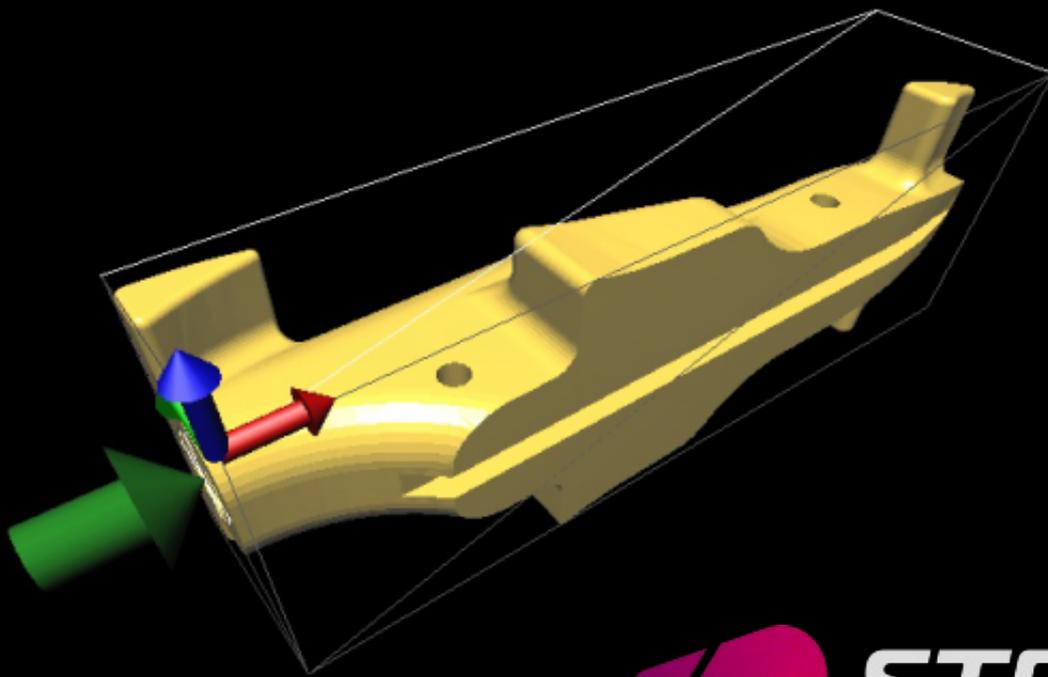


DENFORD
CAD/CAM Solutions & Projects for Education

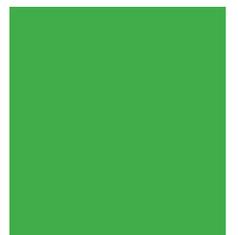
MCR100

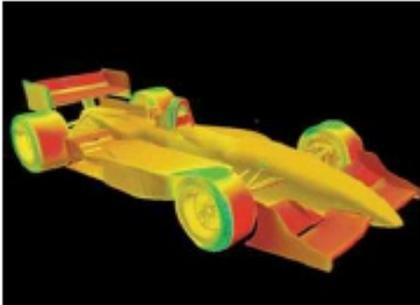
QuickCAM Pro

+ Car Wizard



 **STEM
RACING**





ANALYSE

Virtual Wind Tunnel Software

VWT Analysis Software Mk8

Single Seat

5 User Licence

Site Licence

BI01841

BI01841A

BI01841C

MAKE

CNC Machine Options for F1 Car Manufacture:

MCR 100

Compact 1000

Compact 1000 Pro (Metal Cutting)

Router 2600

Router 2600 Pro (Metal Cutting)

Router 6600

Router 6600 Pro (Metal Cutting)

F1R001000

MRC002000A

MRC003000

MRP002000

MRP003000

MRF002000

MRF003000



Car Manufacturing Fixture

To enable the manufacture of Formula 1 Class cars. The fixture clamps directly to the T-slotted table on the Compact 1000/Pro, Router 2600/Pro and Router 6600/Pro and is also suitable for use on the VMC 1300 Pro (it is necessary to remove the tool changer to fit the fixture).

NR1/0400UA



F1 Entry / Development Class Starter Kits

SOLO

1 x F1 Model Block Car Kit

1 x IsoSketch 3D Drawing Tool - single blister pack

F1DKIT01

TEAM

5 x F1 Model Block Car Kit

5 x IsoSketch 3D Drawing Tool - single blister pack

F1DKIT05

GROUP

10 x F1 Model Block Car Kit

1 x IsoSketch 3D Drawing Tool - class pack of 30

F1DKIT30



F1 Model Block (pack of 10)

This official F1 Model Block measures 223mm x 65mm x 50mm, with a consistent weight and density, and contains a pre-drilled hole for the Power Pack.

F1223/10



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Navigating QuickCAM Pro	6
Opening your Model	7
Orientate Model	8
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Set Axle Holes	10
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Set Billet Size	12
Set Model Position	13
Set Boundary	14
Machining Plans	15
Editing Machining Plans	16
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Setting the X axis Datum	22
Setting the Y axis Datum	23
Setting the Z axis Datum	24
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About QuickCAM Pro

QuickCAM Pro is an advanced, yet simple to use, wizard-based CAM package, which is used to create cutter paths for machining 3D parts on a milling machine or router. Both STL files and image files can be imported into QuickCAM PRO, and a comprehensive set of machining plans can be used individually or in combination to produce complex 3D surfaces and lithophanes.

Introduction

The aim of this training guide is to show you how to navigate your way around QuickCAM Pro and instruct you how to operate this software to and specifically how to manufacture a STEM Racing car using Car Wizard.

This guide will explain the steps taken by the Wizard to create the CNC programs for the Right hand side and Left hand side of the car.

This guide makes use of screen shots where possible and will use the following conventions:

Instructions will be in this format

Text to be typed will be in this format

Any software buttons to be pressed, a picture of the button will follow the instruction

This guide assumes that your software has already been installed and your machine has been commissioned.

If any of the features described in this guide are not operating as described please check that the version number you are using is the same as that shown on the front cover.

Version is written on the title bar of the main software window.

Denford provide machine training and it is recommended that you undertake the training and use this guide as a revision guide after completion of the machine

Launching QuickCAM Pro

Open the "Denford Applications" folder.
"Double click" on the QuickCAM Pro icon.

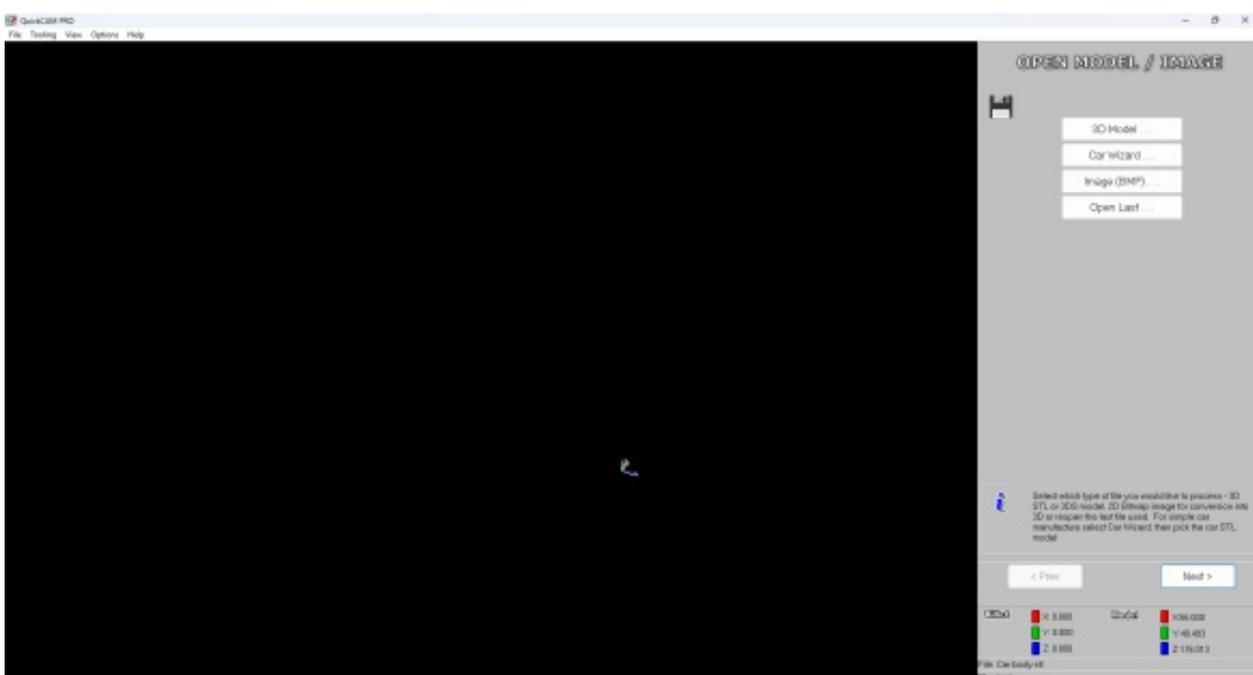


The screen shown on the right will be displayed and the software will take a minute or 2 to open. You can force the software to open quicker by following the next instruction.

"Double click" on the area circled below.



The software will open and you will be greeted with the screen below.



