-1.Cross Mill.Left 1         ✓       Machine Group-1.Turning.Right.Upper 1         ✓       Machine Group-1.Face Mill.180.Left 1         ✓       Machine Group-1.Face Mill.180.Right 1         ✓       Machine Group-1.Axis Sub.Right 1	Name		G	WCS	С	т		
Back Bottom Right Left Isometric Isometric reverse Tool Spindle - Machine Orient. Machine Group-1 WCS Machine Group-1.Turning.Left.Upper 1 Machine Group-1.Turning.Left.Upper 1 Machine Group-1.Face Mill.Left 1 Machine Group-1.Face Mill.Left 1 Machine Group-1.Face Mill.Left 1 Machine Group-1.Turning.Right.Lower 1 Machine Group-1.Turning.Right.Upper 1 Machine Group-1.Turning.Right.Lower 1 Machine Group-1.Turning.Right.Lower 1 Machine Group-1.Face Mill.Right 1 Machine Group-1.Face Mill.Right 1 Machine Group-1.Face Mill.Right 1 Machine Group-1.Face Mill.Right 1 Machine Group-1.Axis Sub.Right 1 Machine Group-1.Axis Sub.Right 1 Machine Group-1.Axis Sub.Right 1	1	Тор						
<ul> <li>Bottom</li> <li>Right</li> <li>Left</li> <li>Isometric</li> <li>Isometric reverse</li> <li>Tool Spindle - Machine Orient.</li> <li>Machine Group-1 WCS</li> <li>WCS</li> <li>Machine Group-1.Turning.Left.Upper 1</li> <li>Machine Group-1.Turning.Left.Lower 1</li> <li>Machine Group-1.Face Mill.Left 1</li> <li>Machine Group-1.Face Mill.Left 1</li> <li>Machine Group-1.Axis Sub.Left 1</li> <li>Machine Group-1.Turning.Right.Upper 1</li> <li>Machine Group-1.Turning.Right.Upper 1</li> <li>Machine Group-1.Face Mill.180.Right 1</li> <li>Machine Group-1.Face Mill.Right 1</li> <li>Machine Group-1.Face Mill.Right 1</li> <li>Machine Group-1.Axis Sub.Right 1</li> <li>Machine Group-1.Face Mill.Right 1</li> </ul>		Front						
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Left       Isometric         Isometric reverse       Isometric reverse	1	Bottom						
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Isometric reverse         Isometric reverse <t< td=""><td></td><td>Left</td><th></th><td></td><td></td><td></td></t<>		Left						
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	-							
Machine Group-1. Lop Right Spindle	~							
		Machine Group-1, I op Right Spindle						

16. The **names** of the views, WCS and Viewsheets are **keyed** to the **Group name** entered in Job Setup.

Files Tool Settings Job Setup		
Machine Configuration Work Holding Work Support Setup Type WCS Left Spindle Part Geometry	Group name: WCS Top	Machine Group-1

17. Save your file as MillTurnLesson1.

#### TASK 3: MAIN SPINDLE TURNING

**I** In this task you will face the part and turn the OD profile in the main (left) spindle.

1. Facing the part. Select Turning > Face



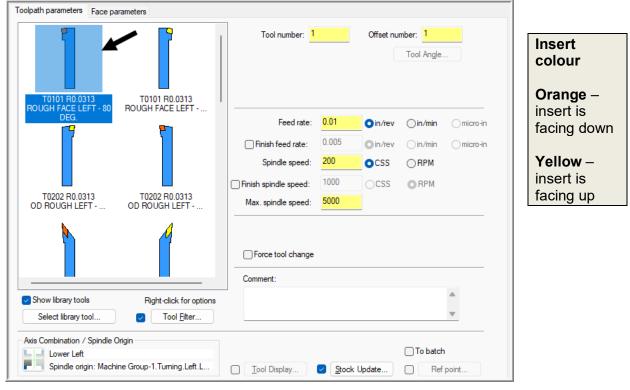
2. When the Lathe Face Properties window opens, select Axis Combination / Spindle Origin by clicking the small graphic.

	Force tool change
	Comment:
Show library tools Right-click for options	
Select library tool 🔽 Tool <u>F</u> ilter	
Axis Combination / Spindle Origin	
🕒 🖃 Upper Left	🗌 To batch
Spindle origin: Machine Group-1.Turning.Left.U	☐ <u>T</u> ool Display
	Generate toolpath

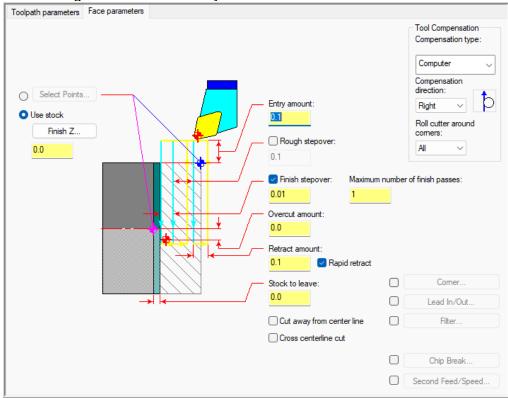
3. This will open the Axis Combination / Spindle Origin window. **Select Lower Left** as we will be using the lower turret to turn on the main (left) spindle. Then hit the **green checkmark** to accept.

			ndle Origin		1		
La i 🚽		1	Name		Origin Z	Work Offset	Display Mode
			Machine Group-1.Face N		11.287008	0	Radial
			Machine Group-1.Turnin	-		0	Radial
Upper Left	Upper Right		Machine Group-1.Turnin	g.Right.Low	30.374016	1	Radial
Lower Left	Lower Right						
		X:	0.0	Work Off		Displa	y Mode
		Z:	11.287008 Z only	Autor		O Rad	

4. On the **Lathe Face Properties** window choose **T0101**. We will not spend time adjusting speeds and feeds. Using defaults will suffice for these lessons.

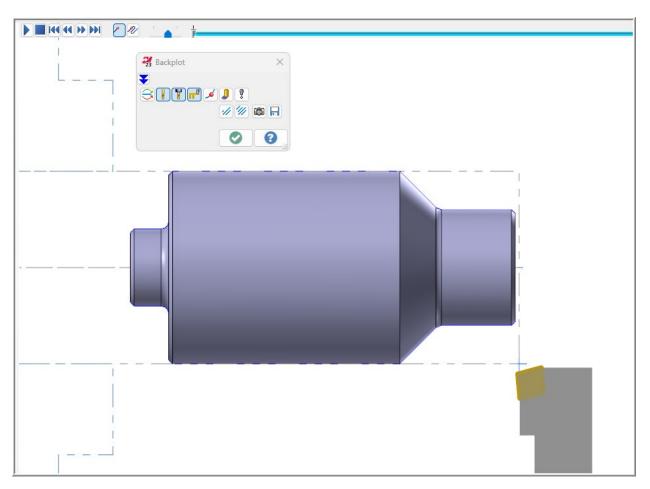


**Note:** The default settings on the **Face Parameters** page will work for our setup. No need to make changes here. Check that yours are the same. Click **Green Checkmark**.

