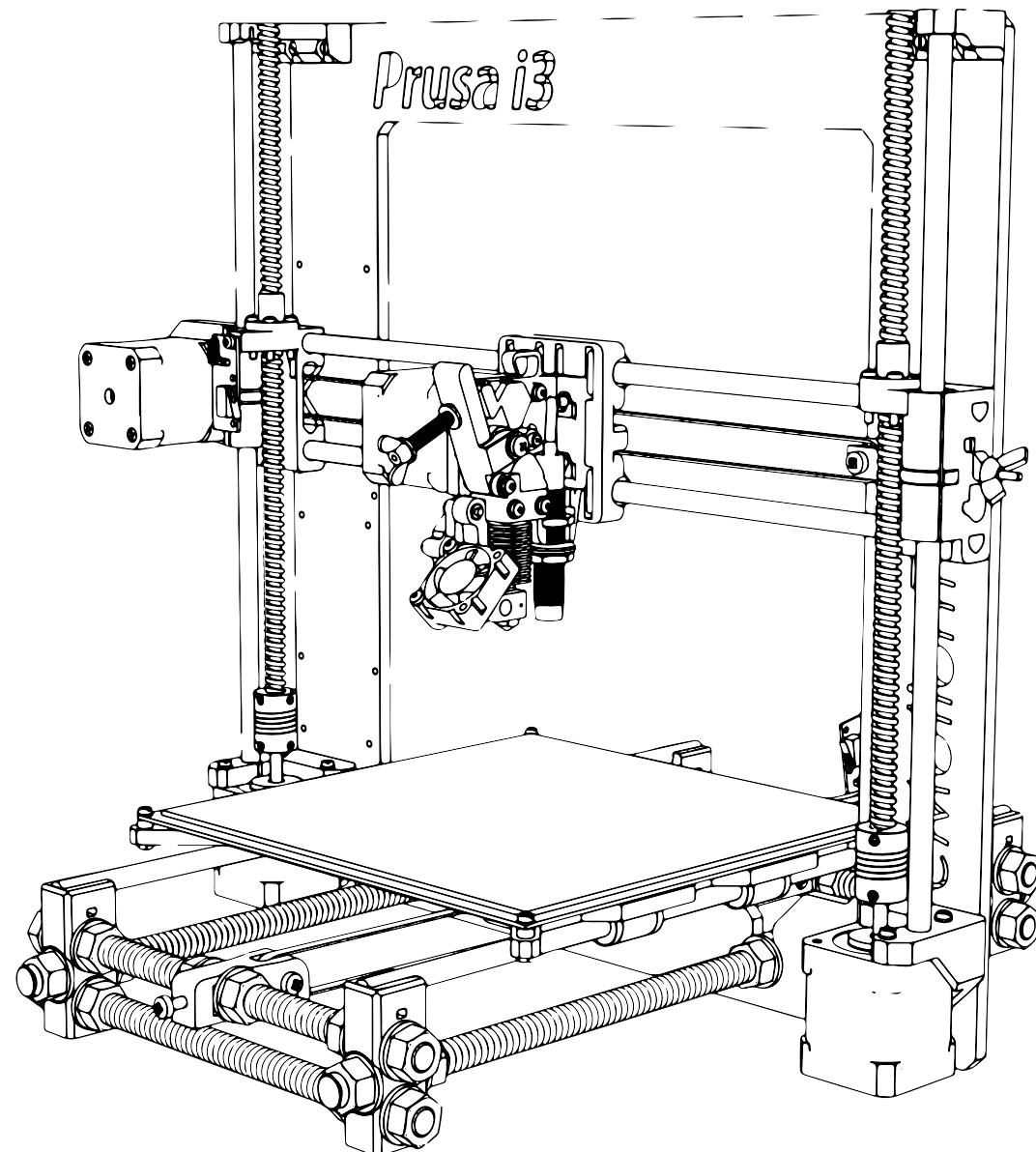


Prusa i3 Rework

USER GUIDE
REV 1.5



INTRODUCTION

- **Target :**

Propose a visual guide of the different steps to build and use a Prusa i3 Rework.

- **Authors of this document :**

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Quentin CESVET

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- **Photographics Credits :**

Pictures and 3D representations made by eMotion Tech

<http://www.emotion-tech.com>

- **Sources :**

<http://reprap.org/wiki/RepRap>

<http://www.repetier.com/>

- **Licences :**

Prusa i3 : GPL 3.0

This document : CC BY-NC-SA 4.0

<http://creativecommons.org/licenses/by-nc-sa/4.0/>



- **Update :**

Last update : 22/11/2016

- **Links :**

You can find more informations on the following links :

RepRap community : <http://reprap.org/wiki/reprap>

Repetier-Host software : <http://www.repetier.com/>

3D models database : <http://www.thingiverse.com/>



SUMMARY

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Driver and the firmware installation

First :

