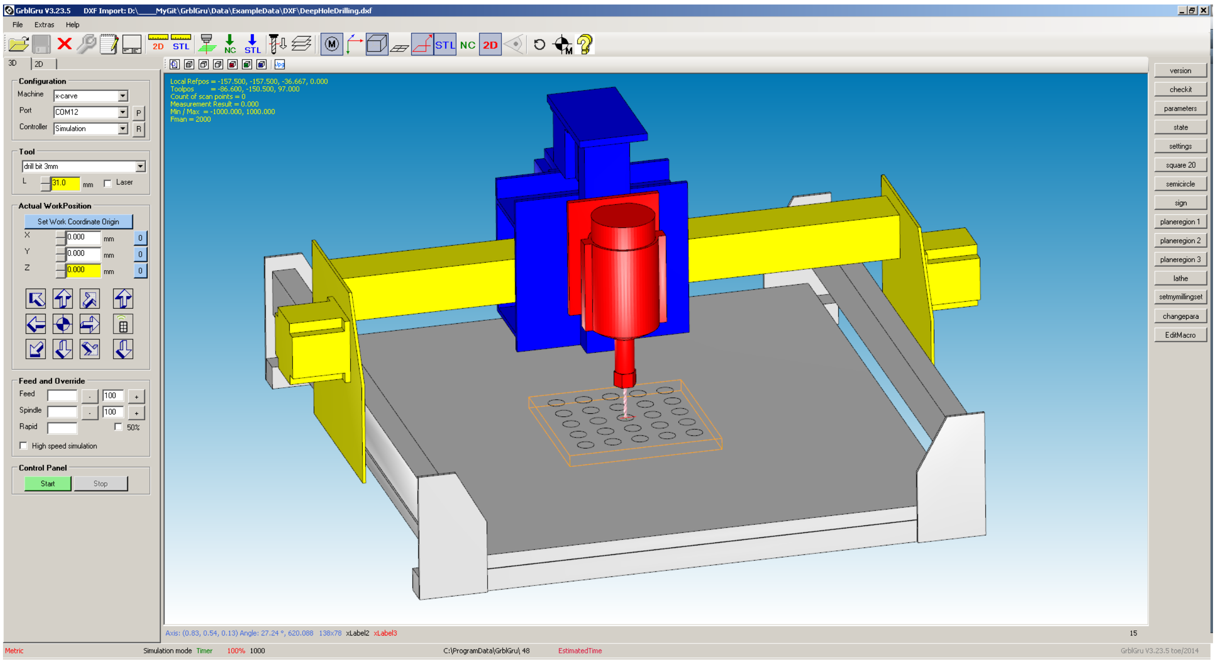
What is *GrblGru* ?

April 13, 2019



GrblGru V3.23.5 DXF Import: D:\____MyGit\GrblGru\Data\ExampleData\DXF\DeepHoleDrilling.dxf

Configuration

Machine x-carve

Port COM12

Controller Simulation

Tool

drill bit 3mm

L 31.0 mm

□ Laser

Actual WorkPosition

X 0.000 mm

Y 0.000 mm

Z 0.000 mm

Feed and Override

Feed 100

Spindle 100

Rapid

□ 50%

□ High speed simulation

```
Local Refpos = -157.500, -157.500, -36.667, 0.000
Toolpos      = -86.600, -150.500, 97.000
Count of scan points = 0
Measurement Result = 0.000
Min / Max  = -1000.000, 1000.000
Fman = 2000
```

Axis: (0.83, 0.54, 0.13) Angle: 27.24 °, 620.088 138x78 xLabel2 xLabel3 15

Metric Simulation mode Timer 100% 1000 C:\ProgramData\GrblGru\ 48 EstimatedTime GrblGru V3.23.5 toe/2014

Contents

1 Motivation 3

2 The name '*GrblGru* ' 3

3 What is *GrblGru* ? 3

4 The operating modes 4

4.1 Simulation mode . . . 5

4.2 Real mode . . . 6

4.2.1 Outlook into the future, the 5 axis machine . . . 7

4.2.2 Terminal mode . . . 8

5 Functions 9

5.1 CAM functions . . . 9

5.2 STL functions . . . 11

5.3 Slicer function . . . 12

5.4 DXF templates . . . 13

6 System requirements 14

7 Download 14

8 Installation 15

9 It should be noted ... 17

10 Attachment 18

10.1 Available 3D machine models . . . 18

1 Motivation

Recently, I've been often asked to describe what ***GrblGru*** actually is. This document is now an attempt to fulfill this request.

2 The name '***GrblGru*** '

Grbl is the name of a free brilliant open source software for controlling the motion of machines. It can interpret G-code and creates pulse and direction information to control stepper motors.
Because ***GrblGru*** controls ***Grbl*** in control mode, the name ***GrblGru*** is the consistent continuation of the 'stupid' name ***Grbl*** , which nobody really knows what it means. The pronunciation is also not clearly defined. I prefer '**Grabble Gru**' and because I often make a slip of the pen, I very often use a simple short '**GG**'.

3 What is ***GrblGru*** ?

GrblGru is ...

- a 3D-simulation tool for mills and lathes
- a G-code sender for Grbl and TinyG
- a CAM-program for mills and lathes
- a tool to learn the CNC-technic without having a 'real' machine.

I myself noticed only relatively late, which immense advantages the use of virtual simulations offers for training purposes.
It would be a great pleasure to me if the program could be used, e.g. to introduce young people to this great hobby. If changes or additions are necessary, of course I am willing to do so.

4 The operating modes

GrblGru has 2 operating modes that basically differ:

- **Simulations mode**
  for virtual 3D simulation of a CNC machine

- **Real mode**
  for real control of a CNC machine with **Grbl**, **TinyG** or **G2Core** (currently in preparation) operating system.

4.1 Simulation mode

This mode of operation is the original idea of the program, which was primarily intended to check existing G-code on a virtual machine and show possible collisions. This kind of early virtual verification has become more and more prevalent in the industry in recent years because it saves valuable machine time and uncovers errors in advance.

GrblGru is started and the mode switch is set to the 'Simulation' position. This gives the following situation.

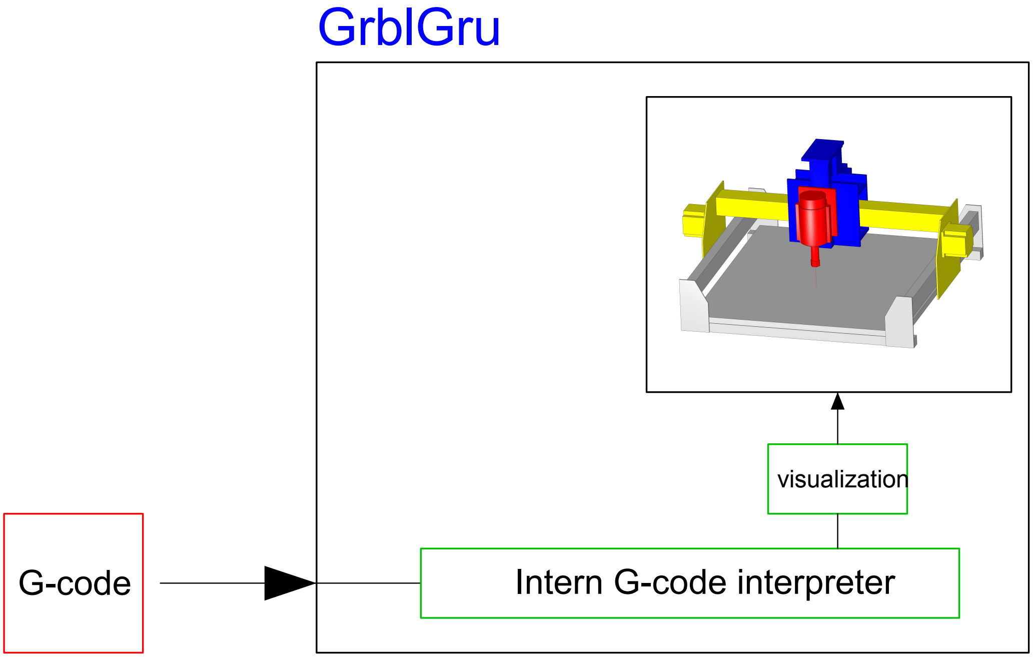


Figure 1: ***GrblGru*** in simulation mode

There is no connection to a controller. The G-code, to be examined is loaded and the commands are processed by the internal G-code interpreter. The loaded 3D model is animated accordingly.

Attached you will find the available 3D models of milling machines and lathes.

A special feature of the program, however, is that the user can also import their own 3D models. This makes it possible to model each mill or lathe as a simple model in ***GrblGru*** .

So if someone is a little familiar with 3D and interested in visualizing his homemade machine, I am happy to assist.

4.2 Real mode

In this mode, ***GrblGru*** is connected to an Arduino or TinyG. The connection is made via the USB interface, which transmits both the G-code commands to the controller and the information about the current axis positions back to ***GrblGru*** . ***GrblGru*** uses this information to control the 3D model so that the 3D model moves parallel to the 'real' axes.

The main difference between the two controllers is that TinyG can also control a rotary axis, often called the 4th axis, in addition to the 3 linear axes. Also there are already 2.5 A drivers on board, to which you can immediately connect corresponding motors. For bigger motors, however, the signals for controlling external drivers are also available.

GrblGru is started and the mode switch is set to the 'Grbl' or 'TinyG' position. This will give you one of the following two situations.