Navigating QuickCAM Pro

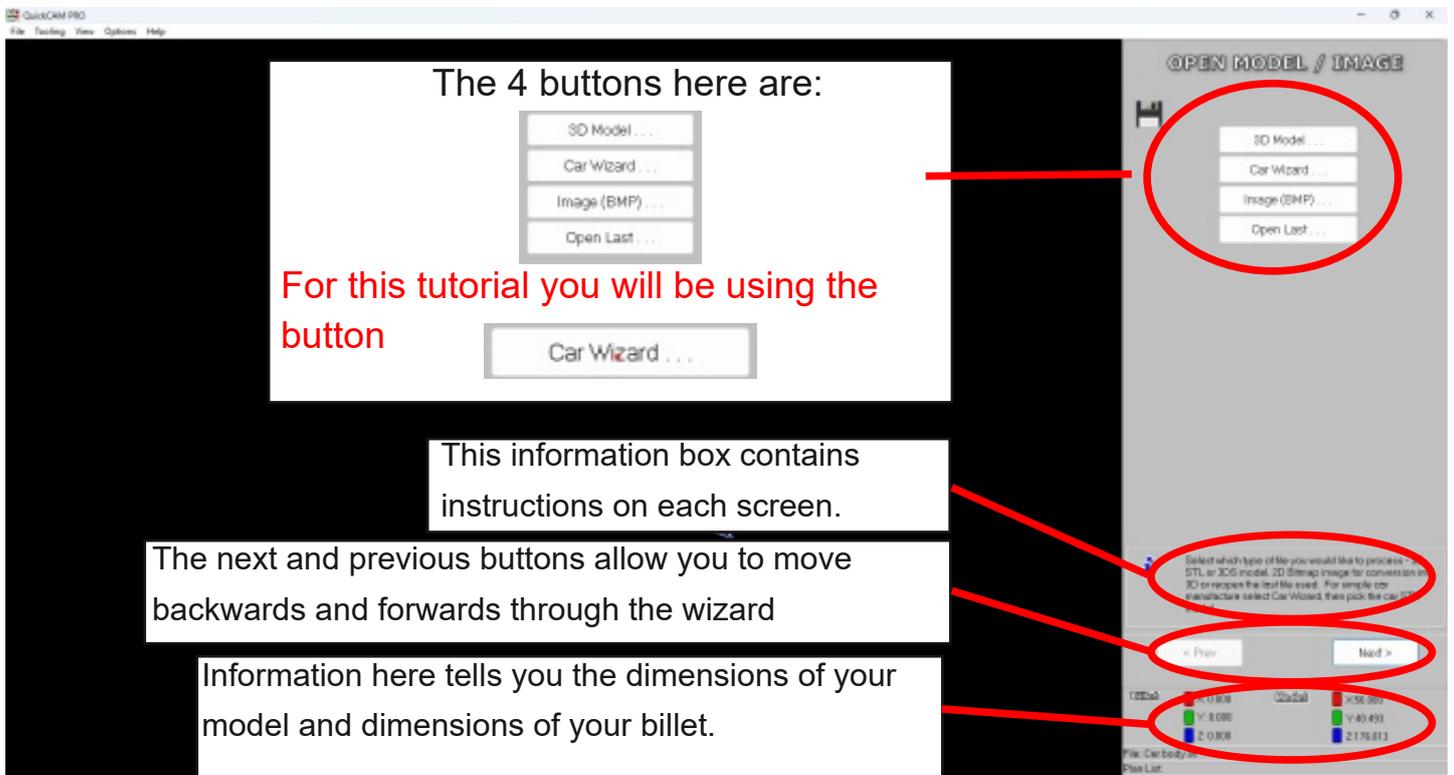
QuickCAM Pro is very easy to use, the main screen displays what is going on and the navigation panel on the right is how you select options and move around this wizard based program.

The Menu options at the top of the screen allow you to open the tool library and View the tools available.

The Car Wizard requires that tool 1 is a 1/4" Ball Nose cutter. If VR Milling is installed on the computer then that is the tool library that is used. To change the QuickCAM PRO tool library you must edit the tools in VR Milling 5. When you restart QuickCAM PRO the new tools will be available.

The view Menu allows you to reset the View which is useful if you have zoomed out too far or cannot see your model.

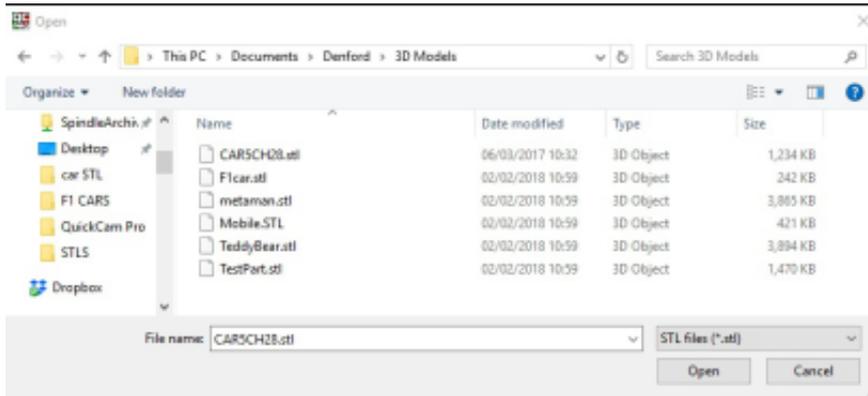
The options menu allows you to change various view settings.



Opening your Model

Select the 3D Model button

Car Wizard ...



Select the .STL file you wish to machine and click the open

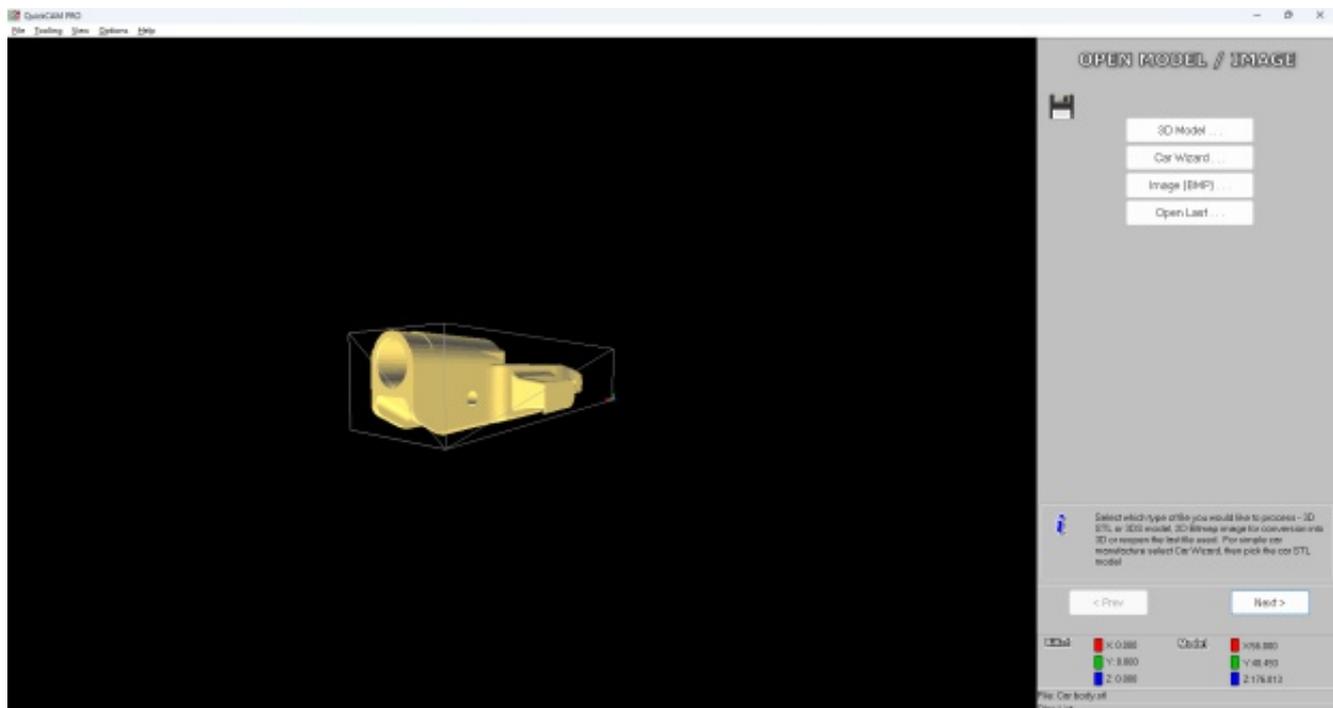
Open

The Car Wizard will now check that Tool 1 in your tool library is a 1/4" Ball end cutter.

If this is not the case then you have to edit your tool library in VR Milling 5 or you will not be able to use the Wizard

Provided the correct tool is selected as tool 1 your model will now be displayed in the main screen.

You can hold the left mouse button to rotate your model, holding the right mouse button zooms in and out. Holding both buttons down allows you to Pan the view.



Once the Model is imported

Click the next button

Next >

Orientate Model

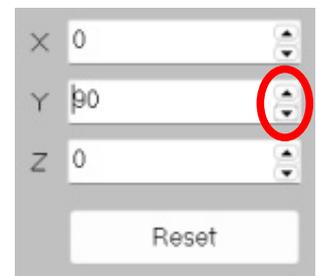
There are a number of ways to orientate the model, there is no right or wrong way as long as the fixture in the machine is aligned in the same way.

We will orientate the model so that the large Red arrow points at the right hand side(RHS) of the car and the large Yellow arrow points to the face with the CO2 cartridge chamber.

In the illustration below you can see a large red arrow has appeared in the main display, this represents the direction that the cutting tool will be coming from. The Yellow arrow indicates the face with the CO2 cartridge chamber in it.



If the model needs to be rotated, click on any of the axes buttons and these will rotate the model in increments of 90 degrees.



In this case the model has imported in the correct orientation.

Whether or not the model will need rotating will depend on which planes you used when creating the model.

The car width, height and length are checked and recorded at this point, these values will be used to correctly position the block in the next pages of the Wizard.

If the car exceeds the machinable area of the Model Block then the wizard will not highlight the Next button and an error will be displayed in Red. If the car is the wrong size then it will have to be edited in CAD before you can proceed.

If all the dimensions are correct then click the Next button



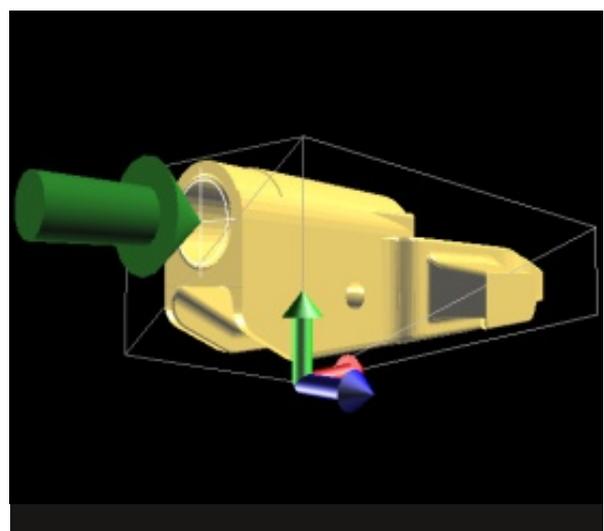
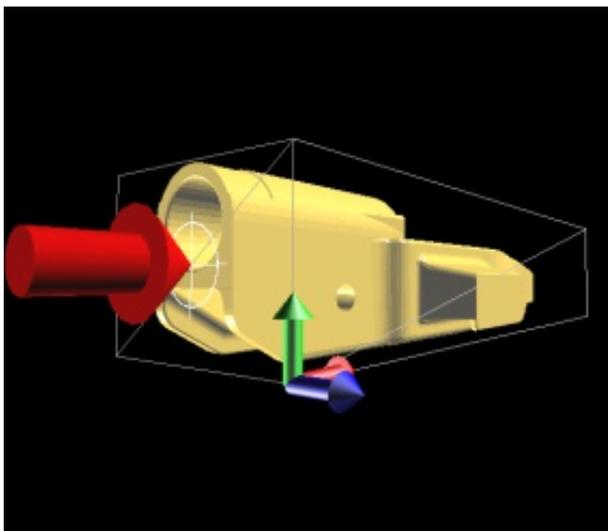
CO2 Cartridge Centre Height

This screen requires you to enter the height of the CO2 Cartridge chamber from the base of the car.



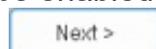
The model will be positioned around a datum position set in the middle of the CO2 Cartridge chamber. The height of this must be recorded when the car is being designed in CAD and to ensure the car can be manufactured in an STEM Racing Model block the value must be between 21mm and 29mm.