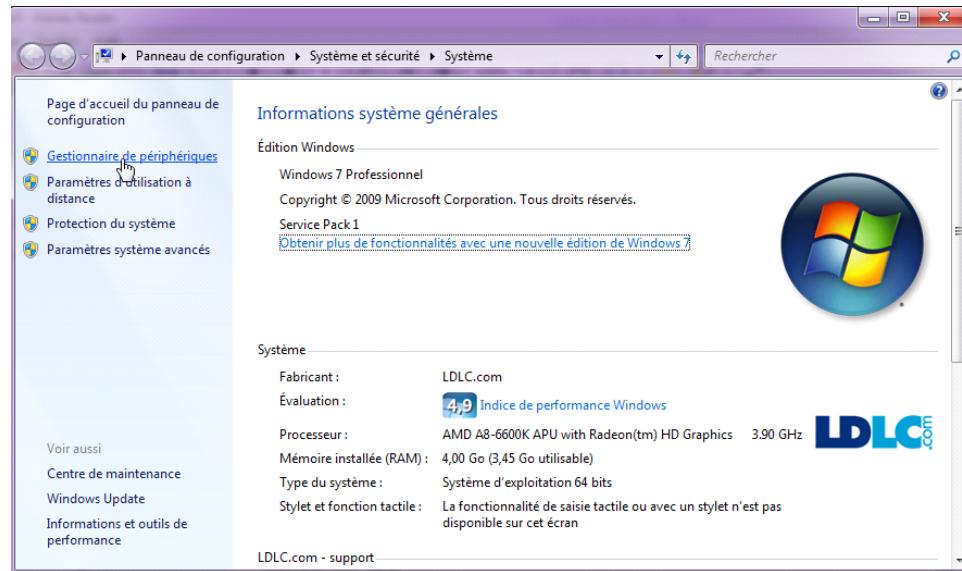
- Install the Arduino software (**1.0.6 version or lower**). You can download it from our website or the official Arduino's website.

After that, the RAMPS board must be connected on the Arduino board.

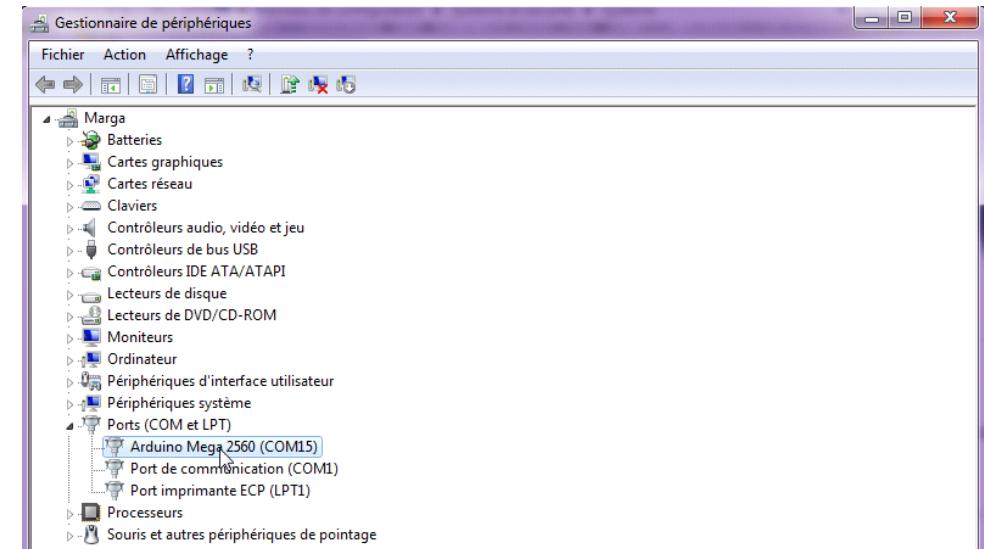
- Connect USB (do not connect the power supply).
- Check if the board is identified by your computer. You can push on « Windows + Pause » -or go to your compute setup-, and on « Device manager » on the left. The Arduino Mega 2560 board must appear in the device list.

If it is not recognized, please install drivers manually by doing a right-click on it. Arduino's drivers is in the Arduino «drivers» folder.

Note : If Windows 8 or higher is installed on your PC, you should deactivate automatic control of unsigned drivers. It's possible to find process about this on the web.