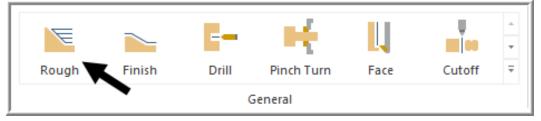


5. You can do a quick **backplot** to check your toolpath now. However, we will hold off on the complete verification until all ops are done.

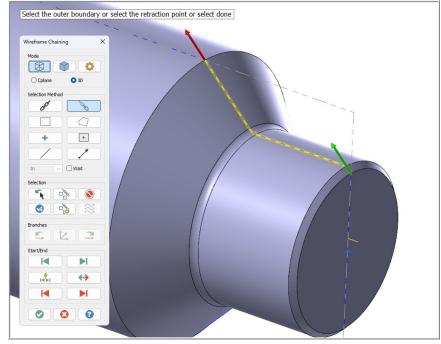




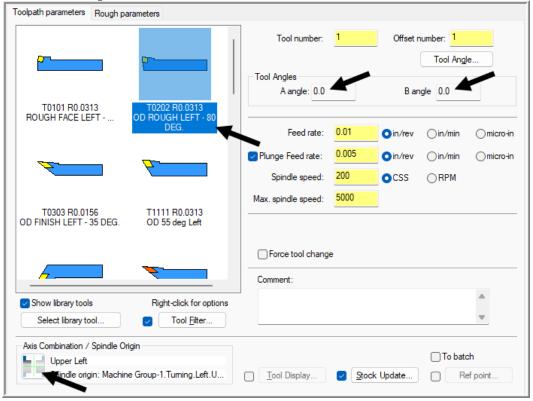
6. Roughing the OD. Select Turning > Rough...



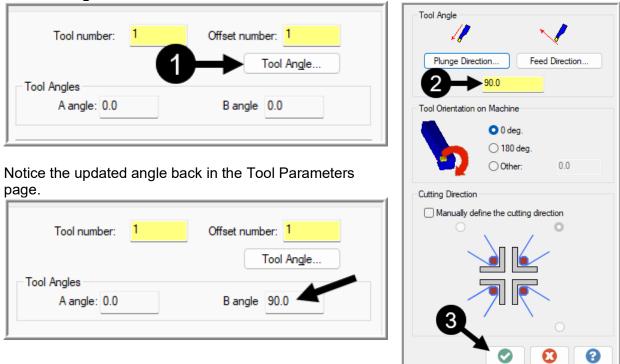
7. Chain from the 0.05 chamfer to the intersection of the taper and the OD. Make sure you chain the geometry on the **upper side of the part**. Hit the green check to accept.



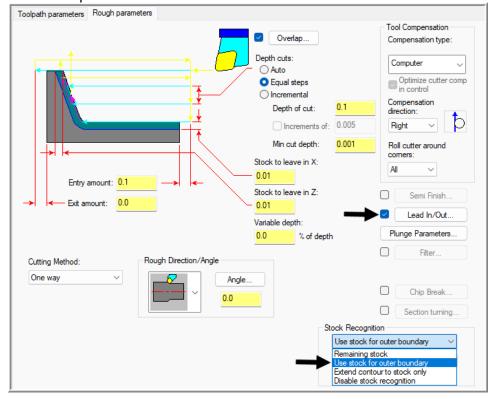
 The roughing will take place with the Upper Turret (B-axis head). Select an appropriate tool for OD roughing. Check that the Axis Combination/Spindle Origin is set to Left Spindle Upper Turret. The tools in the library are shown in the toolchange position, for our machine this is 0 degrees.



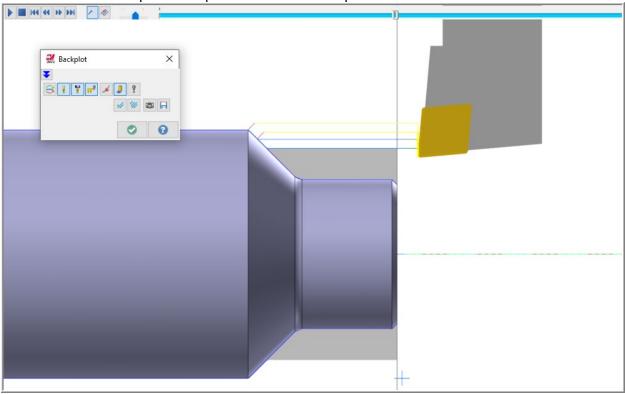
9. Since we are turning the OD, we need to set the **Tool B Angle at 90.0** for the correct orientation. Press the Tool Angle button at the top left. In the new menu, enter **90.0** for the **Tool Angle** and then click **OK**.



10. **Roughing Parameters**. Use the default settings. **Enable Lead In/Out** and set to appropriate values. Set Stock Recognition to **Use stock for outer boundary**. Green check to accept.

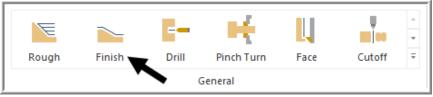


Mill-Turn Lesson-1 - 20

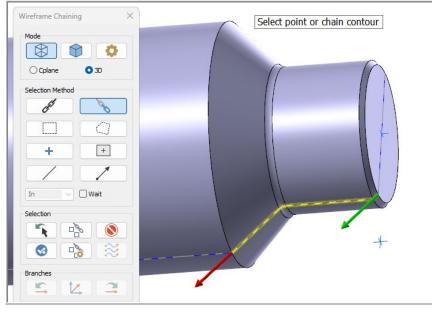


11. You can run backplot for a quick visual of the toolpath.

12. Finish the OD. Select Turning > Finish...

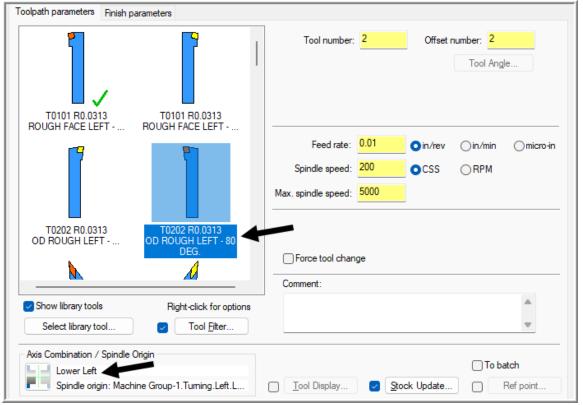


13. The lower turret will be used to finish the OD, select geometry on the **lower side of the model**. Chain the same section as the Roughing op. Green check to accept the chain.