The cross hairs will help locate the centre of the bore. The arrow pointing at the bore will be Red if the value is invalid and turn green when a valid value appears.



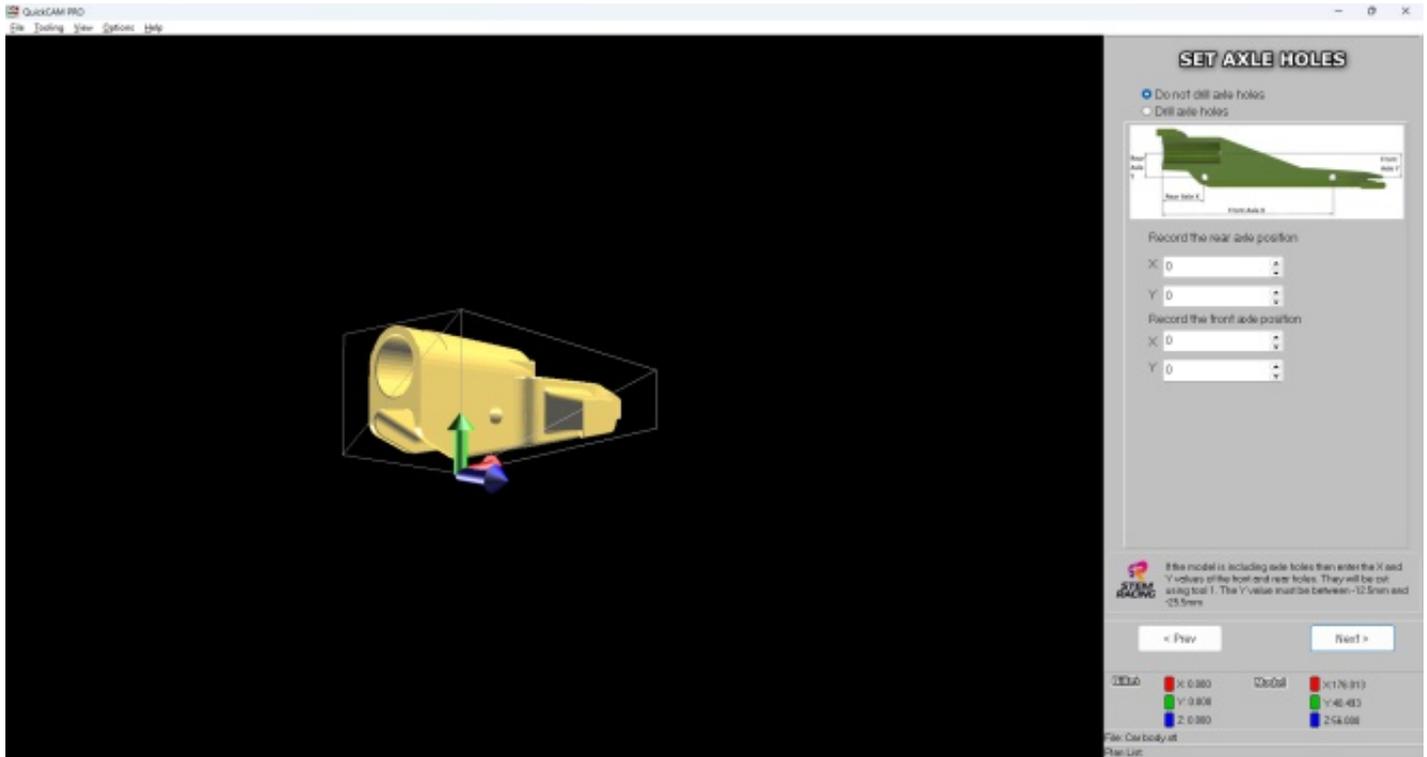
Once the centre height is correctly entered and the green arrow is correctly positioned in relation to the bore the Next button will be enabled. ***This value will be recorded for later use.***

Click the Next button



Set Axle Holes

The Car Wizard automatically sets the Cut Depth



The first option you have is whether you would like to drill your axle holes or not. This will be done with Tool 1 - 1/4" Ball Nose Cutter (6.35mm). If you do not wish to drill axle holes just click Next.

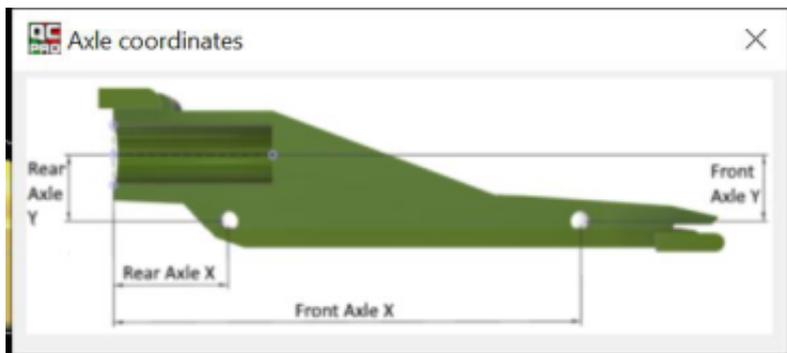
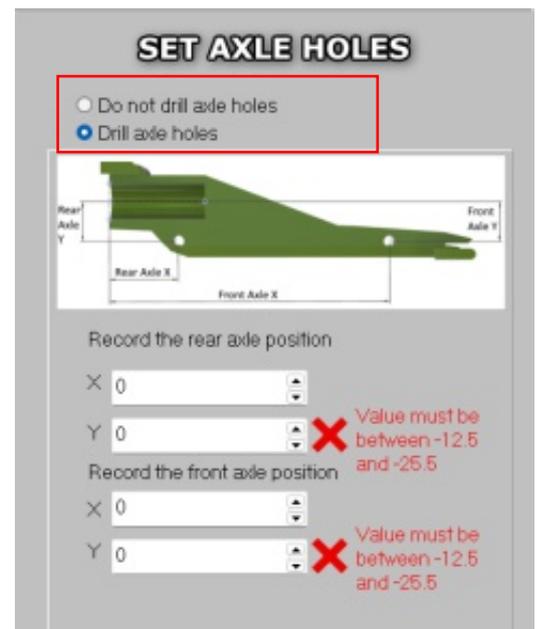
However, if you do wish to drill, you axle holes select 'Drill Axle Holes' option.

Once selected you will need to input the values.

If you don't know the values you can press this button.



The Help button will load up the image below.



Next >

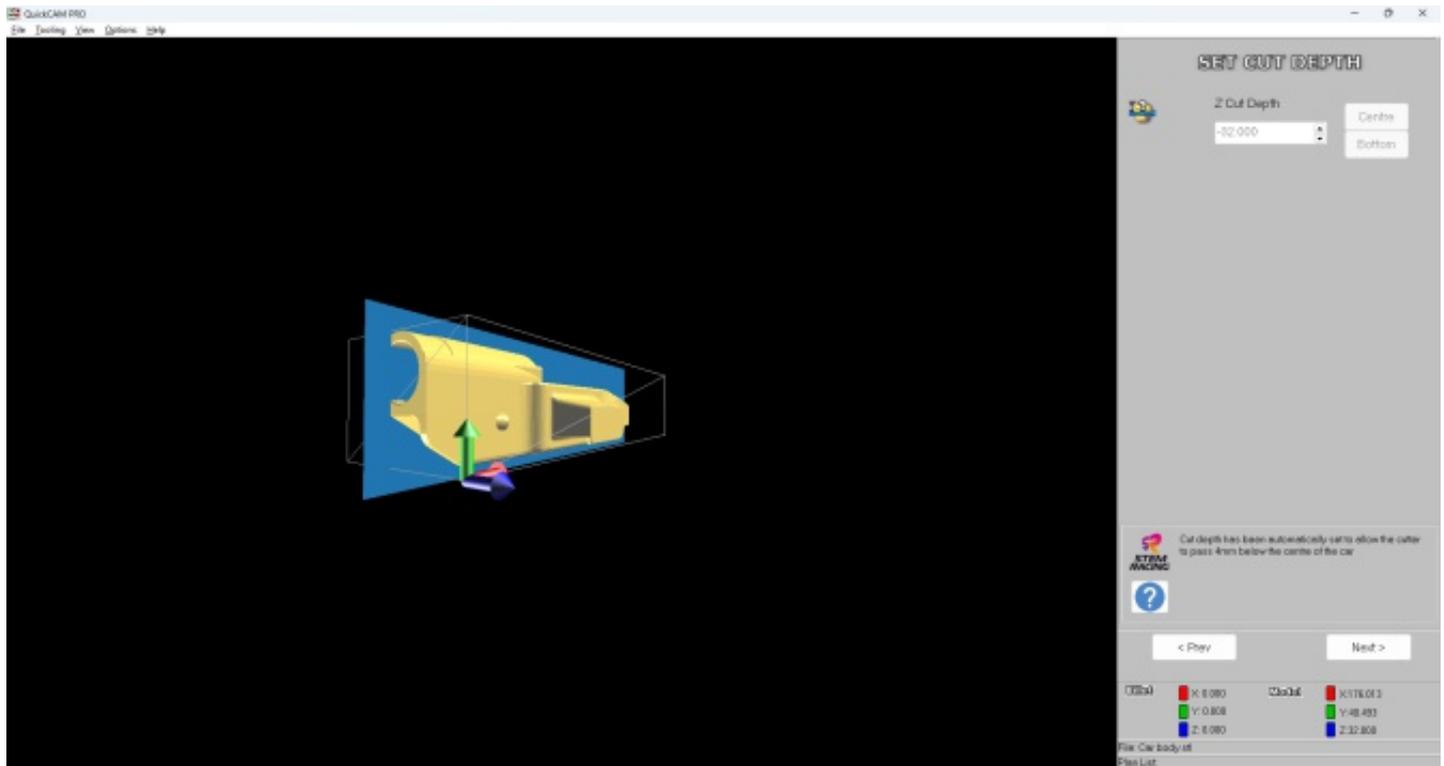
As you can see you need to input an X and a Y value for both the front and rear axle positions.

The X axis values will be a positive number and the Y axis values will to negative between -12.5 and -25.5.

Ideally these values will be recorded using the CAD model or drawing.

Set Cut Depth

The Car Wizard automatically sets the Cut Depth



The Car Wizard recorded the width of the car when it was imported on the Orientate Model page of the wizard.

The depth of cut needs to go beyond the centre line of the car by a minimum of the cutter radius.