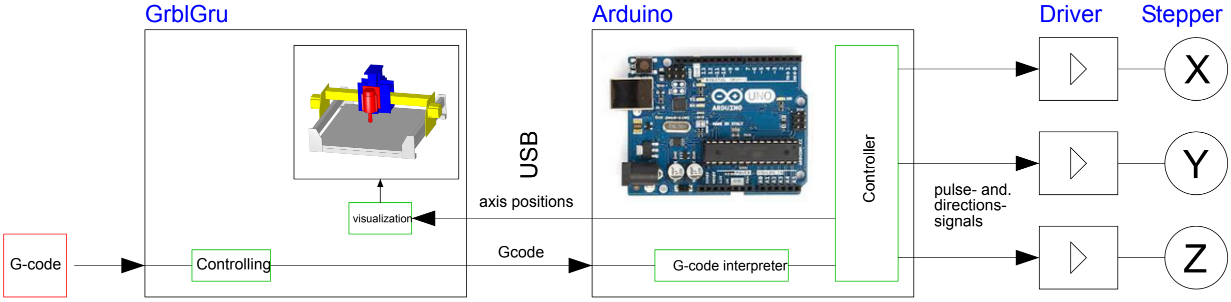


Figure 2: ***GrblGru*** in real mode with Arduino (3 axes)

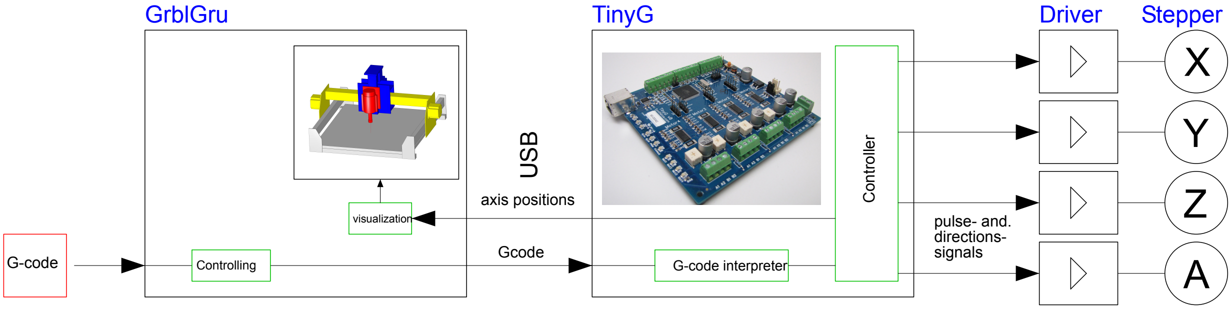


Figure 3: ***GrblGru*** in real mode with TinyG (4 axes)

4.2.1 Outlook into the future, the 5 axis machine

At the moment still in progress is the G2Core software on an Arduino DUE. This system provides 6 axes (linear and rotary), making it to the ideal controller for my 5-axis 'dream' machine. :)
g2core has a number of advanced features including:

- Full 6 axis motion control - XYZ linear axes and ABC rotary axes
- Step outputs available for 6 motors (motors are mappable to axes)
- Jerk controlled motion for acceleration planning (S curve 3rd order motion planning)
- Extremely stable and jitter-free 200 kHz step generation
- USB is native on the ARM chip and runs 12 Mbps or 480 Mbps
- Complete status and system state displays
- Advanced hardware abstraction layer for easy port to multiple ARM and non-ARM processing environments

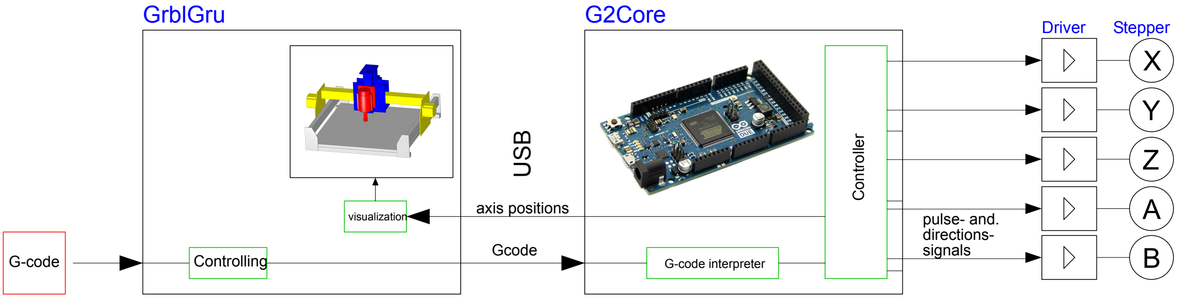


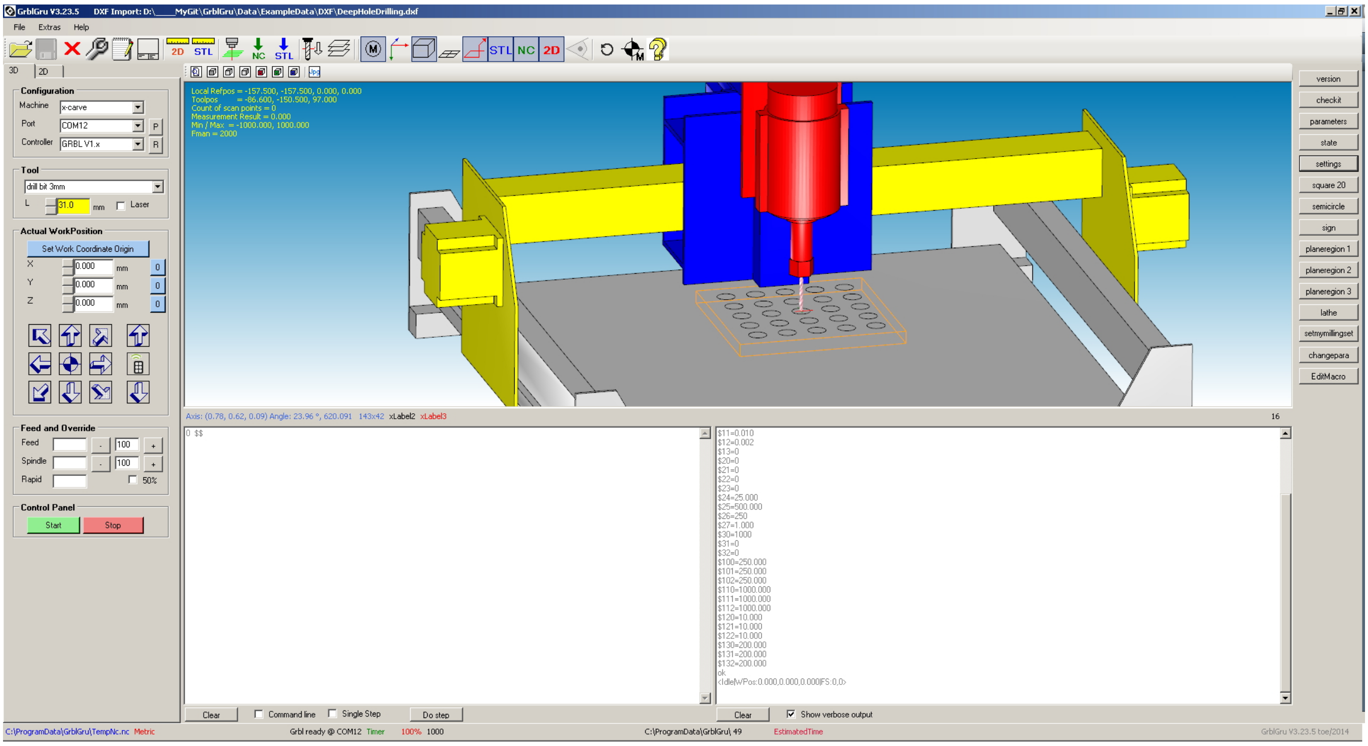
Figure 4: ***GrblGru*** in real mode with G2Core (5-axes)

Additional information about Grbl, TinyG and G2Core:

- **Grbl**
  https://github.com/grbl/grbl/wiki
- **TinyG**
  https://github.com/synthetos/TinyG/wiki
- **G2Core**
  https://github.com/synthetos/g2/wiki/What-is-g2core

4.2.2 Terminal mode

It is also possible to send individual commands for control via the two control windows. So you can, for example also display or change the settings of the controller.



GrblGru V3.23.5 DXF Import: D:____MyGit\GrblGru\Data\ExampleData\DXF\DeepHoleDrilling.dxf

Configuration
Machine: x-carve
Port: COM12
Controller: GRBL V1.x

Tool: drill bit 3mm
L: 31.0 mm □ Laser

Actual WorkPosition
X: 0.000 mm
Y: 0.000 mm
Z: 0.000 mm

Feed and Override
Feed: 100
Spindle: 100
Rapid: □ 50%

```
Local Refpos = -157.500, -157.500, 0.000, 0.000
Toolpos      = -86.600, -150.500, 97.000
Count of scan points = 0
Measurement Result = 0.000
Min / Max  = -1000.000, 1000.000
Fman = 2000
```

Axis: (0.78, 0.62, 0.09) Angle: 23.96 °, 620.091 143x42 xLabel2 xLabel3 16

```
0 $$
```

```
$11=0.010
$12=0.002
$13=0
$20=0
$21=0
$22=0
$23=0
$24=25.000
$25=500.000
$26=250
$27=1.000
$30=1000
$31=0
$32=0
$100=250.000
$101=250.000
$102=250.000
$110=1000.000
$111=1000.000
$112=1000.000
$120=10.000
$121=10.000
$122=10.000
$130=200.000
$131=200.000
$132=200.000
ok
<Idle|WPos:0.000,0.000,0.000|FS:0,0>
```

□ Command line □ Single Step ☑ Show verbose output

C:\ProgramData\GrblGru\TempNc.nc Metric Grbl ready @ COM12 Timer 100% 1000 C:\ProgramData\GrblGru\ 49 EstimatedTime GrblGru V3.23.5 toe/2014

Figure 5: Open controller windows

5 Functions

Regardless of the two modes, ***GrblGru*** provides a number of functions..

5.1 CAM functions

The current functional scope of the CAM currently serves at the moment only the 2D or partially 2.5D area. So you can, for example use ***GrblGru*** to generate G-code for the mill or lathe from DXF or SVG files. To generate processes such as cutting, pocket-clearing or drilling, so-called job templates are used to avoid repetitive typing. Users who are familiar with **CamBam** will be able to get started very quickly.
In addition to the pure 2D work, however, there are also possibilities to include the 4th axis.

A real 3D editing is currently not yet available, but is a stated goal for the next future. :)

The generated G-code can then be transferred in control mode immediately to an Arduino or TinyG connected via USB. It is also possible to load the G-code file into another controller.