Mill-Turn Lesson-1 - 21

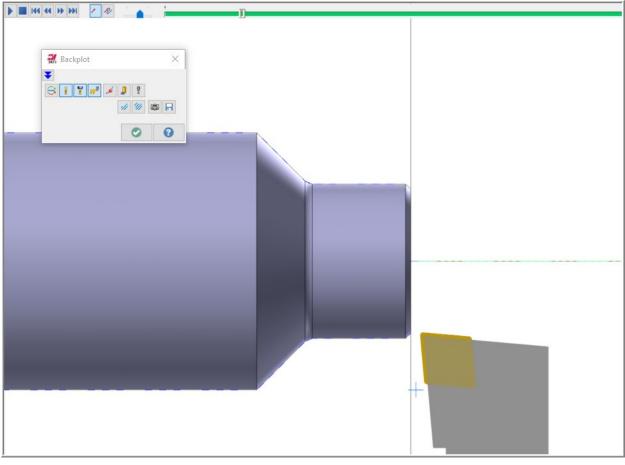
14. Lathe Finish Properties. Select a finish turning tool and check Axis Combination is set to Left Spindle Lower Turret and Turret Index Position is set to Left spindle.



15. **Finish Parameters**. Default setting are good. Check that **Lead In/Out is enabled** and are set to appropriate values, keep in mind the tool orientation when setting your leads. Green check to accept.

Toolpath parameters Finish parameters	
	Tool back offset number:       5         Tool compensation       Compensation type:         Computer
	Finish stepover: Number of finish passes:
	1 Compensation direction:
	Stock to leave in X: 0.0 Roll cutter around comers: All
	Stock to leave in Z:
→  ←	— 0.0 Comer Break
Finish Direction	Down cutting
	Lead In/Out
	Plunge Parameters
	Filter

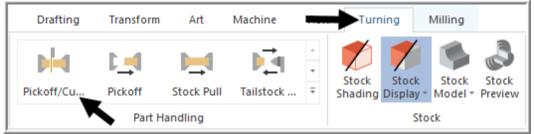




17. Save your file. 토

#### TASK 4: POCO – PICK OFF CUT OFF

- S In this task you will cut the part off and transfer it to the sub (right) spindle.
- 1. From the menu bar select **Turning > Pickoff/Cutoff** found under the **Part Handling** section. This will launch the Pick off, Cut off dialog box.



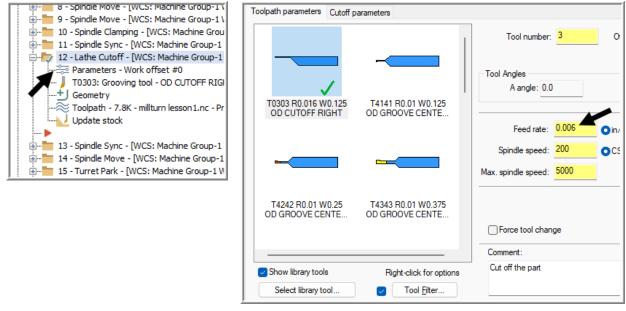
2. **Pickoff, Cutoff.** Since the cutoff operation will be using a tool in the upper turret (B axis head) set the Strategy to **Pickoff, Cutoff (Upper Turret)**. Changes can be made to the operations parameters if needed, however the events and their order cannot be altered. Users can define their own strategies if specific part handoff sequences are needed. These new strategies will appear in the Strategy list. Green check to accept and create the POCO routine.

Strategy: Pickoff, Stock Pull, Cutoff (Upper Turret) Operations Pickoff, Stock Pull, Cutoff (Upper Turret) Pickoff, Stock Pull, Cutoff (Lower Turret)	Name: Pickoff, Stock Pull, Cutoff - Upper Turret
Park Lower Turret Under Left Spindle Pre-position cutoff tool Align spindles Pickoff spindle - Unclamp and eject part	Comment: Park Lower Turret Under Left Spindle
<ul> <li>Pickoff spindle - Move to clearance distance</li> <li>Pickoff spindle - Move to grip position</li> <li>Pickoff spindle - Clamp and transfer stock</li> <li>Stock spindle - Unclamp</li> <li>Pickoff spindle - Pull stock</li> </ul>	Turret:     Lower Turret     ✓       Destination:     Lower Park Left     ✓
Stock spindle - Clamp and transfer stock Synchronize spindles Cut off the part Cancel Spindle Sync Pickoff spindle - Retract Send Upper Turret Home	✓ Linear Movement type: Z first ✓ X: 0.0 Offset from home position Y: 0.0 Offset from home position Z: -14.76378 Offset from home position
	Rotary       B:     0.0       Axis not defined
	Index position: 9

3. **Results of POCO** dialog input. Mastercam creates the handoff operations. None of these created ops can be deleted or moved. This safeguards against unintentional changes that could result in machine crashes.



4. Edit Part-Off Op Just like in the POCO dialog input menu, each op's parameters can be adjusted. For example, if we want to change the feed rate of the part off tool, select op 12's Parameters and edit the Feed rate to 0.006. Click OK.

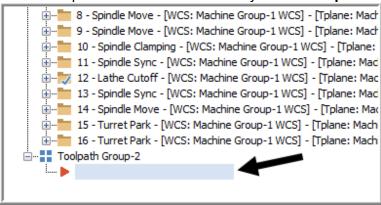


5. Save your file.

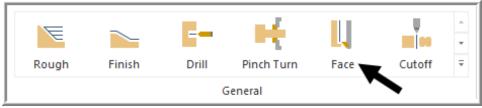
#### TASK 5: SUB SPINDLE TURNING

S In this task you will face the part and turn the OD profile in the sub (right) spindle.

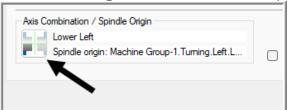
1. Facing the part. Before starting the sub spindle turning make sure the red arrow is in the correct position. It should be directly below Toolpath Group-2.



2. Then select Turning > Face...



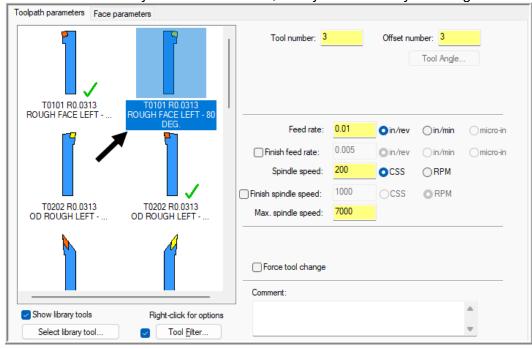
 When the Lathe Face Properties window opens, select Axis Combination/Spindle Origin by clicking the small graphic. This will open the Axis Combination/Spindle Origin window.
 Select Lower Right as we will be using the lower turret to turn on the sub (right) spindle. Then hit the green checkmark to accept.