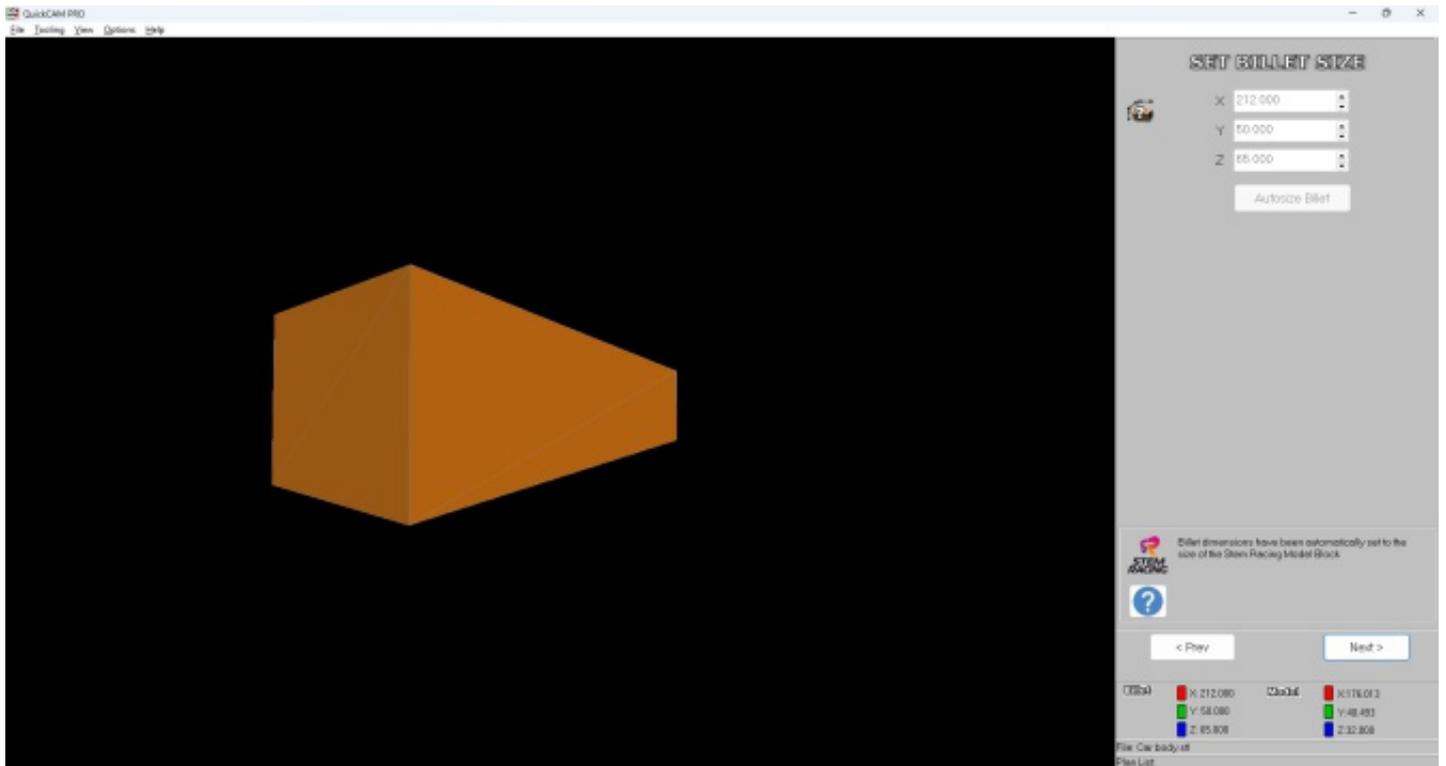
The cut plane will automatically be set at half the width of the car plus 4mm to take the cutter below centerline when the machining plan is calculated.

In this case the Car Width is 56mm so the Cut plane is set to half the car width 28mm + 4mm so the cut depth is set to Z-35mm

Next >

Set Billet Size

The Car Wizard automatically sets the Billet Size



The Car Wizard preloads a Billet size equal to the machinable area of the official STEM Racing Model Block.

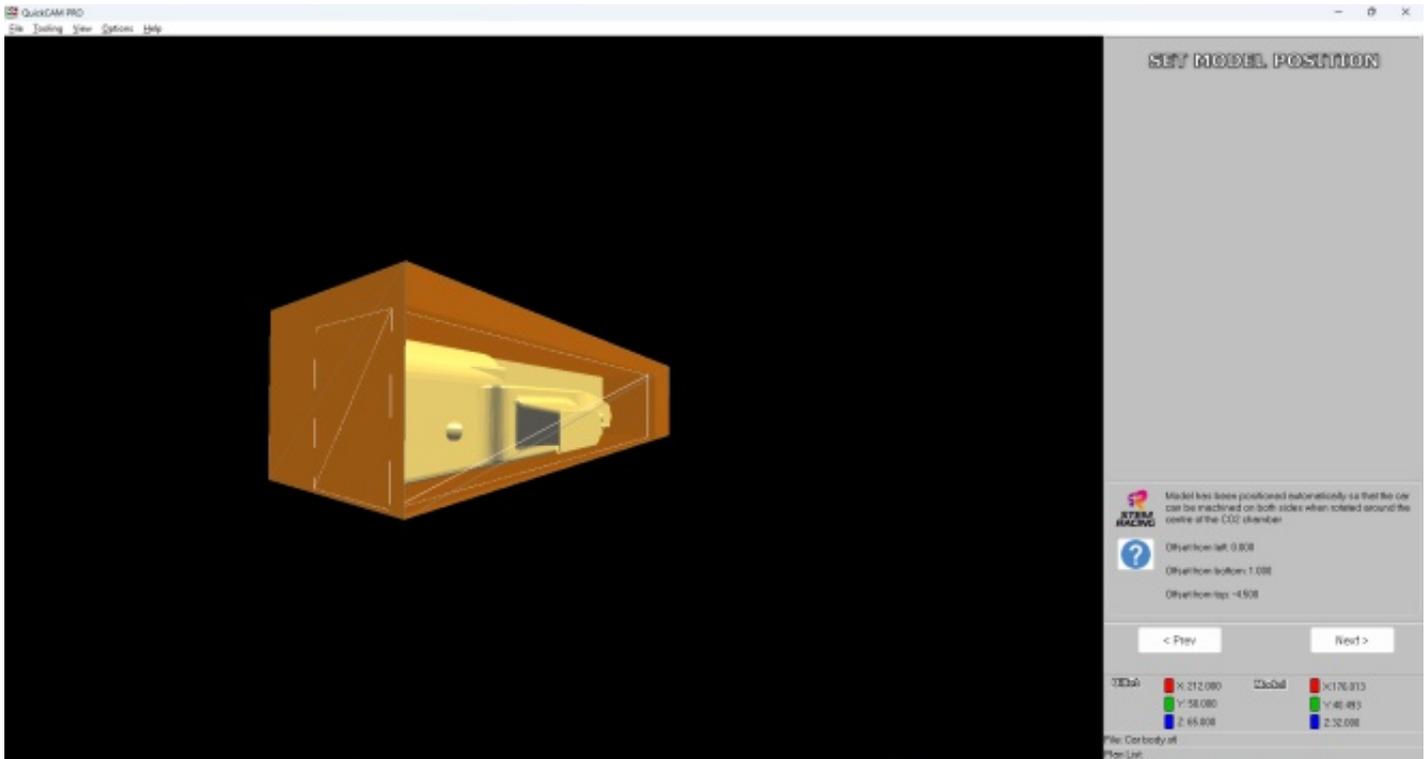
X = 210mm, Y = 50, Z = 65

While a Model Block is 223mm long there is 13mm at the end of the block used as a clearance zone. This is to allow it to be held in the fixture and avoid the cutter causing damage.

Next >

Set Model Position

The Car Wizard automatically sets the Model Position within the Billet



The Car Wizard recorded the width, height and length of the car on the Orientate Model page. The height of the CO2 Cartridge chamber from the base of car was also recorded.

As a result the Model is automatically positioned in the Billet.

The X is always given an offset of 0 and aligned to the left of the billet.

The Y axis has to be set to get the CO2 Cartridge Chamber aligned with the hole in the billet.

The Centre Height of the camber in the Model Block is always 29mm. Subtract the height of the CO2 Cartridge chamber from the base of the car that was recorded earlier, in this case is 28mm therefore the Y offset is 1mm from the bottom.

In this case the model is 56mm wide and the billet is 65mm so there is 9mm difference split equally above and below the model

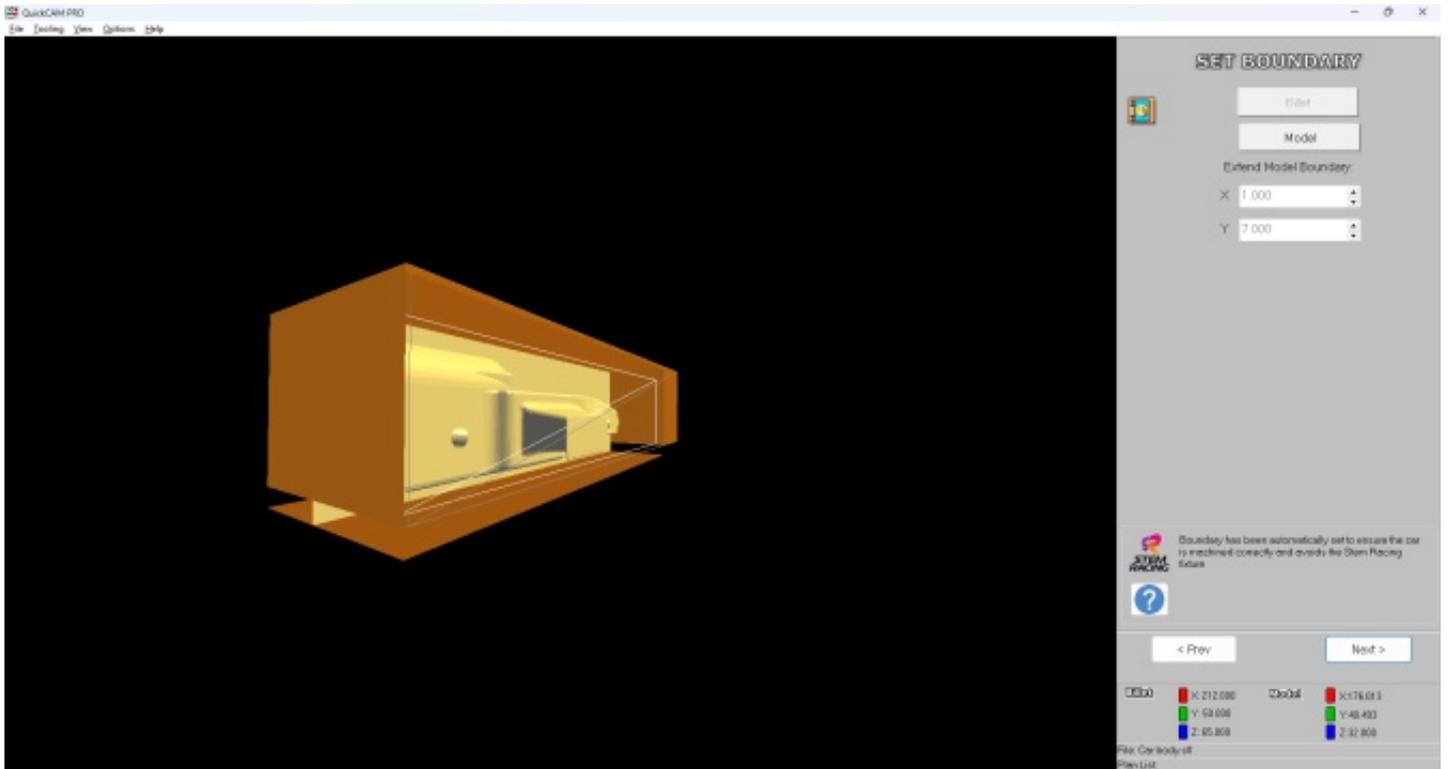
The Z offset is set to -4.5mm from the top of the billet

Click the Next button



Set Boundary

The Car Wizard automatically sets the Machining Boundary.