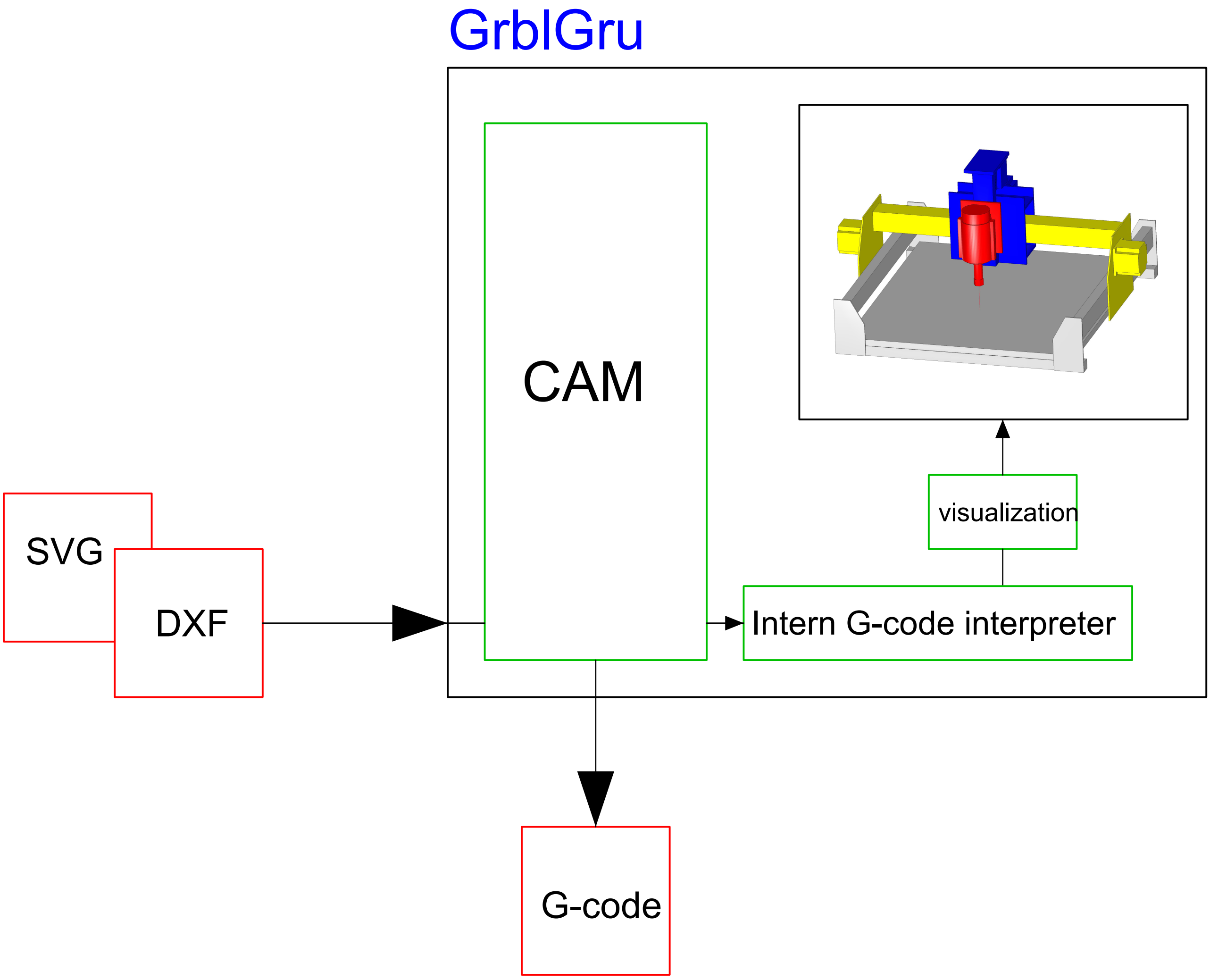
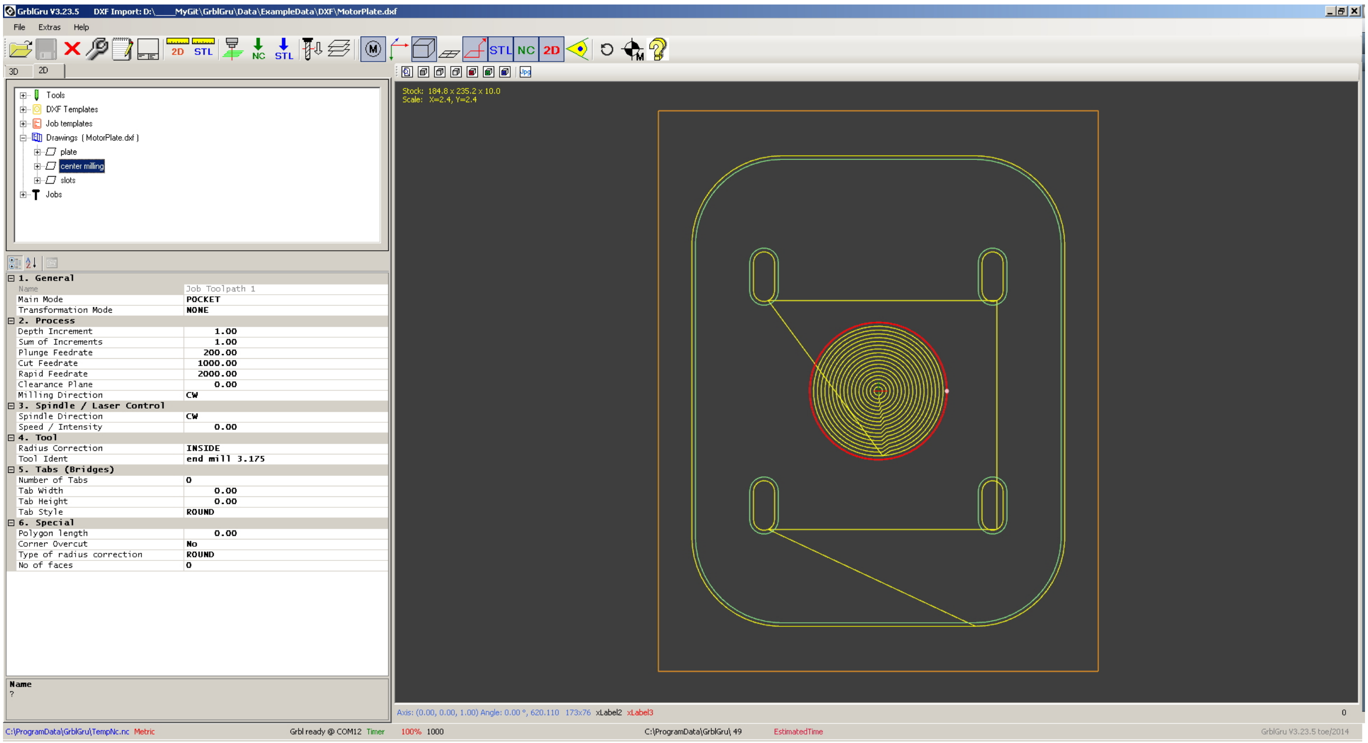


Figure 6: ***GrblGru*** in CAM mode



GrblGru V3.23.5 DXF Import: D:\____MyGit\GrblGru\Data\ExampleData\DXF\MotorPlate.dxf
File
Extras
Help
2D
STL
NC
STL
M
STL
NC
2D
M
3D
2D
Tools
DXF Templates
Job templates
Drawings (MotorPlate.dxf)
plate
center milling
slots
Jobs
Jpg
Stock: 184.8 x 235.2 x 10.0
Scale: X=2.4, Y=2.4
Axis: (0.00, 0.00, 1.00) Angle: 0.00 °, 620.110 173x76 xLabel2 xLabel3
0
C:\ProgramData\GrblGru\TempNc.nc Metric
Grbl ready @ COM12 Timer
100% 1000
C:\ProgramData\GrblGru\ 49
EstimatedTime
GrblGru V3.23.5 toe/2014

⊟ 1. General	
Name	Job Toolpath 1
Main Mode	POCKET
Transformation Mode	NONE
⊟ 2. Process	
Depth Increment	1.00
Sum of Increments	1.00
Plunge Feedrate	200.00
Cut Feedrate	1000.00
Rapid Feedrate	2000.00
Clearance Plane	0.00
Milling Direction	CW
⊟ 3. Spindle / Laser Control	
Spindle Direction	CW
Speed / Intensity	0.00
⊟ 4. Tool	
Radius Correction	INSIDE
Tool Ident	end mill 3.175
⊟ 5. Tabs (Bridges)	
Number of Tabs	0
Tab Width	0.00
Tab Height	0.00
Tab Style	ROUND
⊟ 6. Special	
Polygon length	0.00
Corner Overcut	No
Type of radius correction	ROUND
No of faces	0

Name
?

Figure 7: Creating a job with the help of templates

5.2 STL functions

3D objects are traded as STL format. STL is the simplest format among many formats used by CAD programs.

GrblGru can be used to create STL objects from 2D data (DXF or SVG files). The 2D graphics can either be extruded, ie 'pulled' to a 2.5D object, or rotated around an axis to a rotating body. It is also possible to generate parameterized spur gears or screw threads. The created STL object can then be stored and reused anytime.