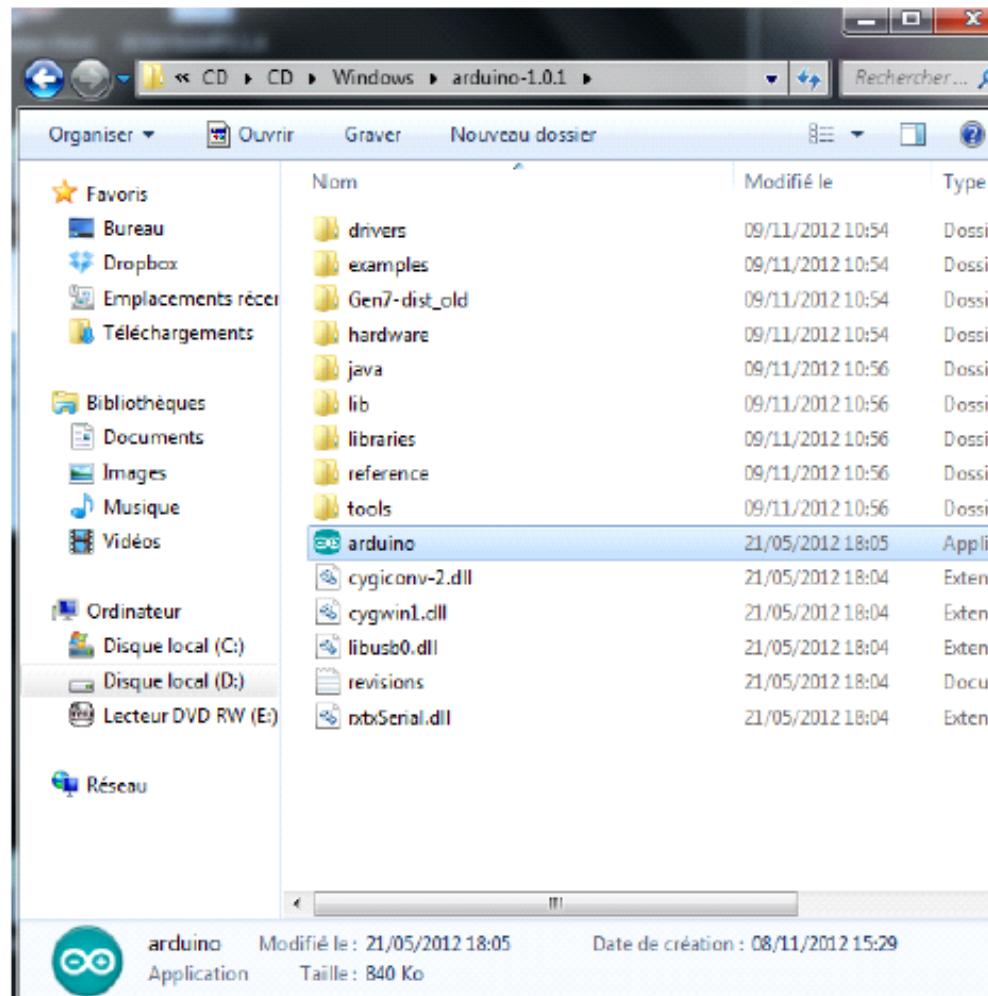
System panel of Windows



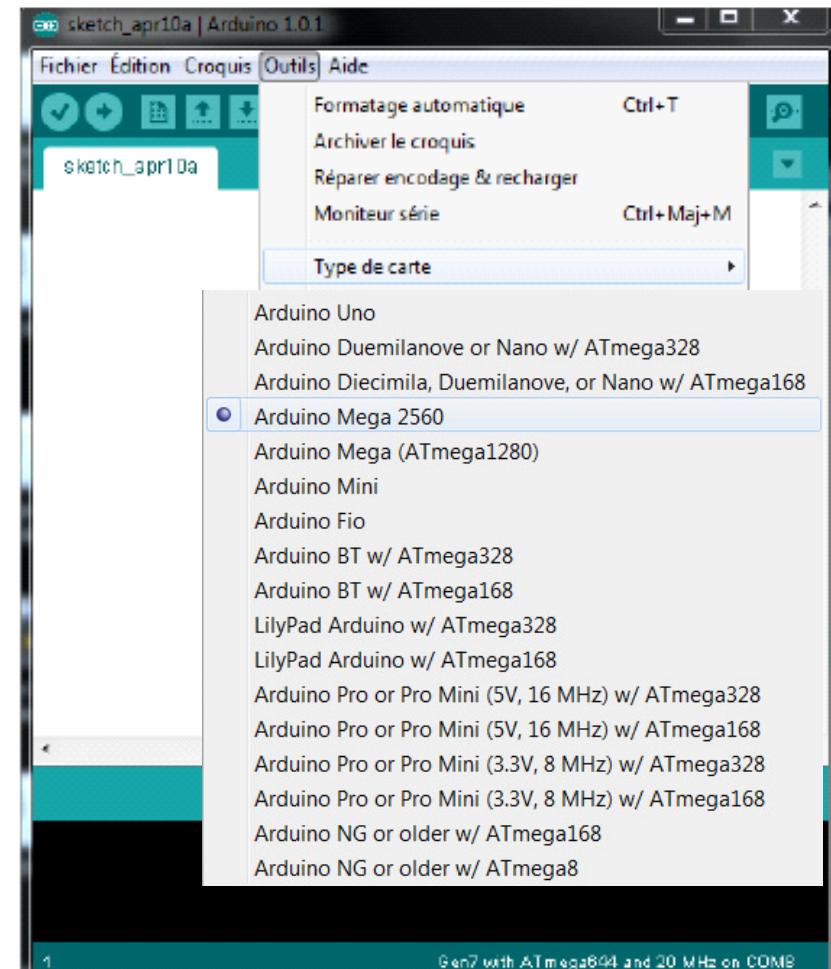
Device manager

Read the COM port of your Arduino board (Arduino Mega 2560)