The Boundary is pre-set to allow the tool to travel 7mm outside the block in the Y axis. This is so that the tool has room to be allowed to machine the floor and top of the car.

The Boundary is also extended by 1mm in the X Axis which will clean up the edge of the model but prevent the tool chopping off the nose of the car and hitting the shaft used to secure the billet in the fixture.

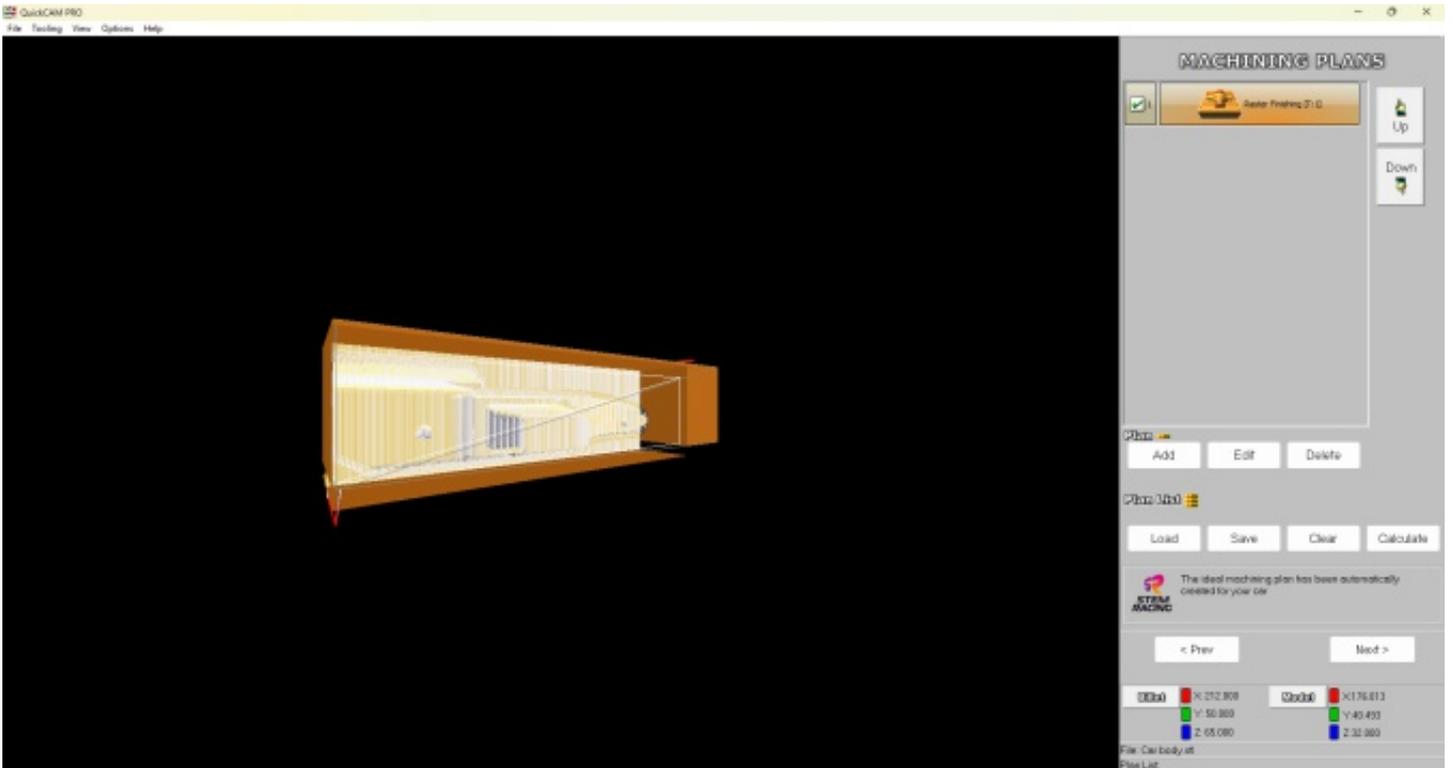
Next >

Machining Plans

The Car Wizard automatically opens and calculates the Cutter Plan.



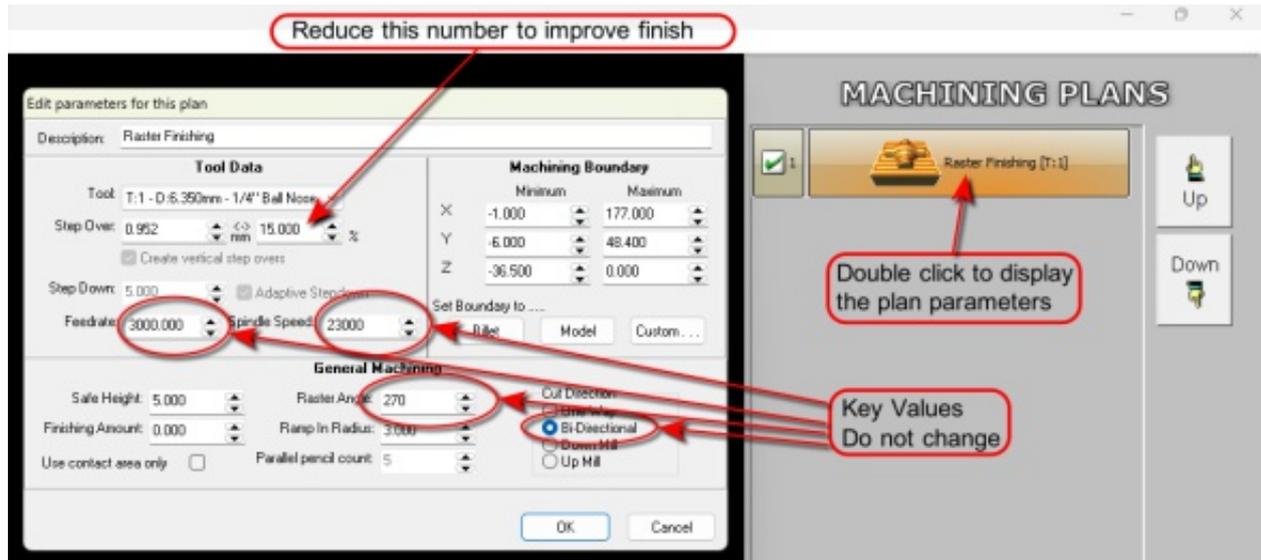
The Car Wizard loads the F1CarPlan.qpp and then automatically generates the cutter path.



Once the cutter plan is generated the cutter path is displayed. While the Raster finishing plan generated will create a good quality model additional cutter paths can be generated if required.

Editing Machining Plans

The Machining Plan can be viewed and Edited.



By double clicking on the machining plan the plan Parameters can be displayed.

The plan settings should be perfect for cutting cars out of the STEM Racing Model Block but if Balsa is used they may need to be modified.

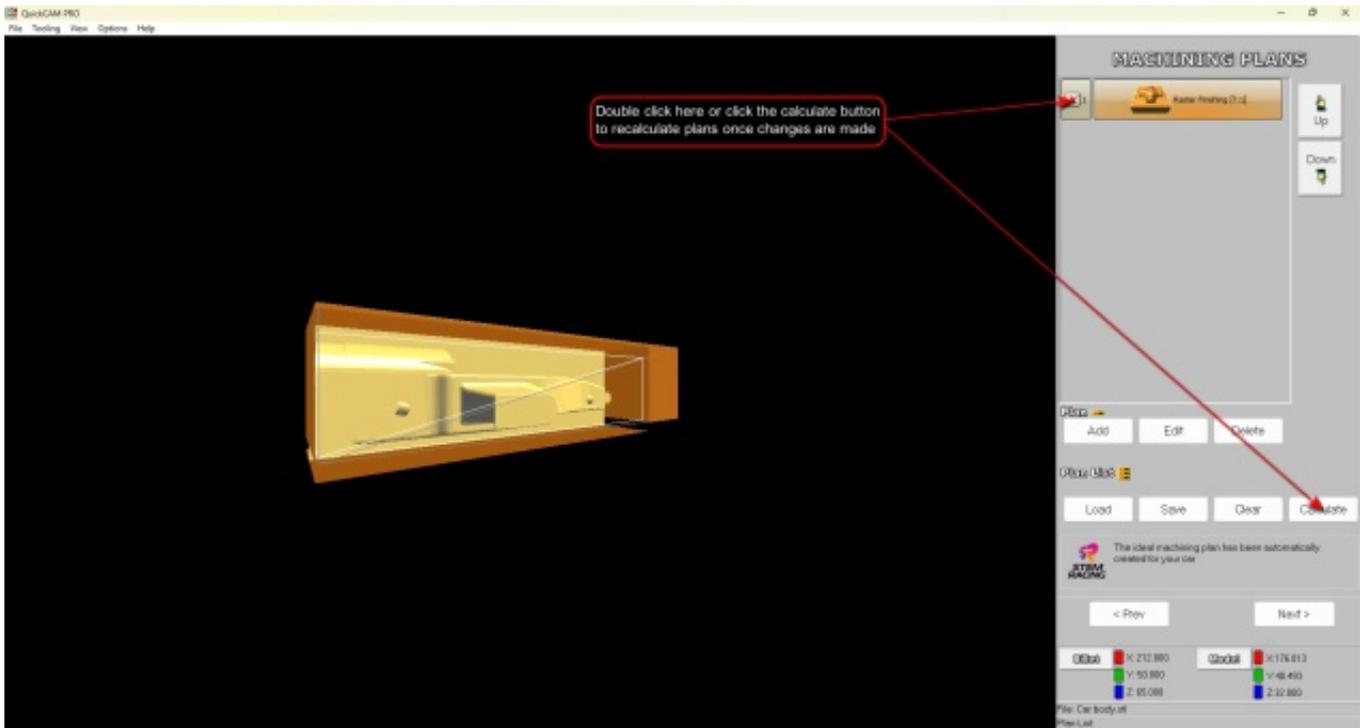
The stepover of 12% will create a smooth finish. Reducing this will improve the finish but also increase the time taken to manufacture the car.

The other key values set are listed below:

Feed	3000mm / Minute
Speed	23000RPM
Raster Angle	270 degrees
Cut Direction	Bi-Directional

Recalculating Machining Plans

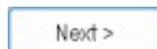
The Machining Plan can be Recalculated



To recalculate a plan double clicking on the question mark icon or click on calculate.