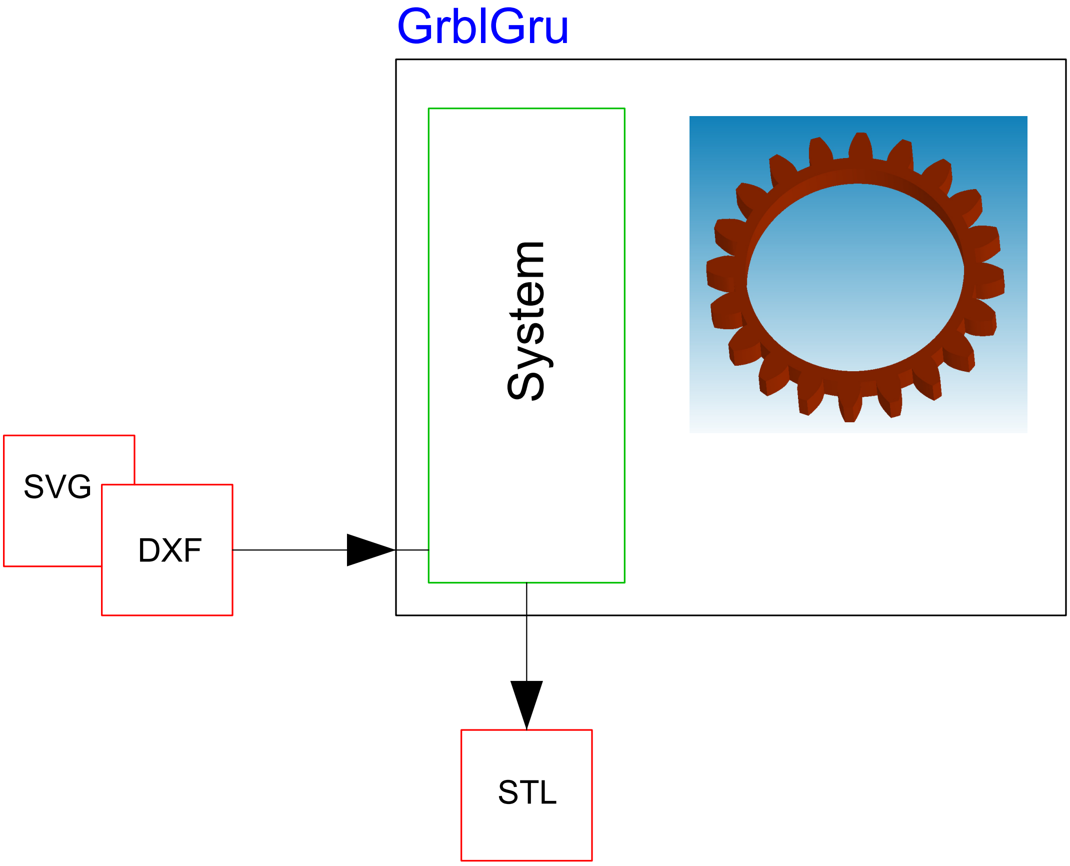


Figure 8: ***GrblGru*** in STL mode

5.3 Slicer function

In order to create ’real’ 3D objects, different sections of the object are often created, which can then be processed in the usual 2D technique.
GrblGru provides a special feature for slicing 3D STL objects and calculating corresponding 2D slices. These can then be saved as DXF.

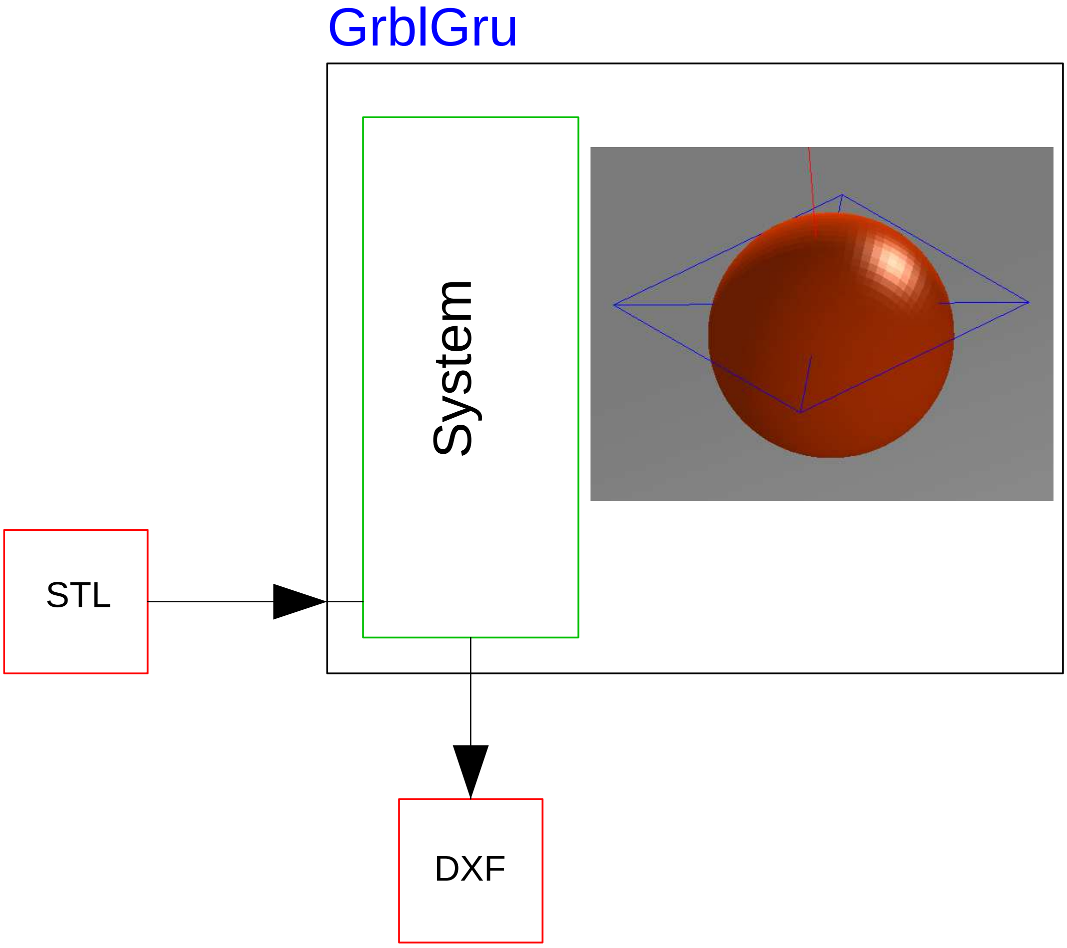
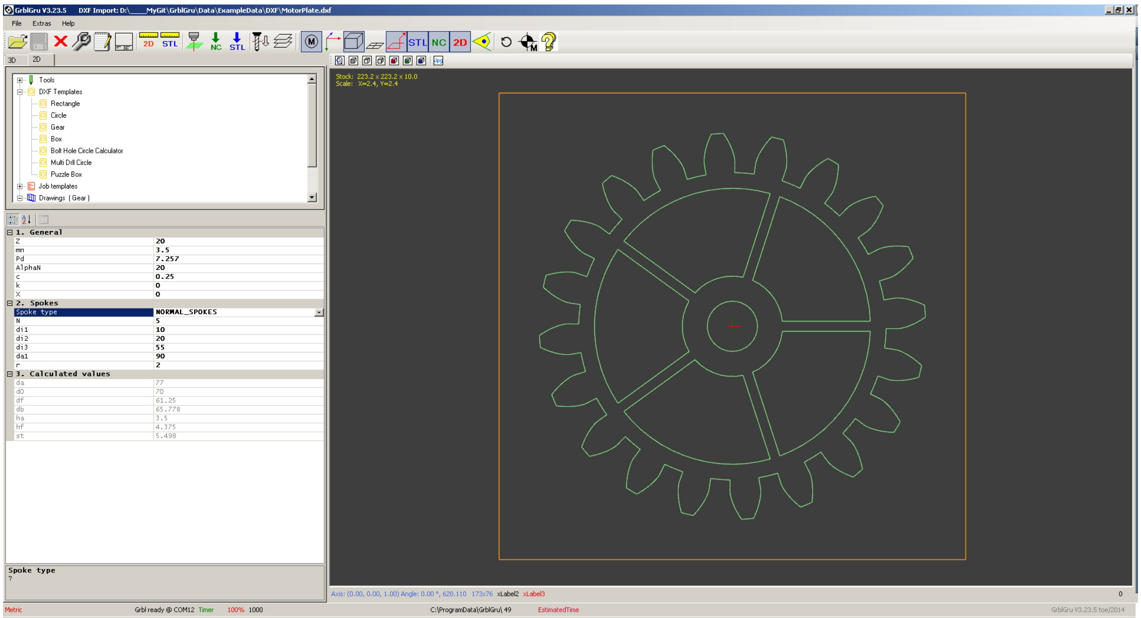


Figure 9: ***GrblGru*** in Slicer mode

5.4 DXF templates

The basic idea of this category is based on **configurable** templates.

An example is the box generator, which, based on some input such as height, width and depth, creates a Dxf drawing that can be used to create its 'box'.
The Dxf file can also be exported to reuse in another system. Of course, you can also use the internal CAM to calculate G-code and send it to the controller in control mode.
There are some very simple templates such as rectangles and circles. However, there are also more complex forms such as the box, the spur or the puzzle generator



Stock: 223.2 x 223.2 x 10.0
Scale: X=2.4, Y=2.4

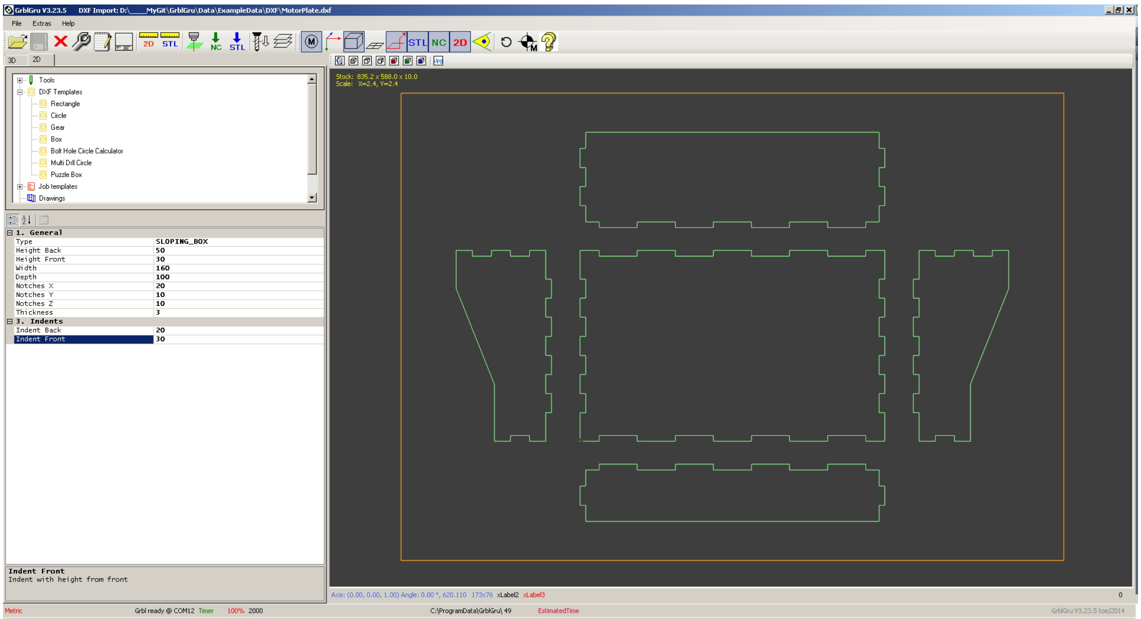
1. General	
Z	20
mn	3.5
Pd	7.257
AlphaN	20
c	0.25
k	0
X	0
2. Spokes	
Spoke type	NORMAL_SPOKES
N	5
di1	10
di2	20
di3	55
da1	90
r	2
3. Calculated values	
da	77
d0	70
df	61.25
db	65.778
ha	3.5
hf	4.375
st	5.498

Spoke type
?