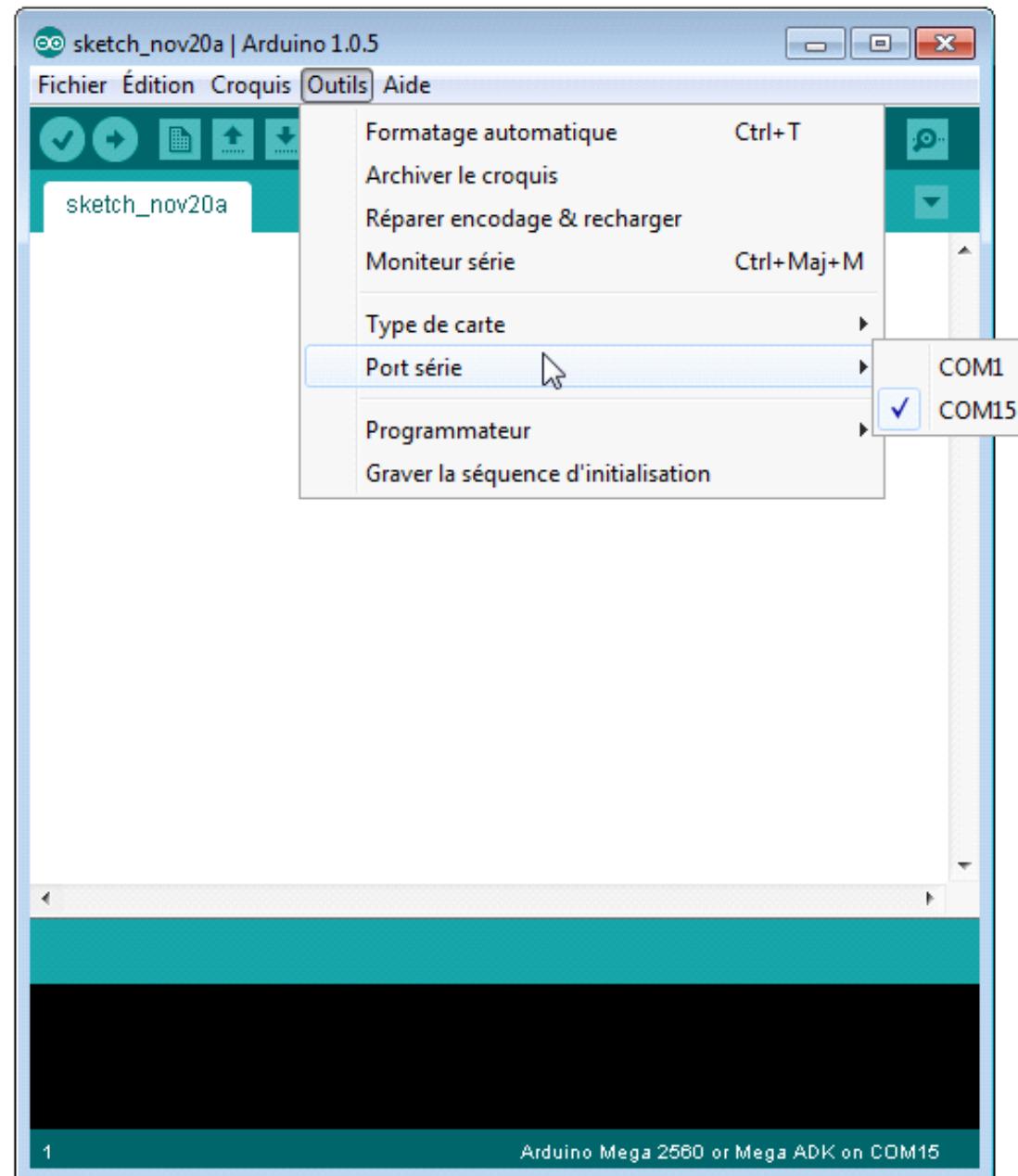
- Run the Arduino software from the office.