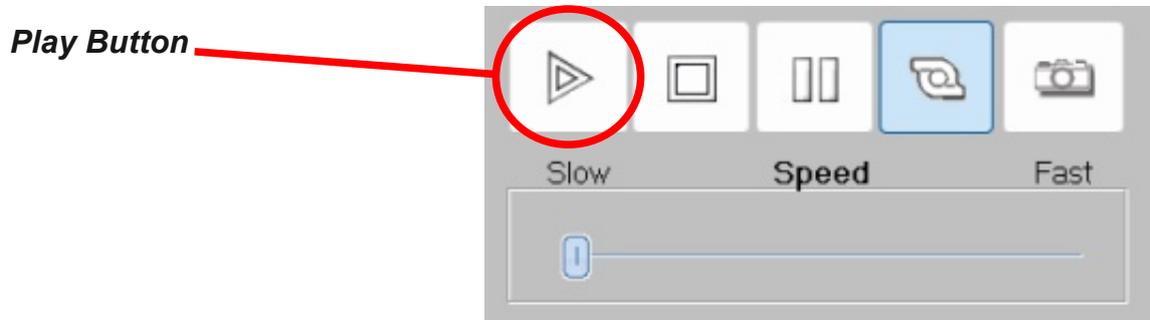
Click the Next button



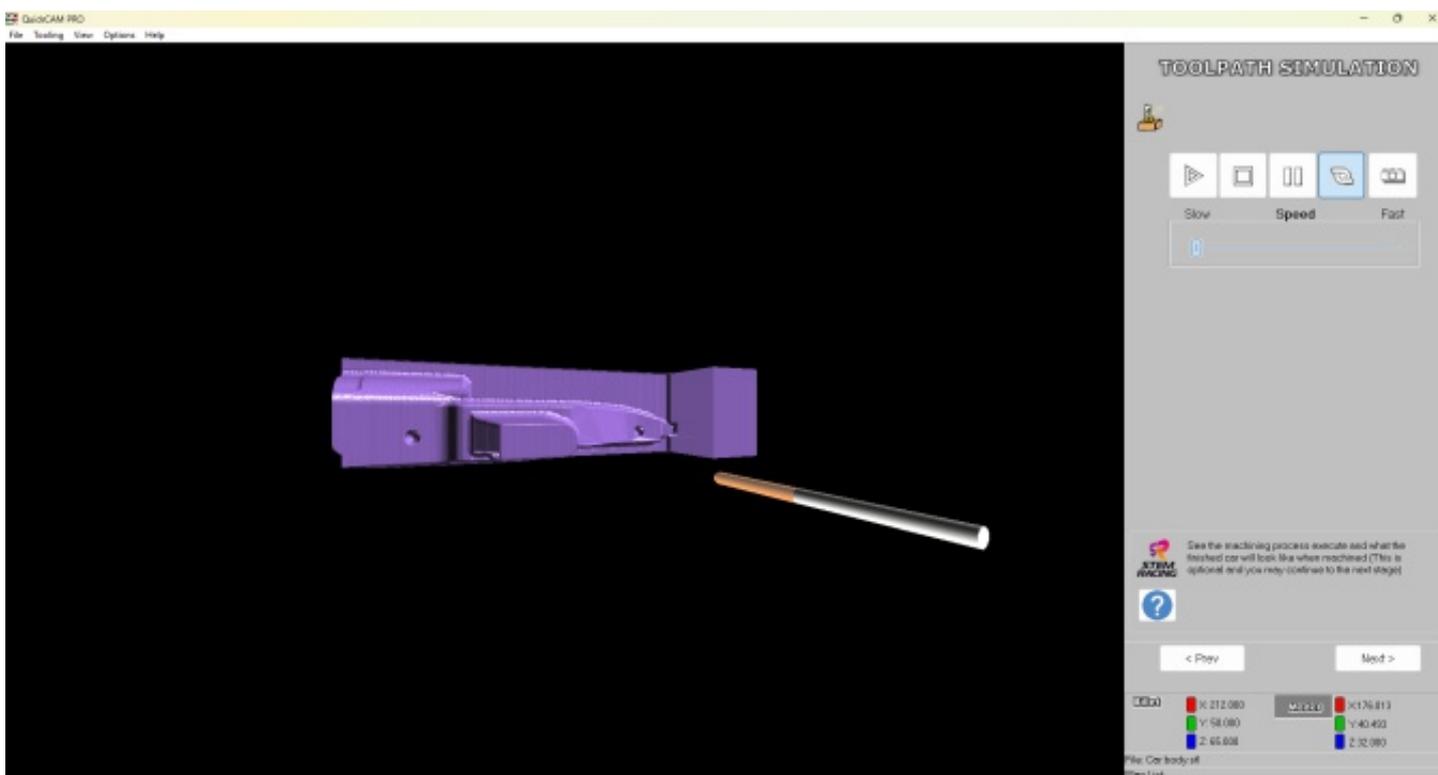
Toolpath Simulation

The generated cutter path can be simulated.

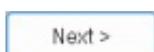
The Navigation panel on the right of your screen now has the video control buttons shown below



Click the Play button to run a simulation of your toolpath
It should look something like the one image below.

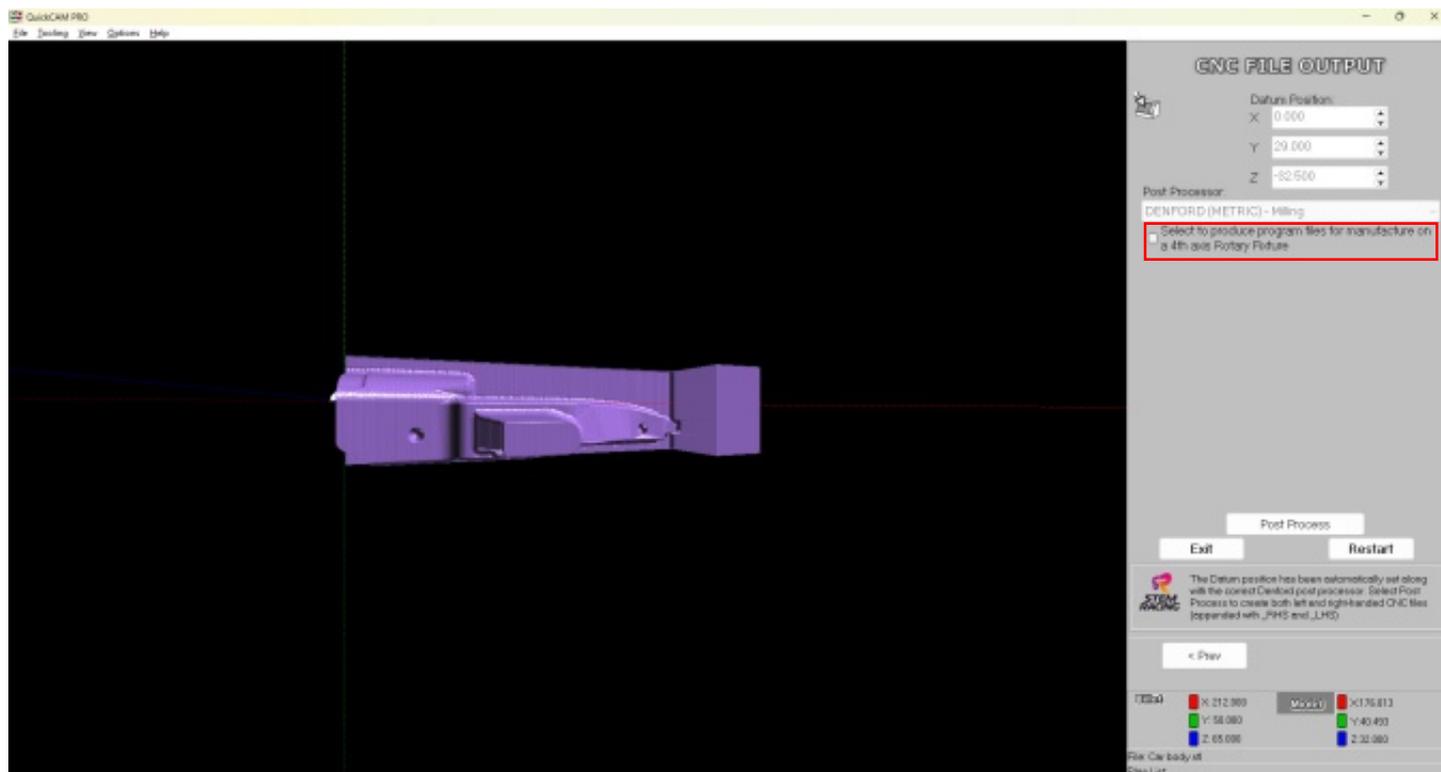


Click the Next button



CNC File Output

The Car Wizard automatically sets the Datum position and select the Post Processor.



The Car Wizard will automatically set the Datum position at the centre of the CO2 Cartridge chamber

The Datum position Values are:

X = 0 (the left hand edge of the block)

Y = 29mm (The distance from the base to the center of the CO2 chamber)

Z = -32.5mm (Half the height of the model block)

It then Selects the Denford Metric Milling Post Processor

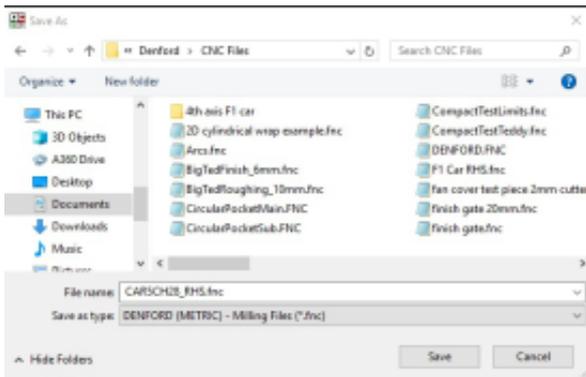
Make sure the 4th axis button is untick (this is used for the automatic rotary 4th axis)

Click the Post Process button to create the programs

Post Process

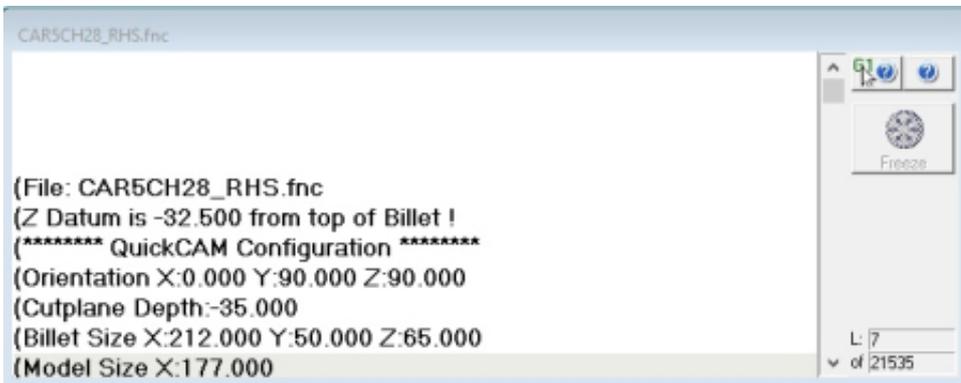
Saving the CNC File for a STEM Racing Fixture

The Car Wizard automatically names the file adding RHS to the end of the file name.