Axis: (0.00, 0.00, 1.00) Angle: 0.00 °, 620.110 173x76 xLabel2 xLabel3 0

Metric Grbl ready @ COM12 Timer 100% 1000 C:\ProgramData\GrblGru\ 49 EstimatedTime GrblGru V3.23.5 toe/2014

Figure 10: The spur gear generator



Stock: 835.2 x 588.0 x 10.0
Scale: X=2.4, Y=2.4

1. General	
Type	SLOPING_BOX
Height Back	50
Height Front	30
Width	160
Depth	100
Notches X	20
Notches Y	10
Notches Z	10
Thickness	3
3. Indents	
Indent Back	20
Indent Front	30

Indent Front
Indent with height from front

Axis: (0.00, 0.00, 1.00) Angle: 0.00 °, 620.110 173x76 xLabel2 xLabel3 0

Metric Grbl ready @ COM12 Timer 100% 2000 C:\ProgramData\GrblGru\ 49 EstimatedTime GrblGru V3.23.5 toe/2014

Figure 11: The box generator

6 System requirements

GrblGru has been developed in c# and unfortunately runs only under Windows operating systems (Windows XP, Win 7, Win 10 ...). It uses the .NET Framework 4, which is usually part of the operating system. Under XP, it may happen that the framework must be installed later.

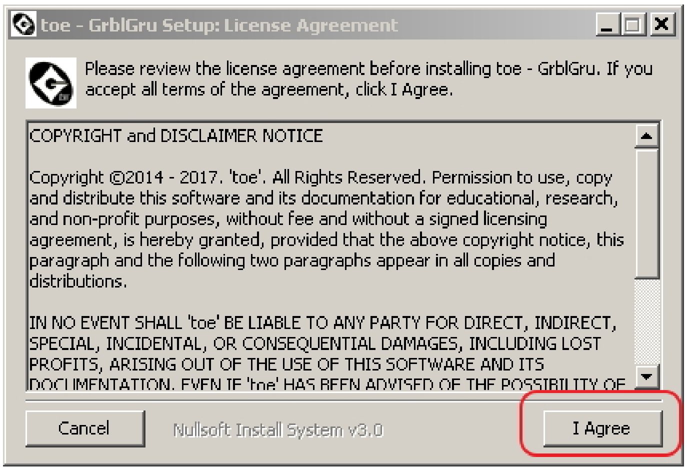
7 Download

From my website at:

http://GrblGru.com

8 Installation

The setup is done by simply starting the installer file. The installation time is only a few seconds.


toe - GrblGru Setup: License Agreement
Cancel
Nullsoft Install System v3.0
I Agree

Please review the license agreement before installing toe - GrblGru. If you accept all terms of the agreement, click I Agree.

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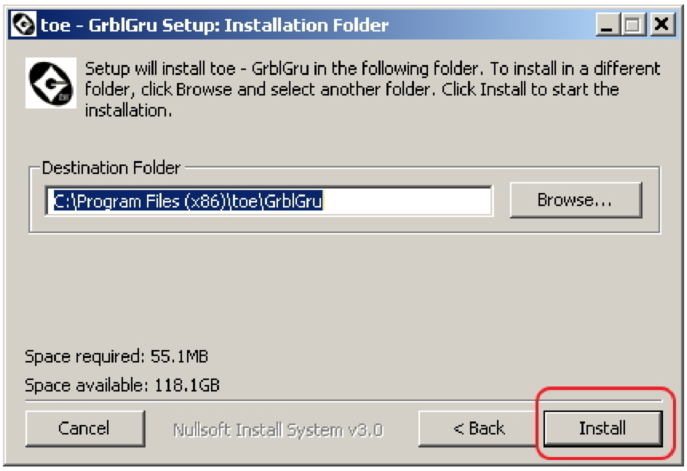
Figure 12: The dialog at starting the setup. The disclaimer must be confirmed.


toe - GrblGru Setup: Installation Folder
Browse...
Cancel
Nullsoft Install System v3.0
< Back
Install

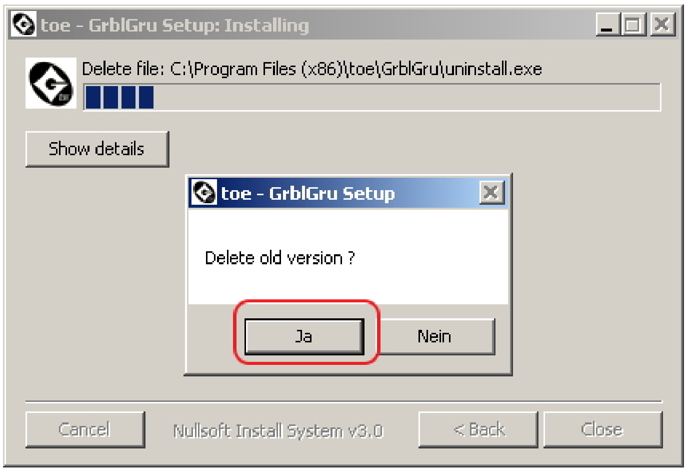
Setup will install toe - GrblGru in the following folder. To install in a different folder, click Browse and select another folder. Click Install to start the installation.

Destination Folder: C:\Program Files (x86)\toe\GrblGru

Space required: 55.1MB

Space available: 118.1GB

Figure 13: Query the destination folder. I recommend keeping the suggested path



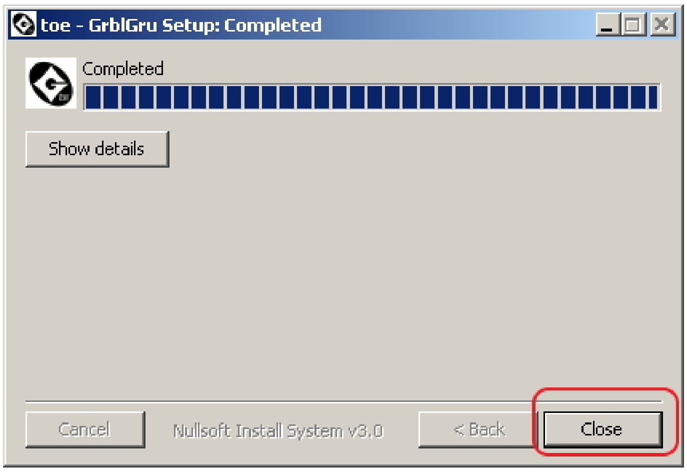
toe - GrblGru Setup: Installing

Delete file: C:\Program Files (x86)\toe\GrblGru\uninstall.exe

toe - GrblGru Setup

Delete old version ?

Figure 14: Answering this question with 'Yes' deletes the working directory under ProgramData before installation, which is equivalent to a basic installation. For users who are not knowledgeable, this is recommended.



toe - GrblGru Setup: Completed

Completed

Figure 15: The display after successful setup

The installer will automatically create a desktop shortcut to launch ***GrblGru*** .

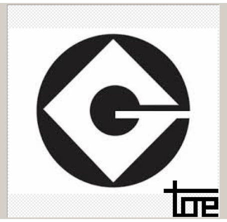


Figure 16: ***GrblGru*** shortcut

9 It should be noted ...

There is certainly a lot more to improve on ***GrblGru*** . Also there might be be some hidden bug, and some things will only work if you do it in a specific order.
I just do it all at my free time because I enjoy programming. Please do not sting me if it does not work out. Let me know, and I'll try to fix it and make the next version a little better.

Ideas, suggestions for improvement and also criticism are always welcome.