Arduino IDE launching

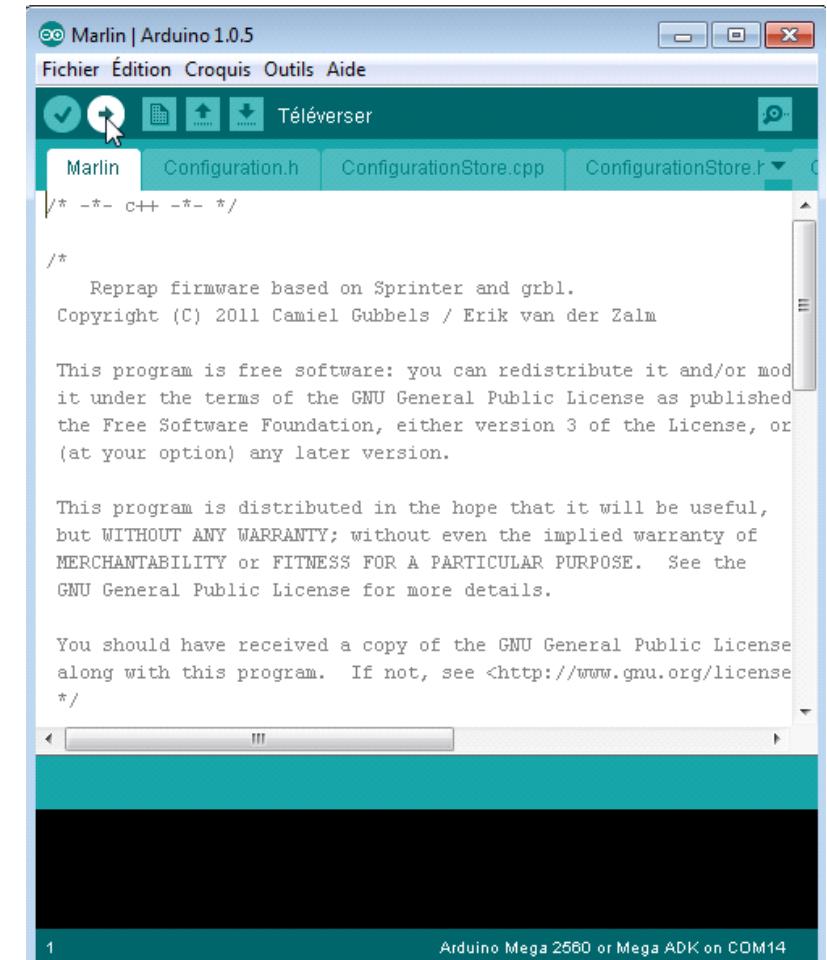
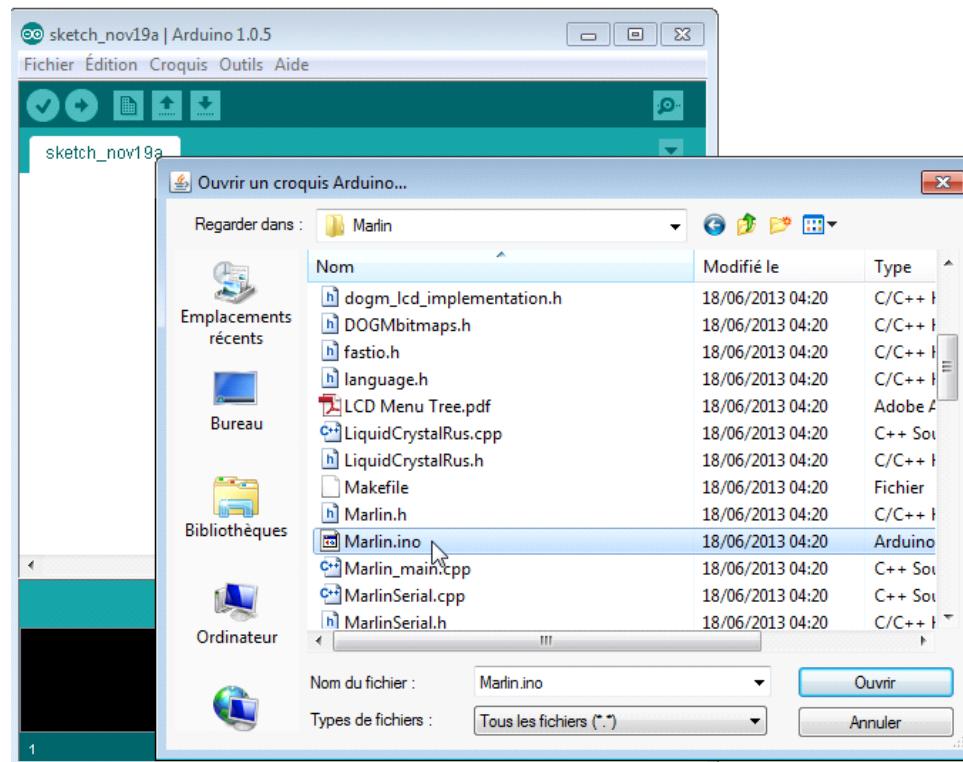


Selecting the card



Transfer of the firmware from Arduino

- Open Arduino (file/open) the file of your USB drive: Prusa i3 Rework 1.5, and « Marlin.ino ».
- Next, Click on Upload.