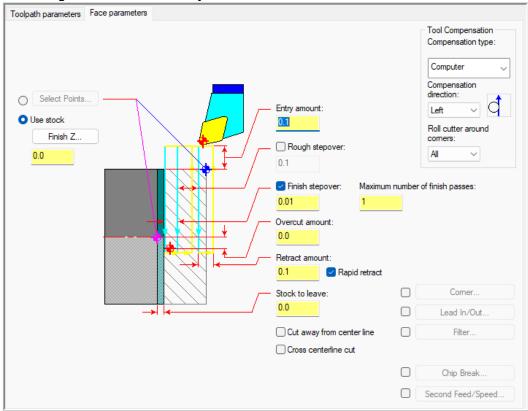
Upper Left	Upper Right		ndle Origin Name Machine Group-1.Face Mill. Machine Group-1.Turning.L Machine Group-1.Turning.R	eft.Lower 1		Work Offset 0 0 1	Display Mode Radial Radial Radial
Lower Left	Lower Right						
		X: Z:	0.0 🕞 30.974016 🕑 Z only	Work Off Manua Autom	al 1	Displa O Dia O Rai	

Mill-Turn Lesson-1 - 26

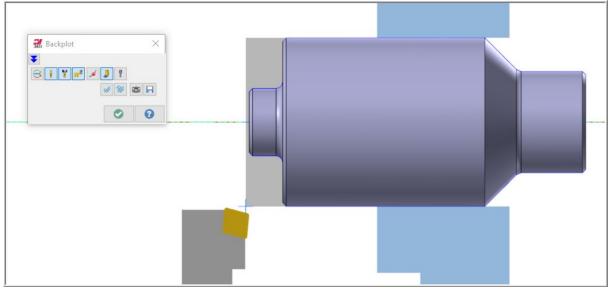
4. On the Lathe Face Properties window choose a tool that works on the right spindle. You must select a different tool than used on the lower turret left spindle as they will be facing opposite directions. The same lower turret tool cannot face on the left and right spindles. Note: Based on your actual machine, it may be necessary to change tool numbers.



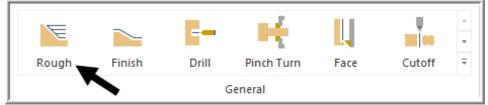
5. The default settings on the Face Parameters page will be sufficient. No need to make changes here. Check that yours are the same.



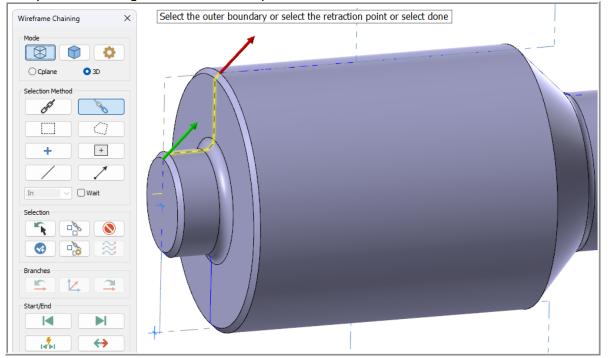
6. You can do a quick **backplot** again to check your toolpath. Select just the sub spindle facing op and run.



7. Roughing the OD. Select Turning > Rough...



 Chain the geometry. Start from the 0.05 chamfer on the 1.00" diameter then to the end of the 0.05 chamfer in the 2.50" diameter. Make sure you chain the geometry on the upper side of the part. Also be sure to chain the geometry on the part that is in the sub (right) spindle. Hit the green check to accept.



Mill-Turn Lesson-1 - 28

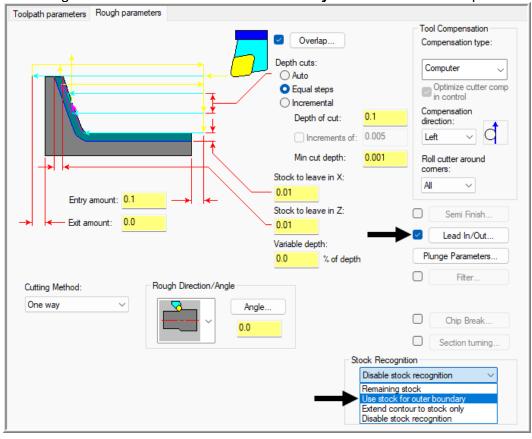
The roughing will take place with the Upper Turret (B-axis head). Select the same OD roughing tool as used on the main spindle (note the green check). Check that the Axis Combination / Spindle Origin is set to Right Spindle Upper Turret.

polpath parameters Rough pa	arameters	_				
	1	Tool number:	1	Offset r	number: 1	
P	p				Tool Ang	le
		Tool Angles				
		A angle: 0.0		B ar	ngle 0.0	
T0101 R0.0313 ROUGH FACE LEFT	T0101 R0.0313 OD ROUGH LEFT					
		Feed rate:	0.01	oin/rev	() in/min	⊖micro-in
		Plunge Feed rate:	0.005	Oin/rev	)in/min	() micro-in
7		Spindle speed:	200	OCSS	ORPM	
		Max. spindle speed:	5000			
T0303 R0.0156 OD FINISH LEFT - 35 DEG.	T1111 R0.0313 OD 55 deg Left					
		Force tool chang	e			
<u> </u>	×	Comment:				
Show library tools	Right-click for options					-
Select library tool	Tool <u>Fi</u> lter					Ŧ
Axis Combination / Spindle Or	igin					
Upper Right 🔶					To bate	ch
Spindle origin: Machin	e Group-1.Turning.Right	<u>T</u> ool Display	Stock	Update	R	ef point

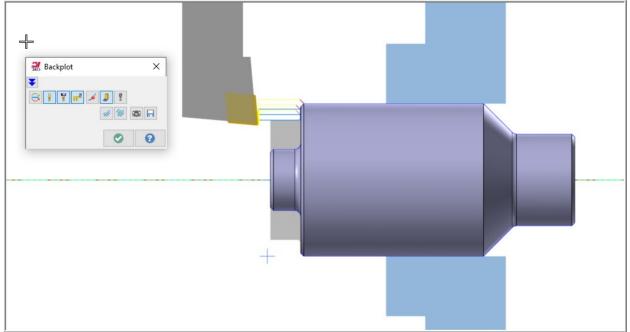
10. Since we are turning the OD on the sub (right) spindle, we need to set the **Tool B Angle at 90.0** (same setting used for main spindle) and **Tool A Angle set at 180.0**. The A angle controls which direction the turning tool faces (main or sub side). To set Tool A Angle click the **Tool Angle** button and **select 180 deg**, for B, input **90.0**.

Tool number: 1	Offset number: 1	Tool Angle
Tool Angles A angle: 0.0	Tool Angle B angle 0.0	Plunge Direction 90.0 Tool Orientation on Machine
Notice the updated angles.		0 deg.     0 180 deg.     0 Other: 180.0
Tool number: 1	Offset number: 1 Tool Angle	Cutting Direction
Tool Angles A angle: 180.0	B angle 90.0	

11. **Roughing Parameters**. Use the default settings. **Enable Lead In/Out** and set to appropriate values, keeping in mind we are turning on the sub spindle. Set Stock Recognition to **Use stock for outer boundary**. Green check to accept.