Have fun with ***GrblGru***

10 Attachment

10.1 Available 3D machine models

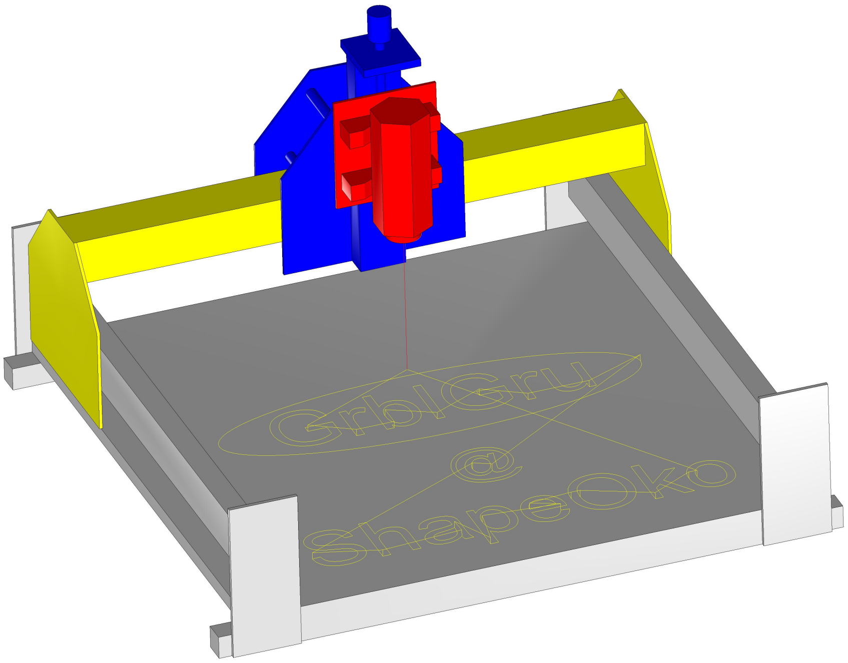


Figure 17: ShapeOko 2

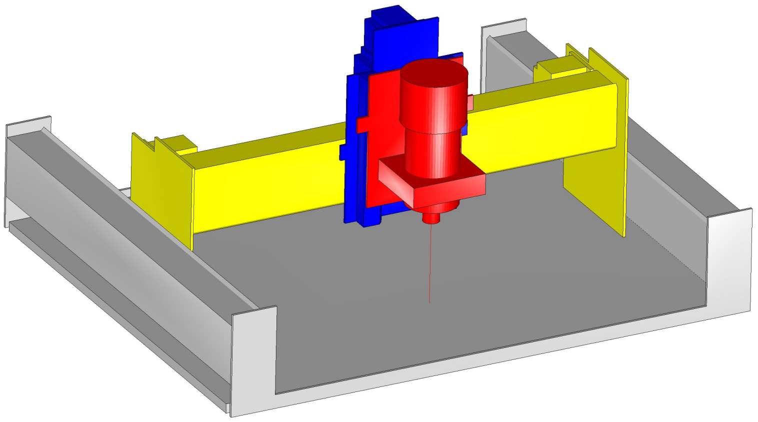


Figure 18: ShapeOko 3

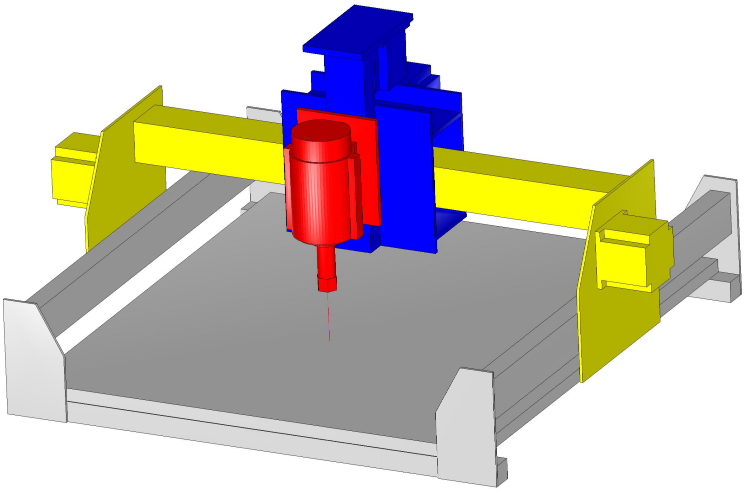


Figure 19: X-Carve

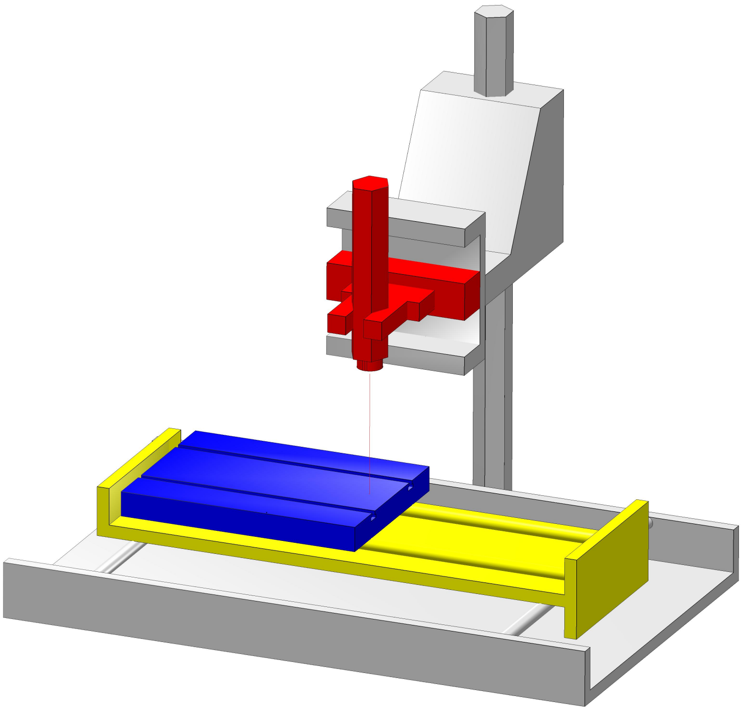


Figure 20: My DIY milling machine 'Milly'

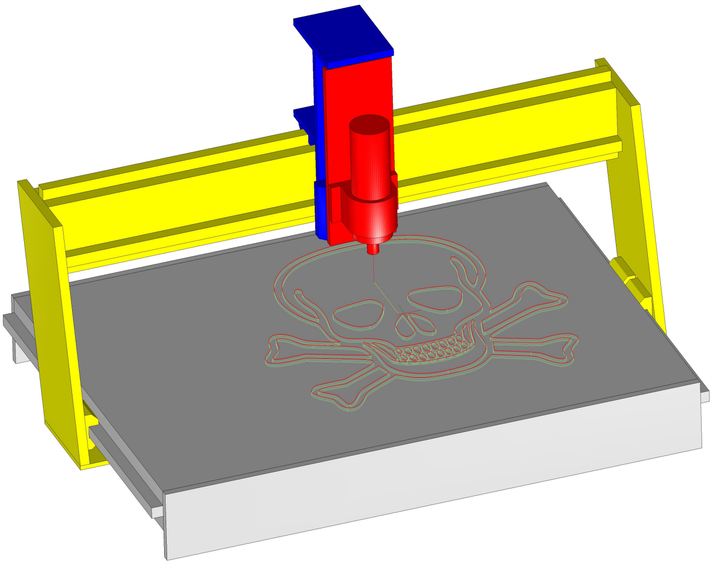


Figure 21: My new machine 'Miss Marple'