When you click of Save the Car Wizard produces two files one for the RHS and the another named LHS with the M71 mirror command code written into it.

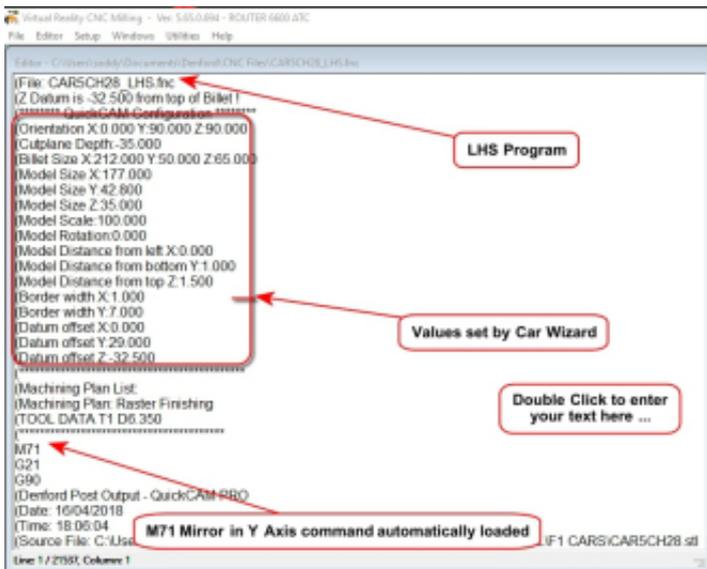
Depending on the settings in QuickCAM PRO the VR Milling Software may open and load the RHS



VR Milling Shown with the RHS program Loaded.

In the same location as the file was saved the program for the LHS will also be stored.

Click file open and select the LHS program

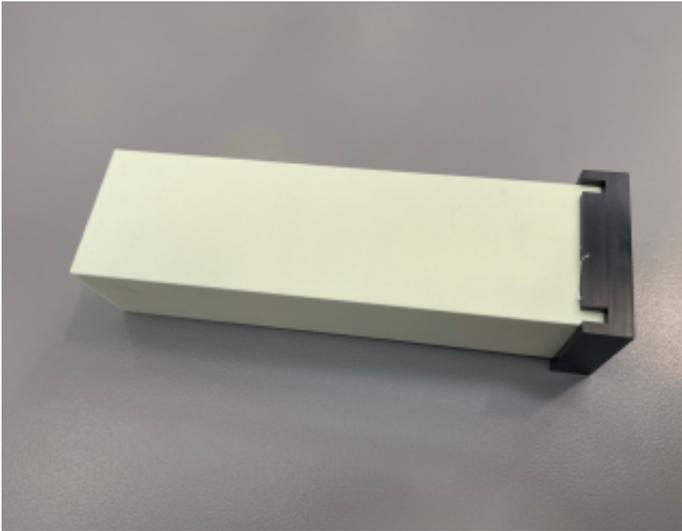


VR Milling 5 Shown with the LHS program Loaded showing the M71 command.

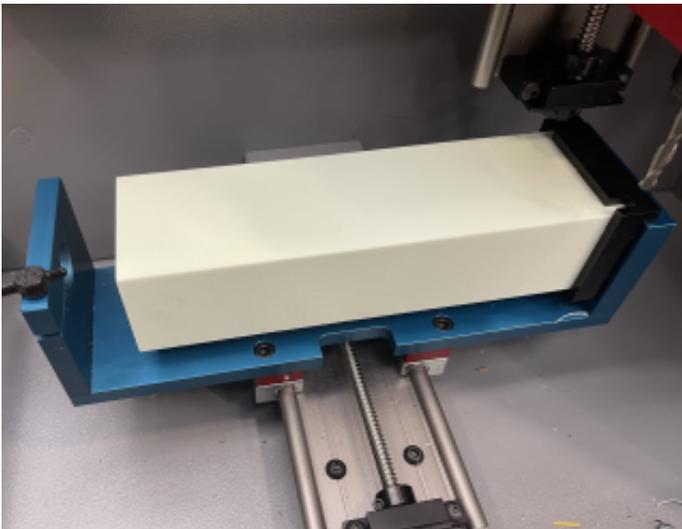
Machining the F1 in Schools Billet

Manufacturing Fixture for MCR100

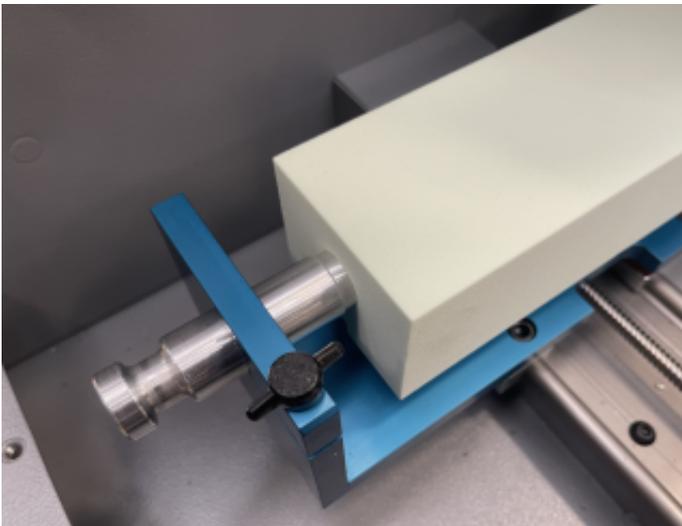
Place the black plastic end cap on the block as shown below:



Place the STEM Racing Model Block into the fixture.



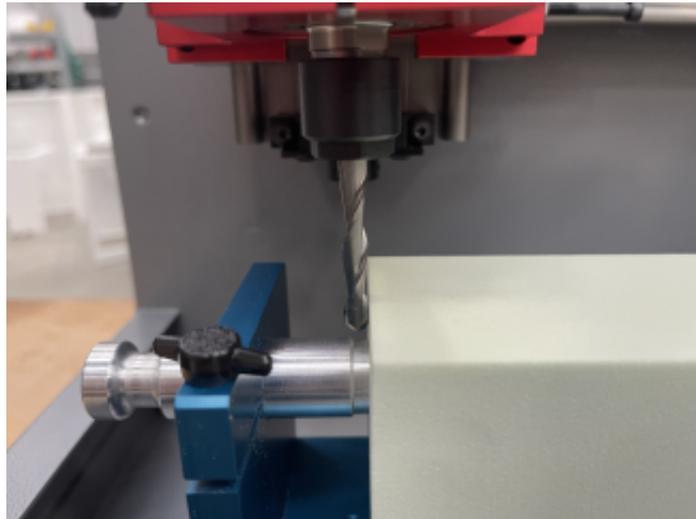
Insert the Aluminium Pin into the STEM Racing Model Block and tighten the clamping Screw on the fixture .



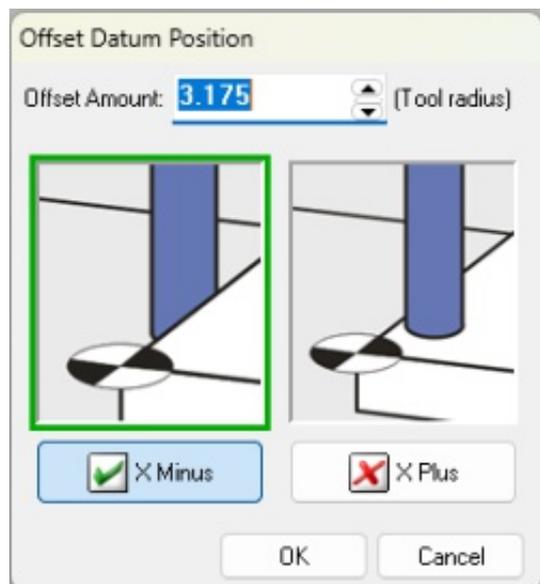
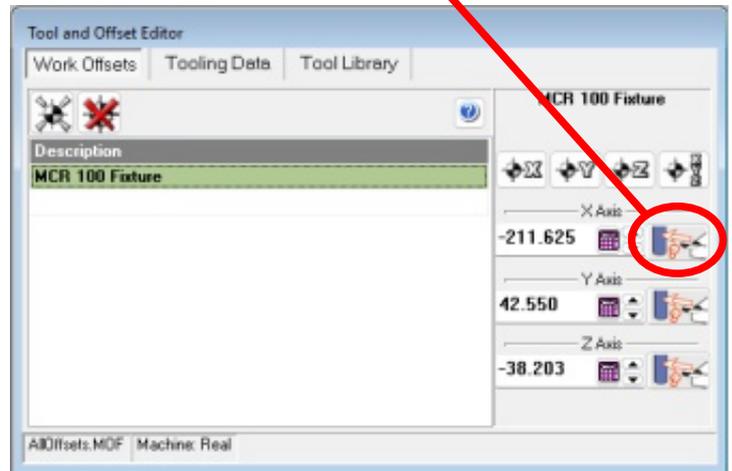
Setting the DATUM

X Axis

Touch the tool onto the left hand side of the billet as shown in the image below



In the Tool and Offset Editor window select the X axis datum offset button



The tool Radius is 3.175 so the centre line of the tool is outside the billet by this amount. This option automatically adds the radius of the tool to set the offset If the offset is not automatically loaded.