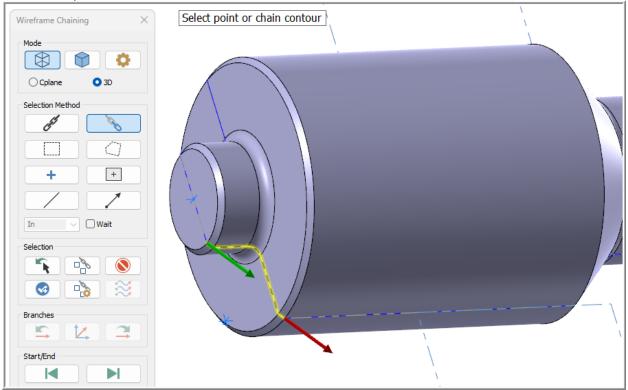


12. Again, you can run **backplot** for a quick visual of the toolpath.

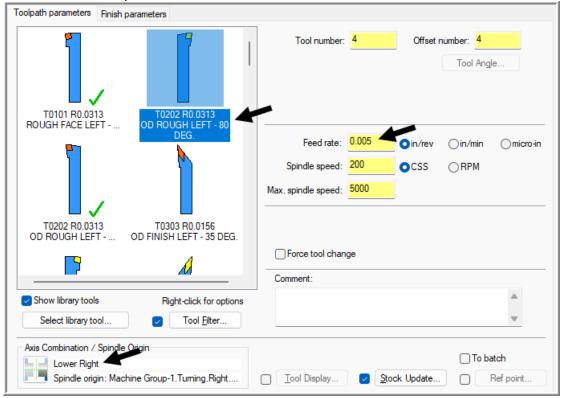


# 13. Finish the OD. Select Turning > Finish...

14. **Chain Geometry**. Since we will be using the lower turret to finish the OD, select geometry on the **lower side of the model**. Chain the same section as the Roughing Op. Green check to accept the chain.

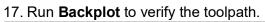


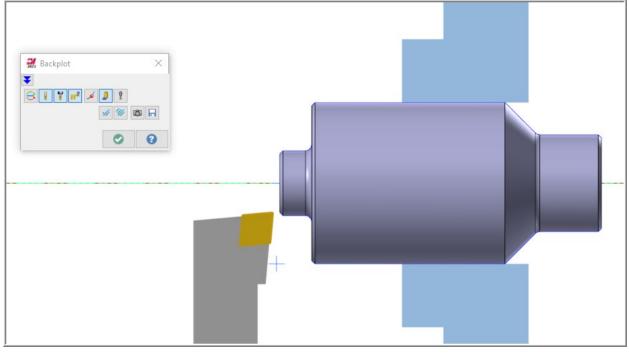
15. Lathe Finish Properties. Select a finishing tool with the correct orientation for the right spindle. Axis Combination should be set to Lower Right and feedrate set to .005 for finishing. As with the lower turret facing operations, the same tool orientation cannot be used for both spindles.



16. **Finish Parameters**. Default settings are good. Check that **Lead In/Out is enabled** and are set to appropriate values, keep in mind the tool orientation when setting your leads. Green check to accept.

Toolpath parameters Finish para	ameters	
Toolpath parameters Finish para	ameters Tool back offset number: 5  Finish stepover: Number of finish passes:  Tool back offset number of finish passes:  Tool back to leave in X:  Colo  Stock to leave in Z:  Colo  Colo	Tool Compensation         Compensation type:         Computer         Optimize cutter comp         in control         Compensation         direction:         Right         Roll cutter around comers:         All         Comer Break         Down cutting
		Lead In/Out Plunge Parameters Filter





18. Save your file. 国

#### TASK 6: MACHINE SYNCING

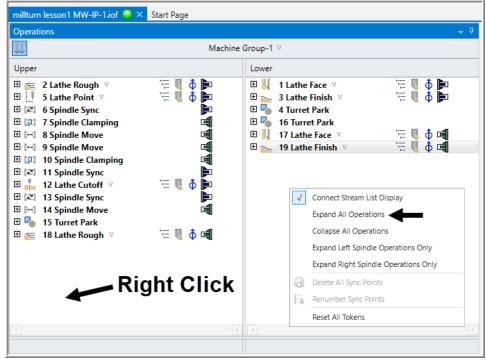
- **I** In this task you will work in Mastercam Code Expert to set the machine syncs.
- Select the Main Viewsheet-1 to display both spindles. In the Operations Manager left click Machine Group -1 to select all operations. Select the Post Selected Operations button. This will generate the IOF file and open a Sync Manager window in Mastercam Code Expert.

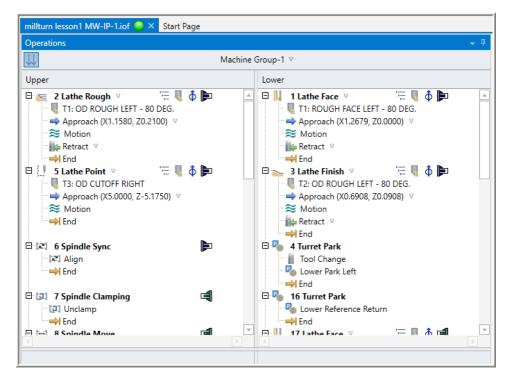
Toolpaths
▶ × ×   ĭ ▶ ĭ × ≒ -    ♠ -  G1 🖡   🌮   @
E Machine Group-1
a 🗄 📲 Properties - Generic Fanuc Mill-Turn LTZ
🖕 👖 Toolpath Group-1
👜 👘 🗤 1 - Lathe Face - [WCS: Machine Group-1 WCS] - [Tplane: Machine Group-1.Turning.Left.Lower 1]
😥 👘 😥 2 - Lathe Rough - [WCS: Machine Group-1 WCS] - [Tplane: Machine Group-1.Turning.Left.Upper 1]
🗟 – 🕎 3 - Lathe Finish - [WCS: Machine Group-1 WCS] - [Tplane: Machine Group-1.Turning.Left.Lower 1]
📮 📴 Pickoff, Cutoff - Upper Turret
🔋 👘 🕸 - Turret Park - [WCS: Machine Group-1 WCS] - [Tplane: Machine Group-1 WCS] - Park Lower Turret Under Left Spindle
🔋 👘 🏷 5 - Lathe Point - [WCS: Machine Group-1 WCS] - [Tplane: Machine Group-1.Turning.Left.Upper 1] - Pre-position cutoff tool
👜 🕎 6 - Spindle Sync - [WCS: Machine Group-1 WCS] - [Tplane: Machine Group-1 WCS] - Align spindles
🕀 👘 😿 7 - Spindle Clamping - [WCS: Machine Group-1 WCS] - [Tplane: Machine Group-1 WCS] - Pickoff spindle - Unclamp and eject part
🗟 👘 🐯 8 - Spindle Move - [WCS: Machine Group-1 WCS] - [Tplane: Machine Group-1 WCS] - Pickoff spindle - Move to dearance distance
🗈 👘 9 - Spindle Move - [WCS: Machine Group-1 WCS] - [Tplane: Machine Group-1 WCS] - Pickoff spindle - Move to grip position
🗄 👘 👘 10 - Spindle Clamping - [WCS: Machine Group-1 WCS] - [Tplane: Machine Group-1 WCS] - Pickoff spindle - Clamp
🔁 📲 11 - Spindle Sync - [WCS: Machine Group-1 WCS] - [Tplane: Machine Group-1 WCS] - Synchronize spindles
🗈 👘 12 - Lathe Cutoff - [WCS: Machine Group-1 WCS] - [Tplane: Machine Group-1.Turning.Left.Upper 1] - Cut off the part
🗈 👘 13 - Spindle Sync - [WCS: Machine Group-1 WCS] - [Tplane: Machine Group-1 WCS] - Cancel Spindle Sync
🔁 👘 👘 14 - Spindle Move - [WCS: Machine Group-1 WCS] - [Tplane: Machine Group-1 WCS] - Pickoff spindle - Retract
🗈 📲 15 - Turret Park - [WCS: Machine Group-1 WCS] - [Tplane: Machine Group-1 WCS] - Send Upper Turret Home
🗈 👘 16 - Turret Park - [WCS: Machine Group-1 WCS] - [Tplane: Machine Group-1 WCS] - Send Lower Turret Home
Emer Toolpath Group-2
🖭 – 🔀 17 - Lathe Face - [WCS: Machine Group-1 WCS] - [Tplane: Machine Group-1.Turning.Right.Lower 1]
28 - Lathe Rough - [WCS: Machine Group-1 WCS] - [Tplane: Machine Group-1.Turning.Right.Upper 1]
🗎 👘 🌄 19 - Lathe Finish - [WCS: Machine Group-1 WCS] - [Tplane: Machine Group-1.Turning.Right.Lower 1]