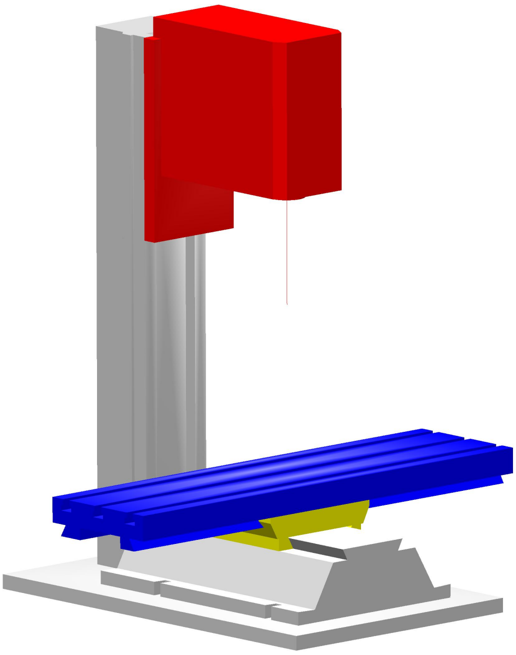


Figure 22: BF 20

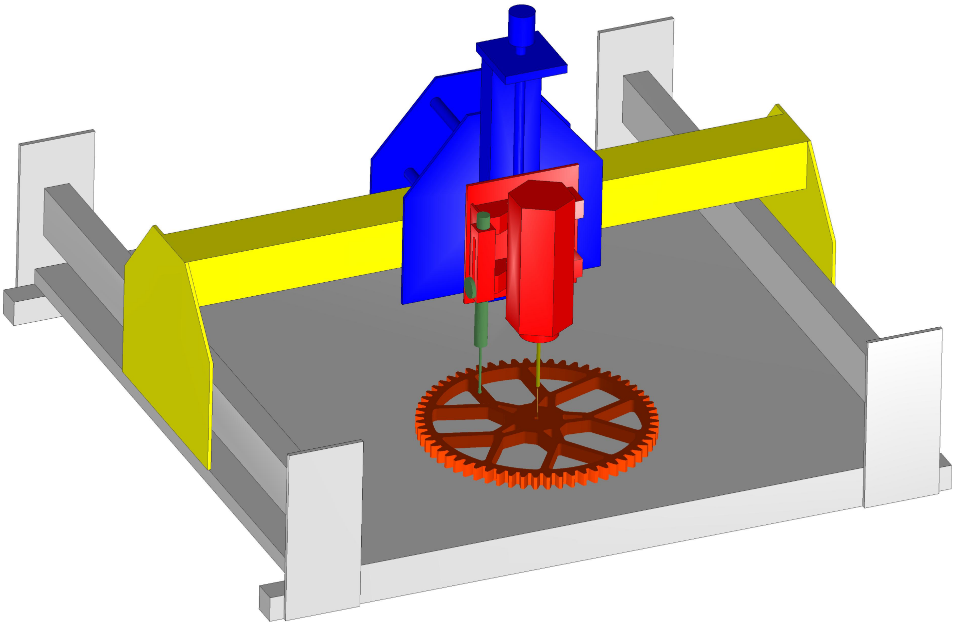


Figure 23: Shapeoko with measure probe

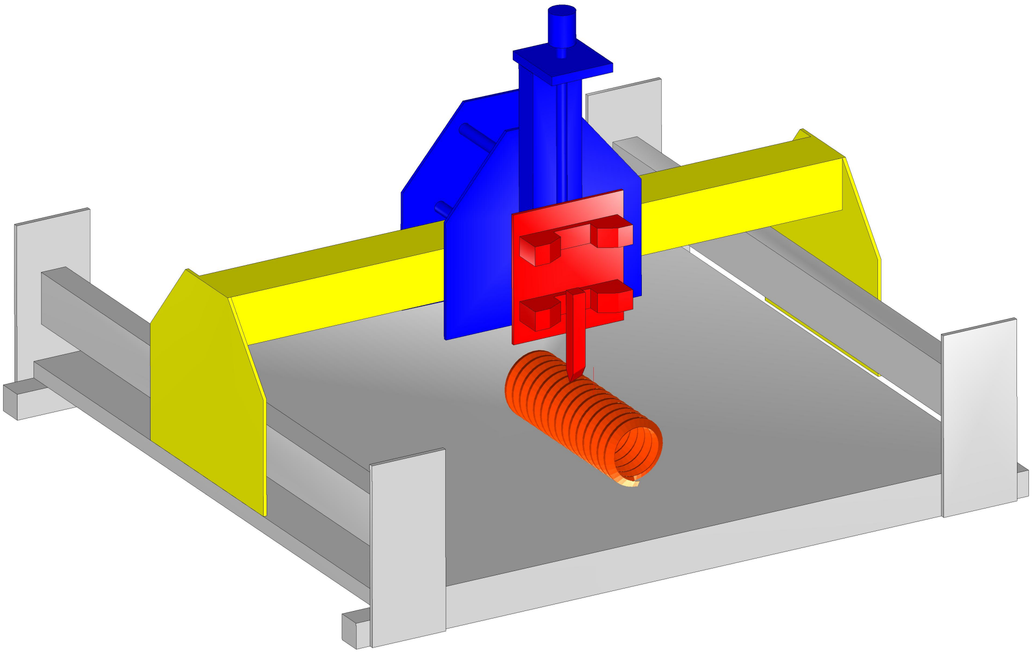


Figure 24: Shapeoko with turning steel for thread production

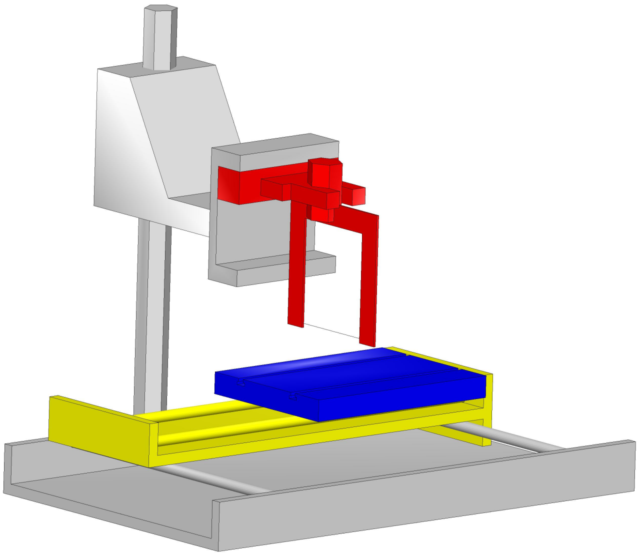


Figure 25: Milly with attachment for Styrofoam cutting

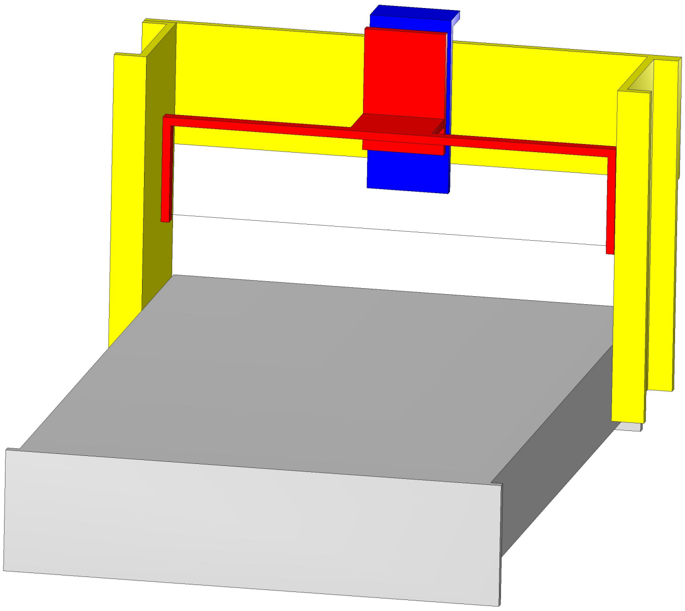


Figure 26: THE Styro Cutter

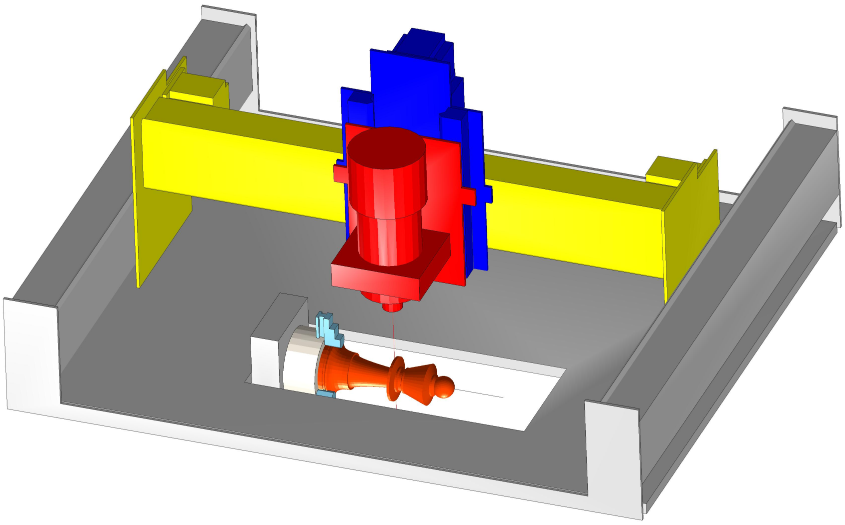


Figure 27: Shapeoko with 4th axis

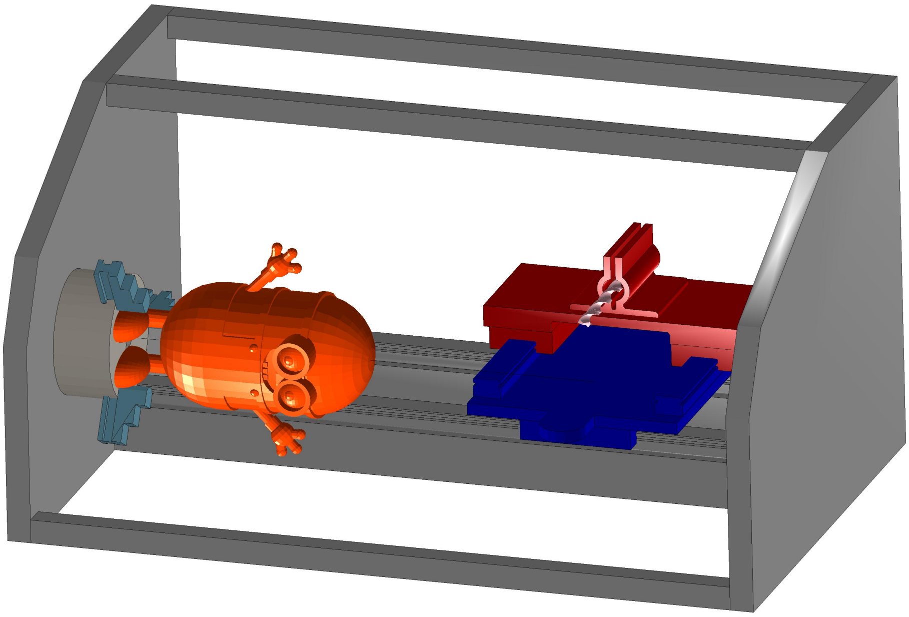