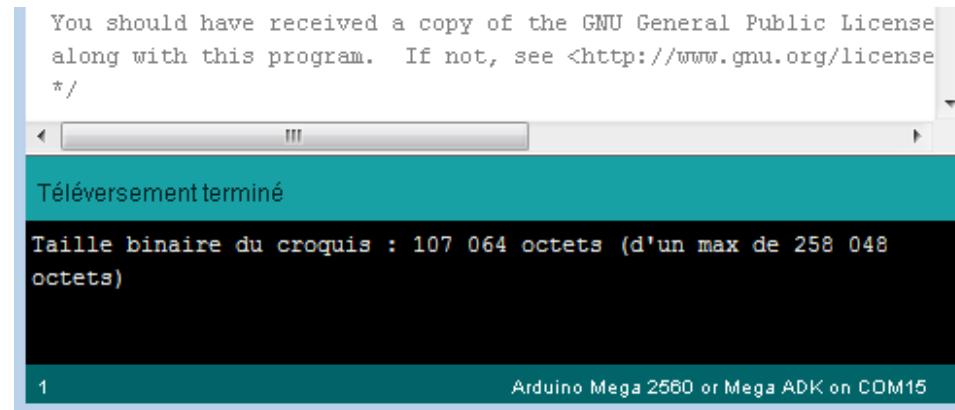
```
/* -*- c++ -*- */

/*
Reprap firmware based on Sprinter and grbl.
Copyright (C) 2011 Camiel Gubbels / Erik van der Zalm

This program is free software: you can redistribute it and/or modify
it under the terms of the GNU General Public License as published
by the Free Software Foundation, either version 3 of the License, or
(at your option) any later version.

This program is distributed in the hope that it will be useful,
but WITHOUT ANY WARRANTY; without even the implied warranty of
MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the
GNU General Public License for more details.

You should have received a copy of the GNU General Public License
along with this program. If not, see <http://www.gnu.org/licenses/>.
*/
```



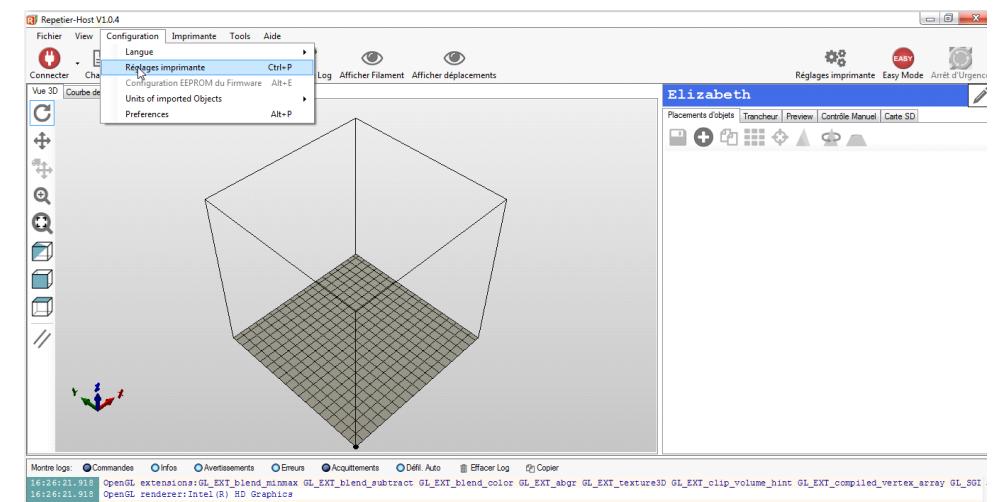
Connection to Repetier-Host

Connect the RAMPS board to the power supply 12v and respect polarity.