2. **Code Expert**. All the menus in Code expert can be moved, docked, hidden, or resized to your preference.

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2       3       3       3       3       3       3       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1										cower x only netoni
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Upper         2 Lathe Rough         2           1 Loner         1 Lathe Face         3 Lathe Finish         Tool Angle           Tool Angle         Tool Angle         Tool Angle         Tool Angle	ime elansed:			5 00:50 00:55 01:00	01:05 01:10 01:15 01:20 01:2	5 01:30 01:35 01:40 01:45	01:50 01:55 02:00 02:05			
I Lover         I Late Face         3 Late Frish         Tool Angle           Upper         Tool Angle         Tool Angle         Tool Angle								×		
to a concrete a concre		A Lotter Trees	Director Fisch		e coure noogii					
Tool angle as set in the selected operation.		I Lathe race	o Lathe rinish						Teel Analy	
Lower     17 Lathe Fixed     19 Lathe Fixed	-								Tool angle as set in the	selected operation.
					17 Lathe Face	19 Lathe Finish				

3. Once you have all your menus set, **right click** on the **Operations Menu**, and select **Expand All Operations**.





4. You can put your cursor on each line in either stream and Code Expert will display some additional information about that object. Some lines will also include a pulldown menu with additional settings/options. In the **Upper Stream**, hover over the tool in the Lathe Rough operation. Code expert shows additional information about the Holder and Insert.

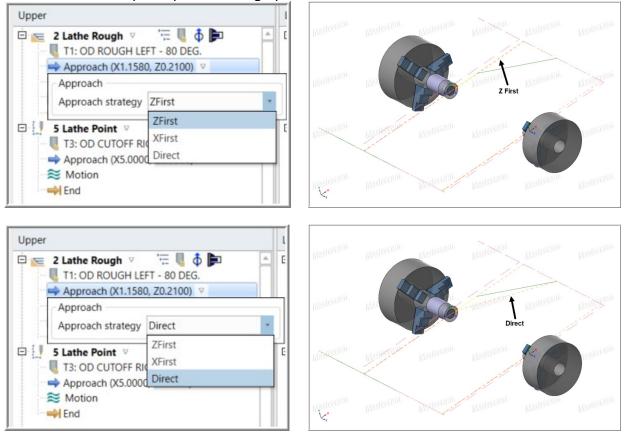
millturn lesson1 MW-IP-1.iof 🥥 × Start Page	
Operations	
$\downarrow\downarrow\downarrow$	Machine Group-1 $^{\bigtriangledown}$
Upper	Lower
□ See 2 Lathe Rough V The Second Sec	
(1) OD ROUGH LEFT - 80 DEG. Holder: DCGNR-164D	Insert: CNMG-432
Retract ⊽ ➡ End	R R

5. If you **click on that tool** additional information is displayed in the **Properties window**. You may need to open the **Properties window > View Menu / Properties.** 

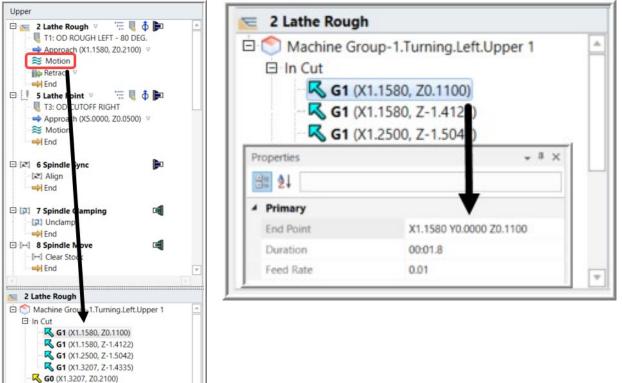
File	Home	View •	<b></b>	nager						
Split V	orizontal	Save Workspace	Load Workspace	Reset Workspace	100%	Start Page		Properties	Fit	lsomet:
		Window			Zoom		Show			3D \

Mastero	Properties ⊉ ⊉↓	- ↓ ×
Mean	A Primary	
	Duration	00:00.1
	Tool Station	-1
	Offset	1
	Tool Name	OD ROUGH LEFT - 80 DEG.
	Tool Number	1
	Slot Id	2
	Holder Name	DCGNR-164D
E AGE	Insert Name	CNMG-432

6. Click the pulldown menu of the Approach in the same op and you are given options as to how the approach is made, Z first, X First or Direct. If you change the approach type you will see the tool path update in the graphics window. Leave this set at Z first for now.

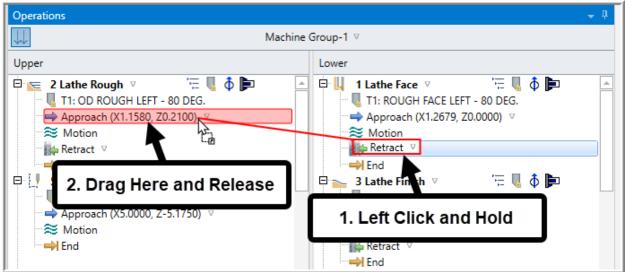


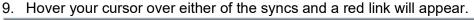
7. If you **click on the Motion** object an overview of the code will display below the stream. The In Cut movements can be expanded as well for further review. **Click** on the **G1** movement and more info is displayed in the Properties Menu.

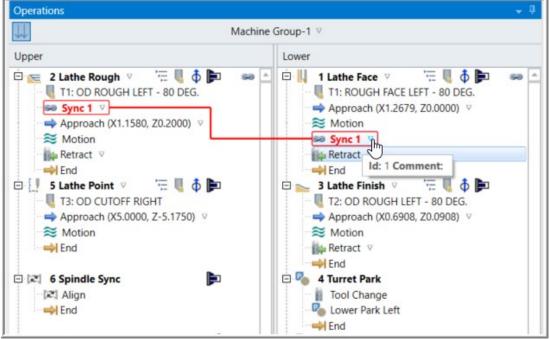


8. **Syncing Operations**. Syncing is done by clicking and holding on an object and dragging to the object you wish to sync with. Our first sync will occur between the **retract of Lower Stream Lathe Face** and the **Approach of the Lathe Rough in the Upper Stream**. Click and hold on the Lathe Face Retract and drag to the Approach of the Lathe Rough and release.