Figure 28: Machine without Y-axis

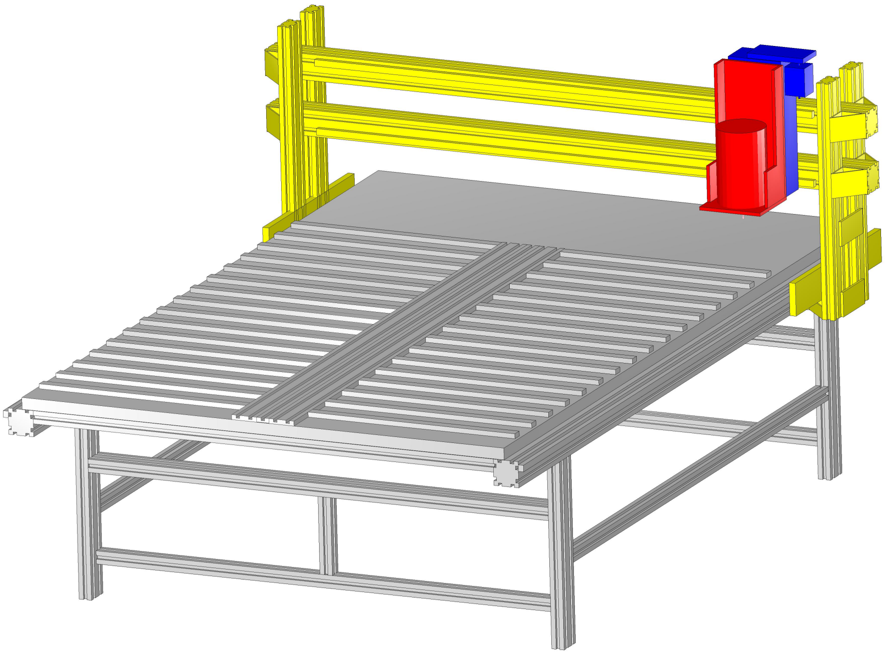


Figure 29: Johudis 'Monster' Machine

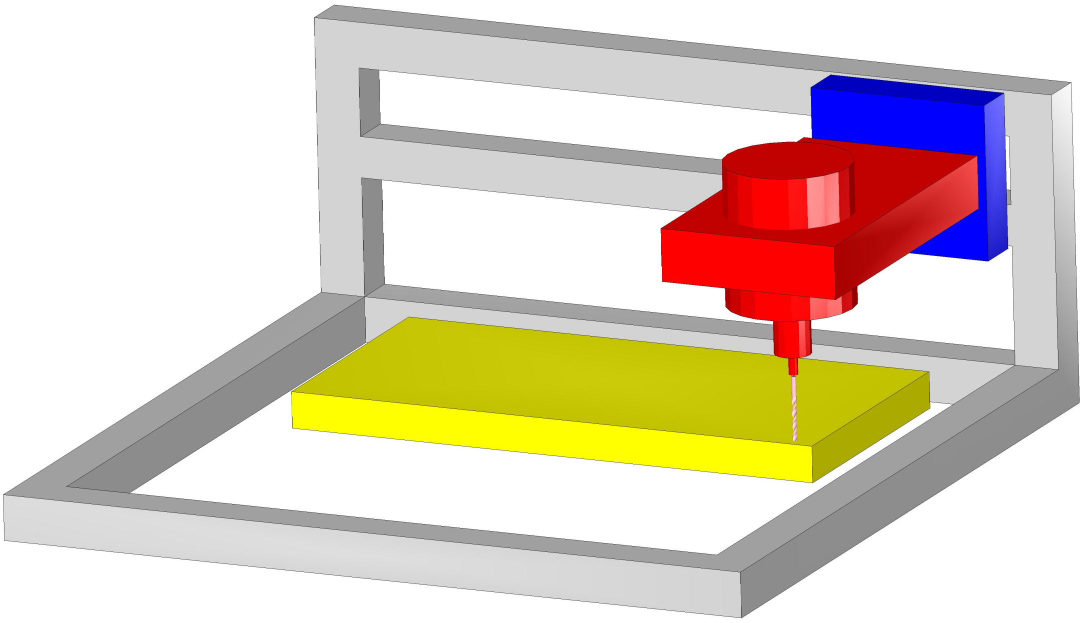


Figure 30: Typ Sprite

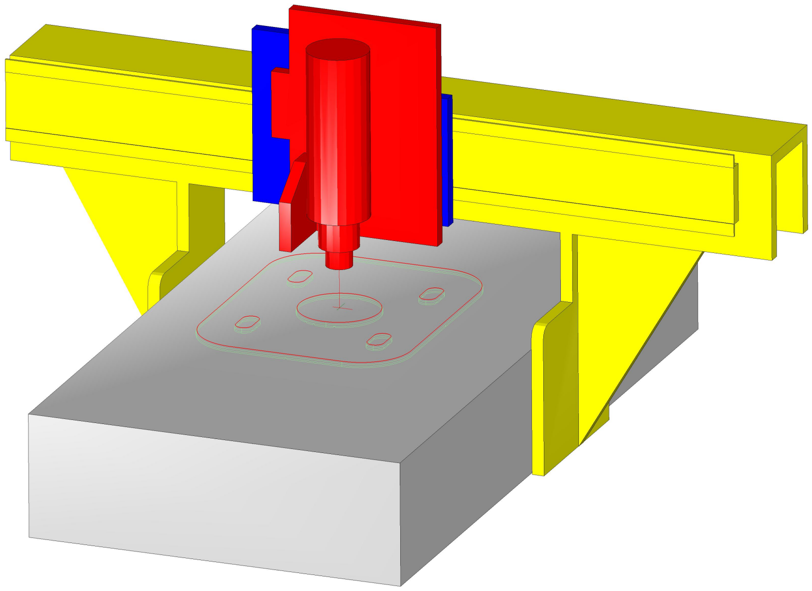


Figure 31: TennesseePilots 2.Machine

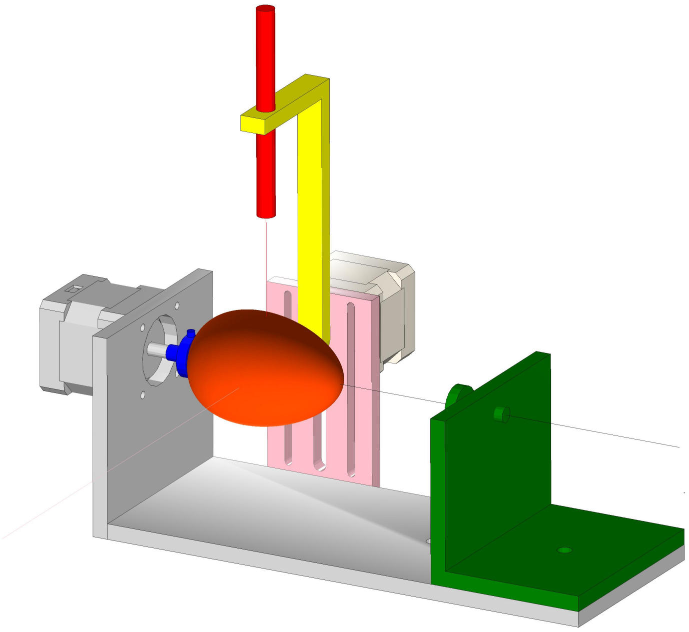


Figure 32: EggBot machine with 2 rotation axes

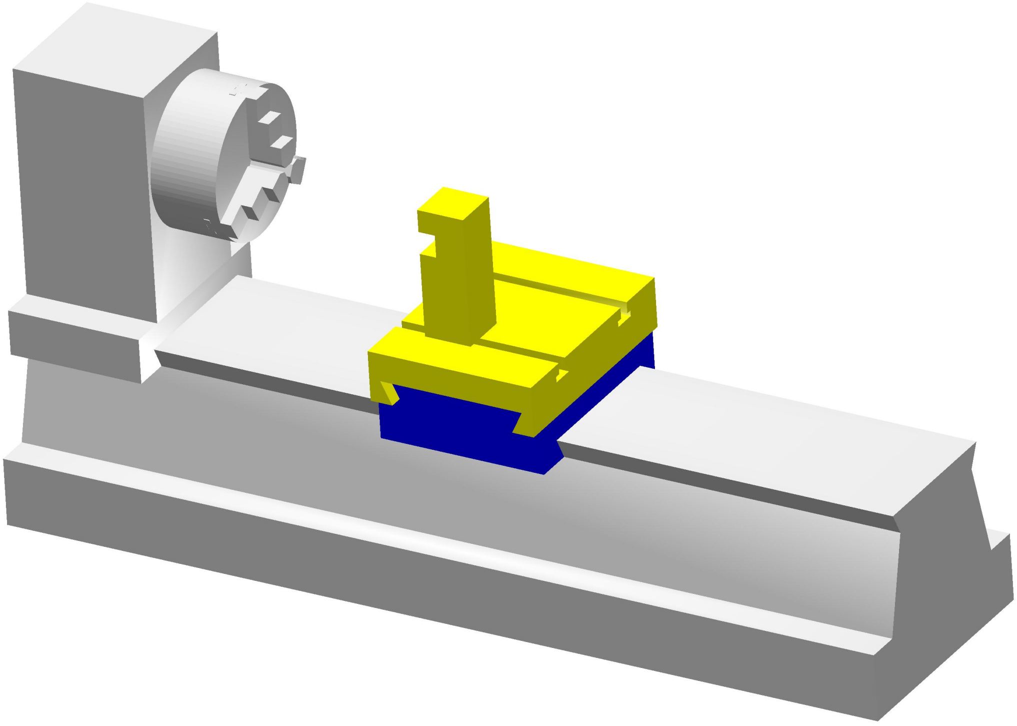


Figure 33: My China lathe

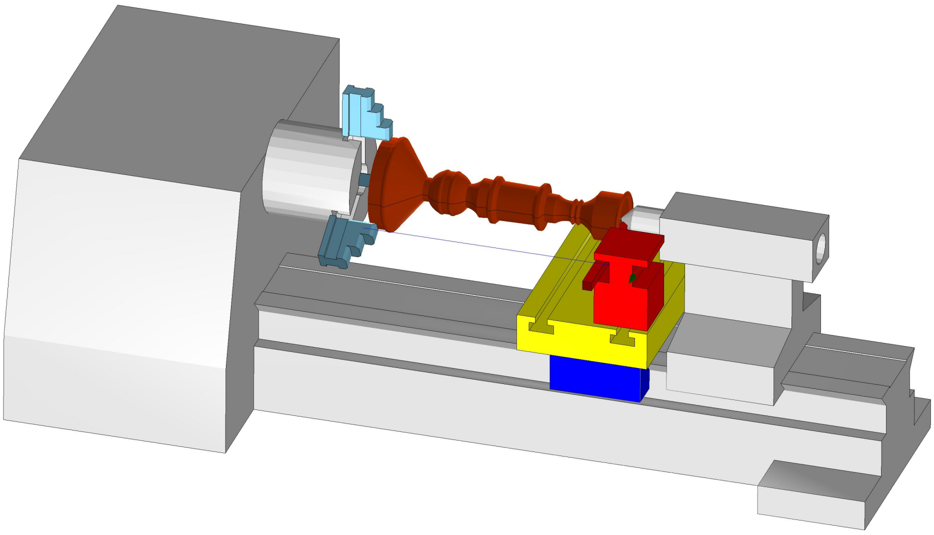


Figure 34: Artec C1

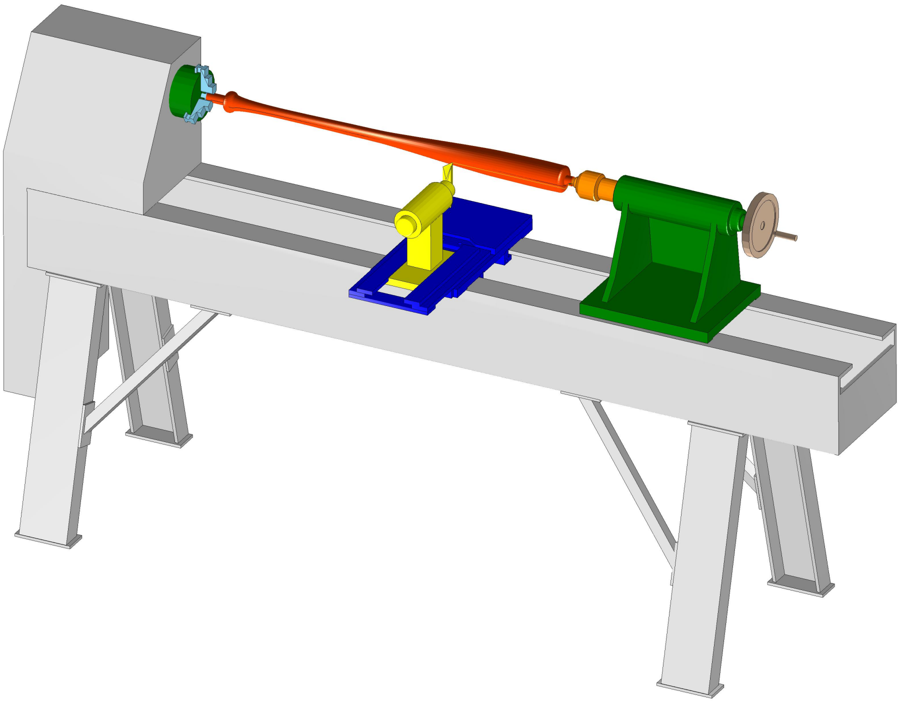


Figure 35: Cesares lathe