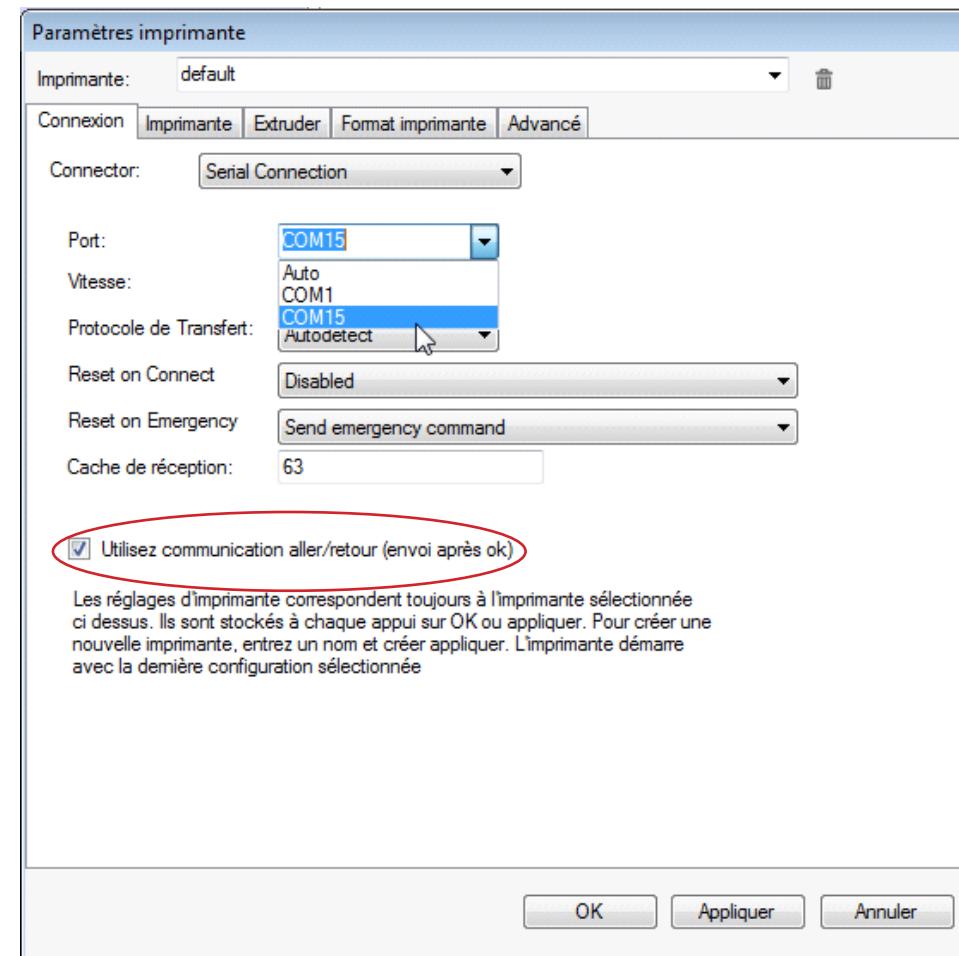
Before to begin this tutorial, you have to get:

- The electronic and mechanic parts (see the assembly instructions);
- The board need to be identified by your computer;
- The firmware is download.

First we are going to settle the host software (Repetier host) communication.