Type the value shown below into the offset amount
3.175

Click the X Minus button



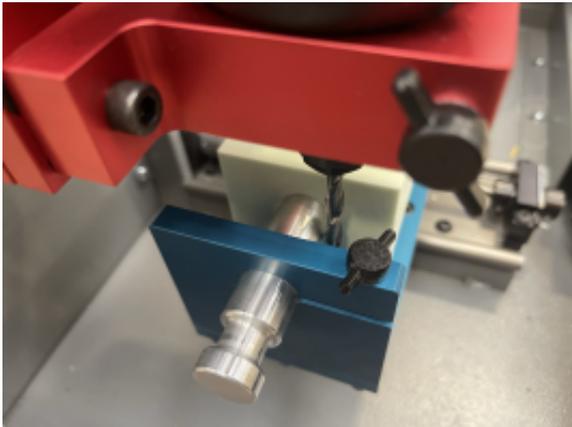
Click the OK button



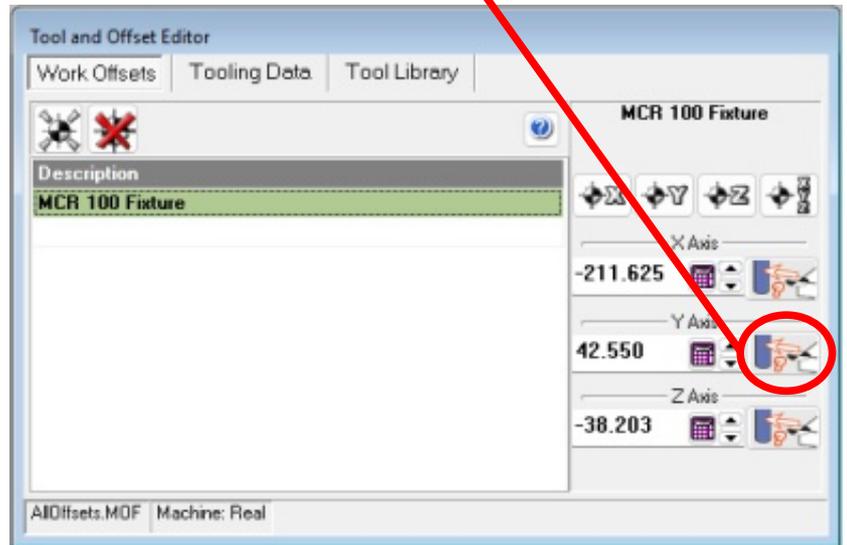
You have now set the X axis

Y Axis

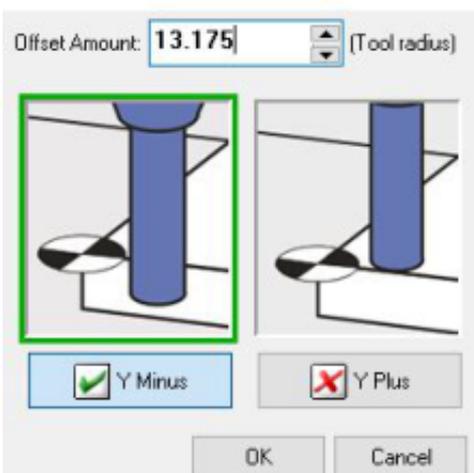
Touch the tool onto the front of the aluminium shaft as shown in the image below



In the Tool and Offset Editor window select the Y axis datum offset button



Offset Datum Position



The aluminium shaft is 20mm Diameter so 10mm Radius.

The tool is 6.35mm Diameter so 3.175mm Radius.
When the tool touches the shaft the centers are 10mm + 3.175mm away from each other = 13.175mm

Type the value shown below into the offset amount.
13.175

This is the radius of the tool and the radius of the bar

Click the Y Minus button



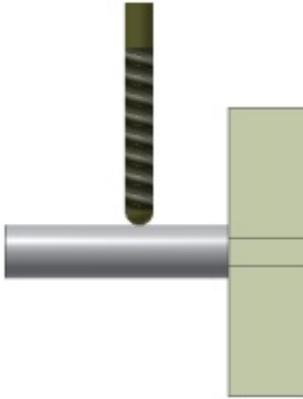
Click the OK button



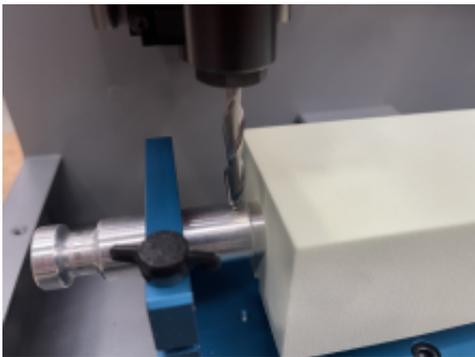
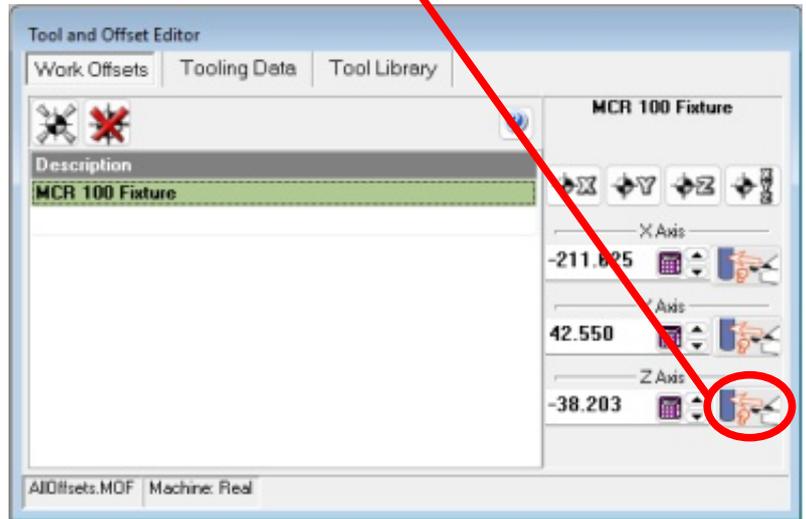
You have now set the Y axis

Z Axis

Touch the tool onto the top of the aluminium shaft as shown in the image below.



In the Tool and Offset Editor window select the Z axis datum offset button



To do this the Y axis must be at 0

Go to the MDI tab in the Control Panel

Type "Y0"

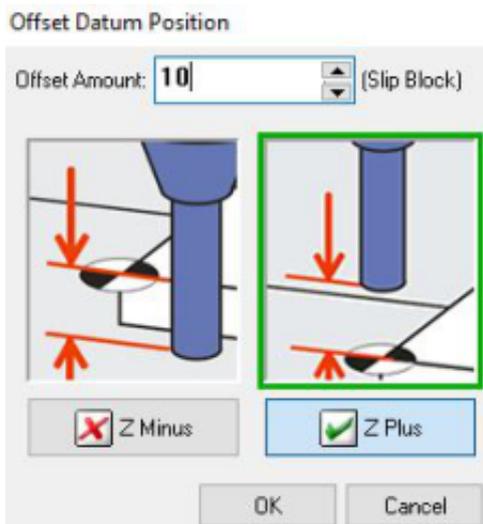
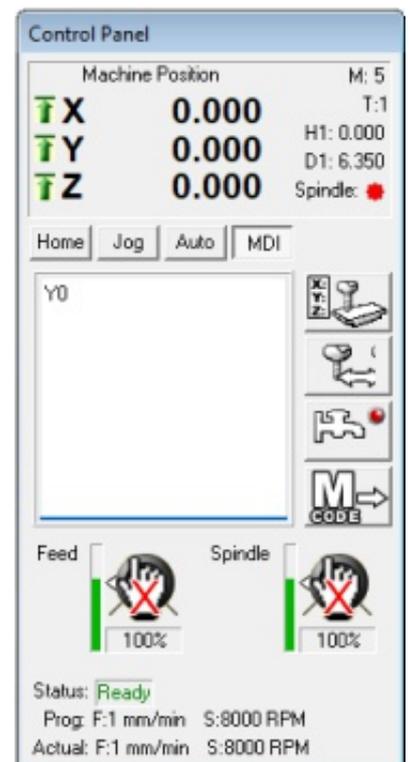
Press the Start button



Go to the jog tab and lower the tool onto the top of the bar

The aluminium shaft is 20mm Diameter so 10mm Radius.

Enter 10mm as the offset amount



Click the Z Plus button



Click the OK button



You have now set the Z axis offset

Running the Program

MCR100

Open your file that you created on page 19 of this guide.

Running the Program

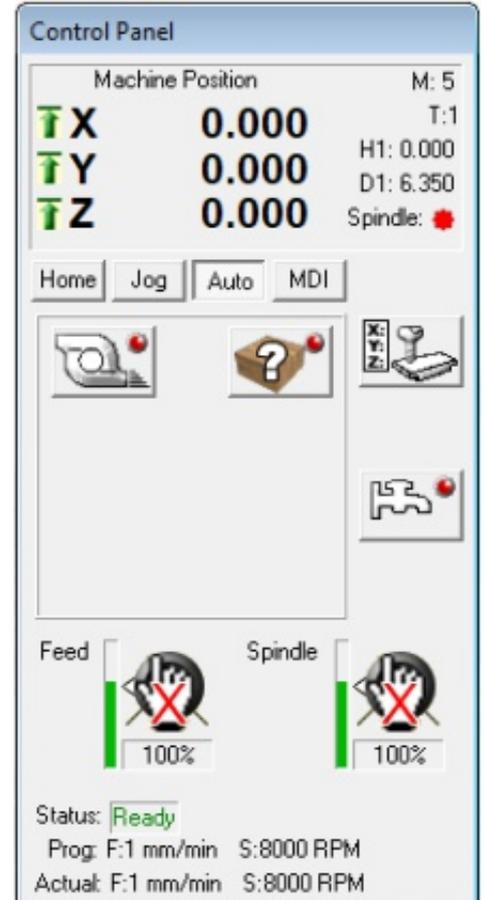
On the Control Panel, ensure that you are in Auto mode

Be sure that Turbo Mode is turned on

Make sure that Material Override is turned off

Check that the Feed Rate Override on the front of the router is set to 100%

With the file control buttons select Stop, Rewind, then Start



Whilst you could just press Start, the above method is safer as it will ensure that you



do not start a program part way through which could cause damage to the fixture and the tool.

When Completed First side turn STEM Racing car over to complete the second side and select the next file to .

Make sure that Material Override is turned off

Check that the Feed Rate Override on the front of the router is set to 100%

With the file control buttons select Stop, Rewind, then Start

On-Line Technical Forum

TECHNICAL SUPPORT AVAILABLE 24 HOURS A DAY, 7 DAYS A WEEK

Denford's Technical Forum is a free of charge on-line technical support service that is available to Denford customers 24 hours a day, 7 days a week.

"The technical forum has provided a wealth of information and support for our 20-year-old Denford CNC machine, in fact just as good as the support we receive for our brand new CNC Router!"



As well as offering comprehensive technical support, Denford's On-Line Technical Forum enables customers to share ideas and projects with other users. Media such as teaching material, project work, PDF's, images, drawings and text documents are easily attached to messages for all users to view and comment on.

You can also read the latest Denford news before anyone else, and keep track of machine and software upgrades, some of which can be downloaded direct from the Technical Forum web site.

The On-Line Technical Forum has proved to be hugely popular with customers. One recent user posted a note to inform us that the Technical Forum has "provided a wealth of information and support for our 20-year-old Denford CNC machine, in fact just as good as the support we receive for our brand new CNC Router!"

Of course the traditional methods of phone and email are still available, but try out this new service by simply logging on to www.denfordata.com/bb/ and register.

Denford's On-Line Technical Forum is a free of charge service that can be accessed 24 hours a day, 7 days a week.

The On-Line Technical Forum is available to Denford customers, old and new, and it couldn't be easier to use. Just visit <http://www.denfordata.com/bb/> and register on line.....it's that simple.

Denford's On-Line Technical Forum opens up the traditional communication channels that can restrict customer and technical support, due to availability of staff, teaching commitments or different time zones.

A multitude of topics relating to Denford machines and software (both new and old) are covered within the forum, which is simple to search, and easy to use.

Denford's Technical Team and Denford customers from around the world regularly log on to the forum to offer support and advice and, most importantly, post a solution for all to see.