K GO (X1.0660, Z0.2100)



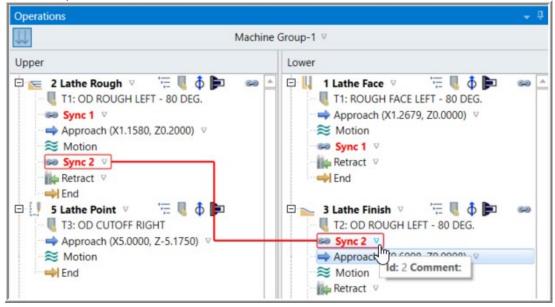




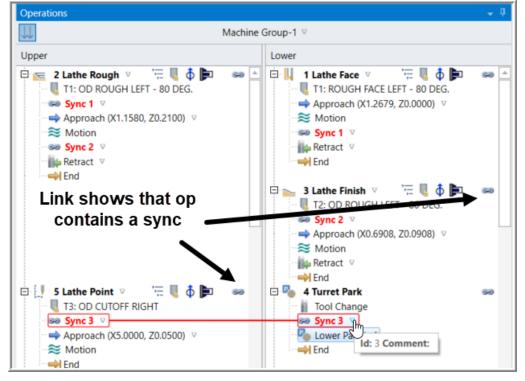
#### 10. The sync also appears in the **Timeline**.

Timeline														- I
	Stream	iew Spir	ndle View	00:18.6									Total time	e: 05:37.1
Time elapsed:	00:00 00:	00:1	0 00:15	00:20	00:25	00:30	00:35	00:40	00:45	00:50	00:55	01:00	01:05	01:10
Upper					_		2 Lathe	Rough						
▷ Lower	1	Lathe Face			3	Lathe Fin	ish			4 Tu	rret Park	r	20 Lat	the Face

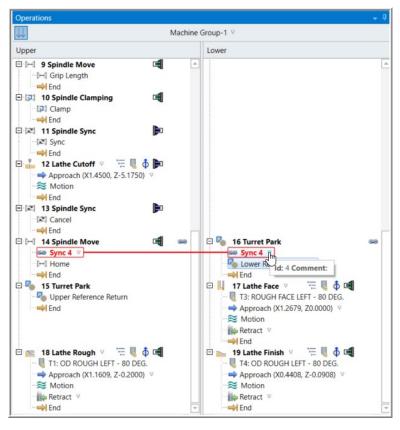
11. The next sync needs to occur once the roughing is done. Sync between the **Lathe Rough Retract** in the Upper Stream and the **Lathe Finish Approach** in the Lower Stream. **Note:** Sync numbers can be changed from the drop-down arrow if needed. Sync numbers cannot be duplicated.



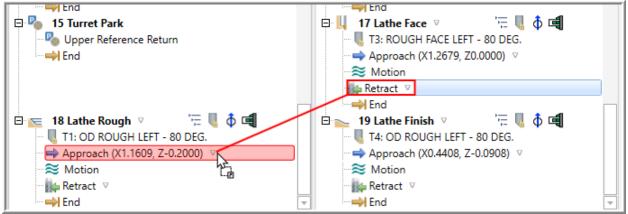
12. Next you will set up a sync between the **End** of **Turret Park** on the **Lower Stream** and the **Approach** of **Lathe Point** on the **Upper Stream**. This sync will ensure the lower turret is parked under the left spindle before the POCO routine runs. You will notice op 5 of the Upper Stream is now dropped to be in-line with op 4 of the lower. Also notice that any op that contains a sync will have a link icon displayed with it.



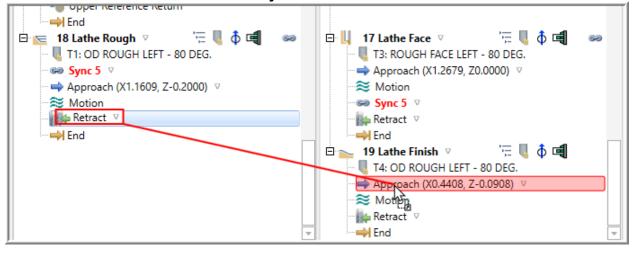
13. After the POCO routine is completed, we need to sync the sub spindles End movement (14 Spindle Move) with the Lower Reference Return of the Turret Park (16 Turret Park). Click and hold on the Lower Reference Return of the 16 Turret Park and drag it down. When you get to the lower extent of the window the menu will start to scroll. Drop the sync on the End movement of 14 Spindle Move. Sync 4 is created.



14. All that is left now is to sync the sub spindle ops the same way we did the main spindle. Sync the **Retract of the Lathe Face** in the Lower Stream with the **Approach of the Lathe Rough** of the Upper Stream. **Sync 5** is created.



15. Then sync the **Retract of the Lathe Rough** in the Upper Stream with the **Approach of the Lathe Finish** in the Lower Stream. **Sync 6** is created.



16. **Save** your file. It is will also be written back to the Mastercam file. There is a colored light in the upper left tab of the Code Expert. This light indicates if your current settings are backed up to the Mastercam file.



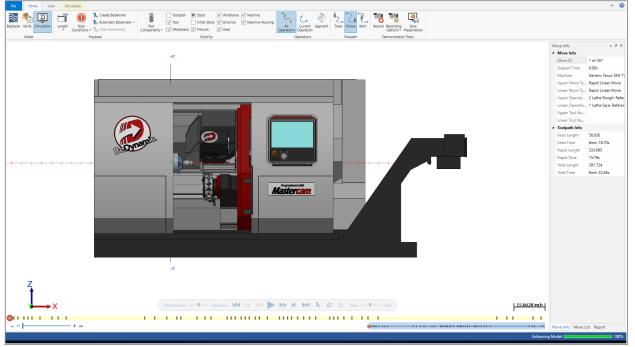
#### TASK 7: MACHINE SIMULATION:

**I** In this task you will run a complete machine simulation to check for potential problems.

1. In Code Expert, from the **Sync Manager** tab click on the **Launch Icon** to launch machine simulation.

File H	lome View	Sync Manag	er 🗲			
Post Stop	Launch	Renumber	Reset All Values	Approach     Approach     Retract     Link	<ul> <li>✓ Stock</li> <li>✓ Fixtures</li> <li>✓ Component</li> </ul>	Selected Operations Only
Post	Simulation 🖻	Synchronization	Tokens		Displa	ay 🖓

#### 2. Machine Simulation will open.



3. Turn the **speed of the simulation** down to approximately ¼ so you can see some of the faster moves. For clarity you can also **toggle the machine housing to transparent or invisible.** Check mark is full visibility, grey box is transparent, and white box is invisible. Transparency can also be set from File / Options / Graphics menu.

-	Performance -		٠		Precision	K	14	44	(	••	1	1,	6	Ø	15	Slo	w —	-	6	- Fast	
1		I.	I.	1		1	 1		1		 1	 1	I.			I.	1	1		Simulation S	peed
																		0		Set the spee	d of simulation.

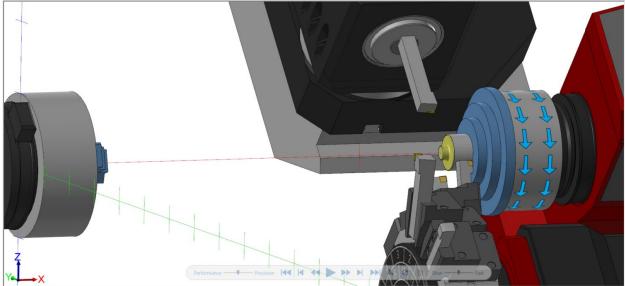
File	Home Vi	ew Simulati	ion					
Backplot	Verify Simulation	Length Cor	Stop nditions • To Clear Bookmarks	Tool	Toolpath Tool Workpiece	Initial Stock	Wireframe Gnomon Axes	<ul> <li>✓ Machine</li> <li>✓ Machine Housing</li> </ul>
	Mode		Playback			Visibility		

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4. Click the **Play** button to start the simulation.



5. Play through the entire simulation checking for potential issues.



6. When you are finished click the **Close** button in the upper right corner and return to Code Expert to post the NC code.



#### TASK 8: POSTING THE CODE:

- ➔ In this task you use code expert to post the NC program.
- 1. Before we post the code, we have a few extra settings to consider. Each operation has an independent **Coolant Strategy** selection as well as Y-axis offsets and Reference Positions if desired to set. Access from the drop-down arrow for each operation.

perations	•	đ
J Mach	ine Group-1 V	
Jpper	Lower	
🖳 🛛 Lathe Rough 🔽 🦙 📮 🖨 📄 🛛 📾	🔄 📄 📙 1 Lathe Face 🔻 🧮 🖣 🇭 📟	[
Coolant	EG.	
Coolant strategy for an operation	Off 👻 🗸	
Operation		
Y-axis offset for lathe operations	0	
Reference Position		
Reference position that defines where this open	ation begins. Upper X Only Return 🔹 🧄 📄 📟	
	G.	

2. You can also enter more information under the drop-down for Machine Group-1.

W	Machine Group-1 V	
Upper 🖻 🛌 2 Lathe Rough 🗸 🛛 🗮 🌷 🏠 📄	Feed Maximum feedrate for polar interpolation (G112)	100
T1: OD ROUGH LEFT - 80 DEG.     Sync 1 ♥     Approach (X1.1580, Z0.2100) ♥     Motion	- Header Job number Programmer name	
→ Sync 2 ♥ → Retract ♥ → End	Tailstock Stop program to load tailstock	V

3. Save your file.

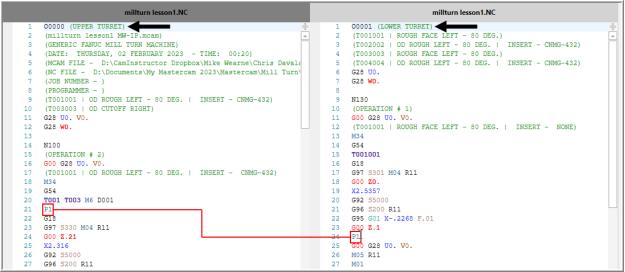
4. **Post** the code by pressing the **G1 button** located under the **Sync Manager** tab. Code Expert will open a new tab with the NC code.

File H	lome View	Sync Manage	er 🗲							
G1 Post Cop		🗔 Renumber 쥕 Delete All	Reset All Values	<ul> <li>✓ Appro</li> <li>✓ Retra</li> <li>✓ Link</li> </ul>	ct 🗸	Stock Fixtures Compon	ent	Selected Op Expanded O		
Post	Simulation 🖬 S	ynchronization	Tokens			D	isplay			5
<u>r</u>										
Insert Block No	Numbers 🐰 Remove Block Si	cip 👔 Send	First Previous Synce		Mark First	Previous Net Tools	xt Last	Single Multi-Stream Stream Display	Align Syncs Configu Utilit	C uration
1 % 2 00000 ( 3 (militu 4 (GENERI 5 (DATE: 6 (MCAM F 7 (NC FIL 8 (JOB NU 9 (PROGRA) 10 (T00100	millum lesson1 MW-IP-1 UPPER TURRET) rn lesson1 MW-IP.mcam C FANUC MILL TURN MAC THURSDAY, 02 FEBRUAR ILE - D:\CamInstruct E - D:\CamInstruct BER - ) MMER - ) MMER - ) 1   OD ROUGH LEFT - 8 3   OD CUTOFF RIGHT) VO.	) HINE) Y 2023 - TIME: 0( or Dropbox\Mike Wes Mastercam 2023\Mast	arne\Chris Da tercam\Mill 1				m Files\	millturn lesson	1 MW-IP.mcam)	)

5. By default, the code is displayed in single stream. Under the **NC Functions** tab, to switch to **Multi-Stream** mode. You may be prompted to select a file name for multi-stream view.

File	Home View	NC Functions	-										
Go To	Insert Block Numbers Remove Block Number Remove Spaces	Insert Block Skip Remove Block Skip		First Previous	Next Last	Mark	First Previous	Next Last	Single Multi-Stream	Align NC Syncs Configuration			
	Editing		Communications	Syn	ICS		Tools		Display	Utilities			
millturn	lesson1.NC × milltu	ırn lesson1 MW-IP-1.iof	f 🔵 Start Page										
1	1 %												
2	O0000 (UPPER	TURRET)				Create M	lulti-Stream Vie	w		×			
3	3 (millturn lesson) MW-IP.mcam)												
4 (GENERIC FANUC MILL TURN MACHINE) NC Configuration:													
5	(DATE: THURS	DAY, 02 FEBRUARY	2023 - TIME: 0	00:20)									
6	(MCAM FILE -	D:\CamInstructor	n Dropbox\Mike We	earne\Chris I	Javala\Mi	Mi Generic Fanuc Mill-Turn LTZ (1 NC stream file)							
7		:\Documents\My Ma	astercam 2023\Mas	stercam\Mill	Turn\NC F	IC Files to view:							
8	(												
9		·				millturn les	son1.NC			Browse			
10	( /	ROUGH LEFT - 80	DEG.   INSERT -	- CNMG-432)						Select			
11	( /	CUTOFF RIGHT)								Scieccan			
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14													
15						Help				OK Cancel			
16		· · · · · · · · · · · · · · · · · · ·			l L	b				Garcer			
17	G00 G28 U0. V	0.											

6. You will see all the sync points you created. Hovering over one sync point will highlight it in both streams if they are both visible on-screen.



7. Your code is now ready to run. If you have communications set up, hit send to send the NC file to your machine.

Go To	Home View nsert Block Numbers Remove Block Numbers Remove Spaces Editing	NC Functions Insert Block Skip Remove Block Skip Remove Comments	Send File Send Receive Communications	First Previous Next
millturn les	(millturn less (GENERIC FANUC	TURRET )	machine o communi configure active.	current NC file to the control. Your cation settings must be ed for this button to be

8. This concludes Mill-Turn Lesson 1.