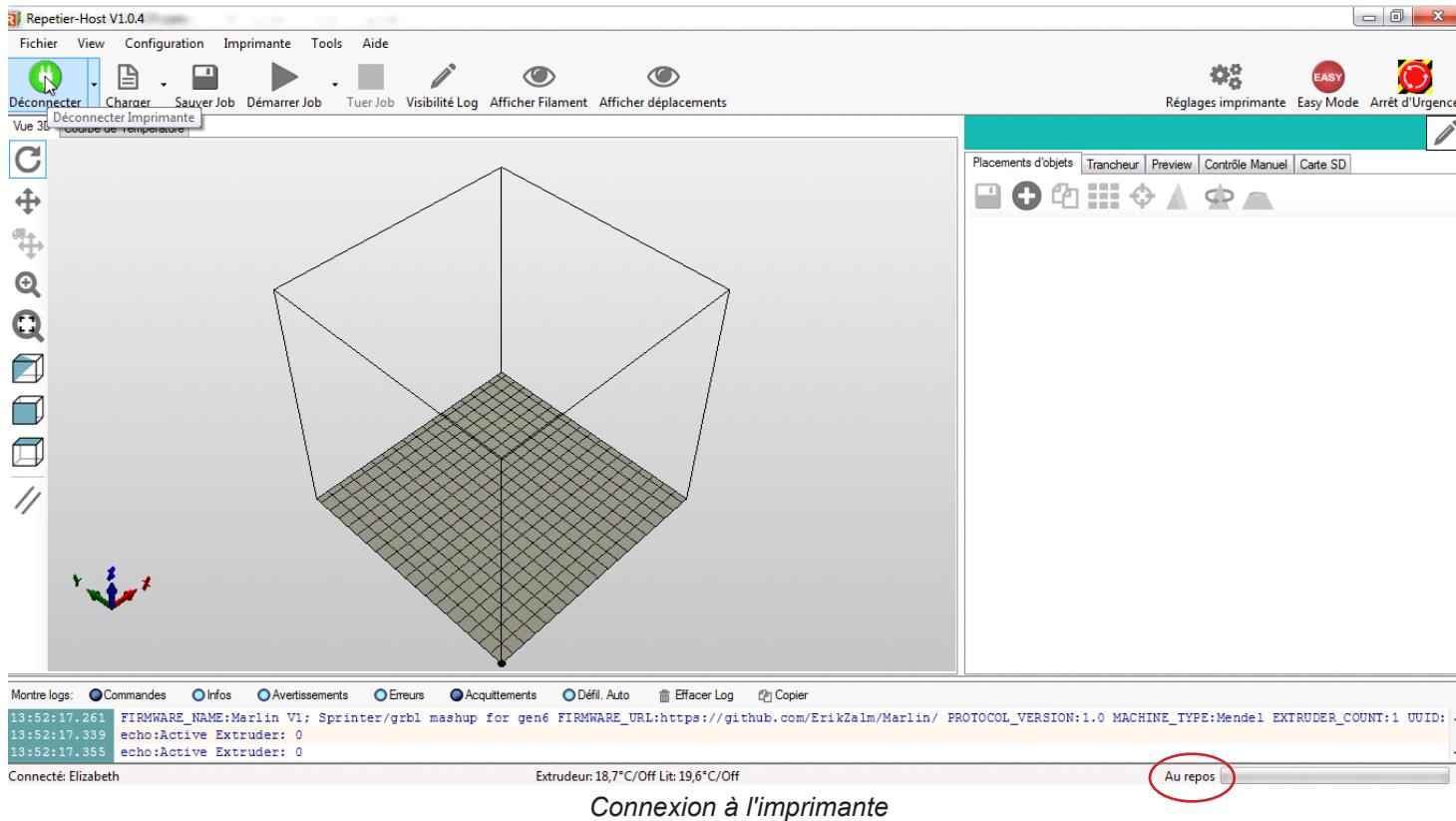


Interface of Repetier-Host and open of Printer settings



Choice of the COM port

Connect Repetier to your 3D printer by pushing on the button « Connect »



Check the message « idle » at the Bottom of the page.

If you have waiting commands, it means that you have connection problem with your printer.

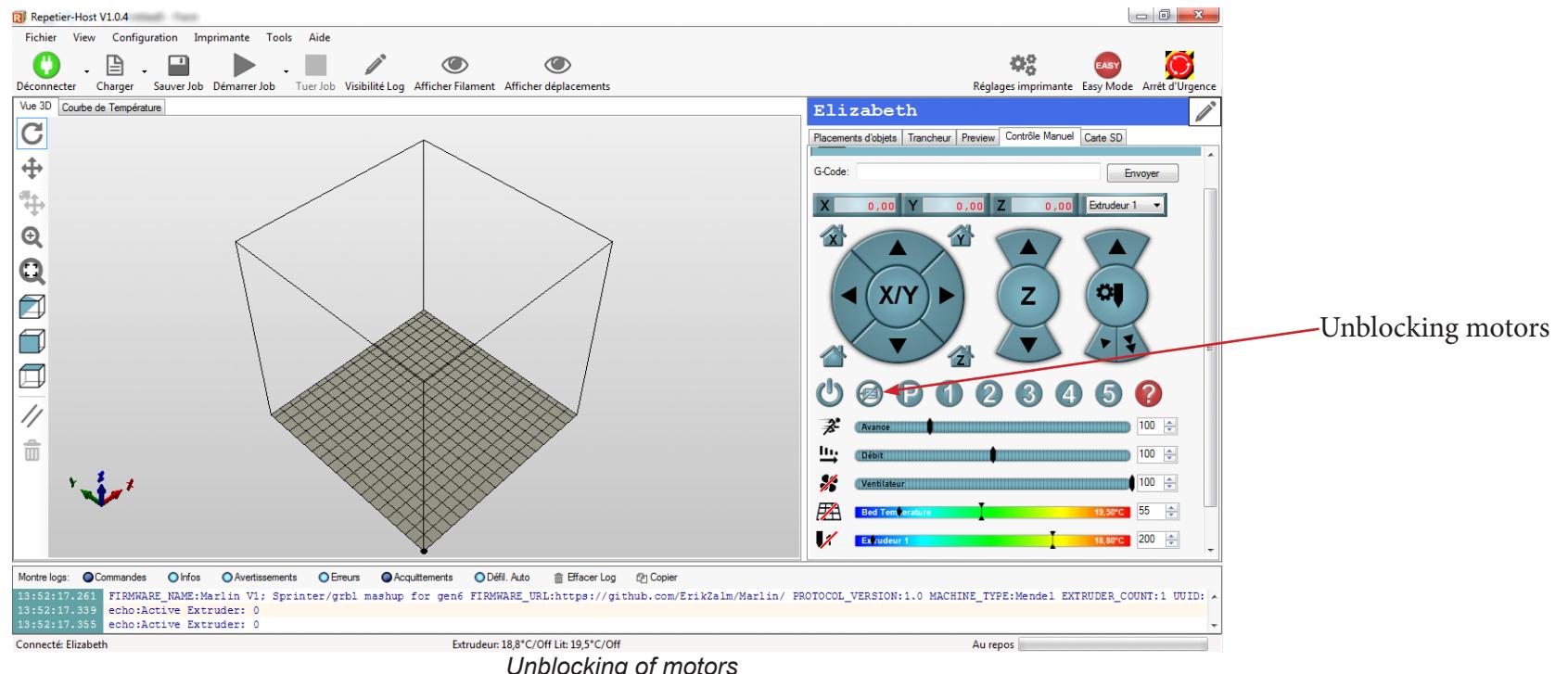
Check the COM port and push on Reset button or reconnect the USB wiring.

Configuration and preset

Let start to a material checking on your machine.

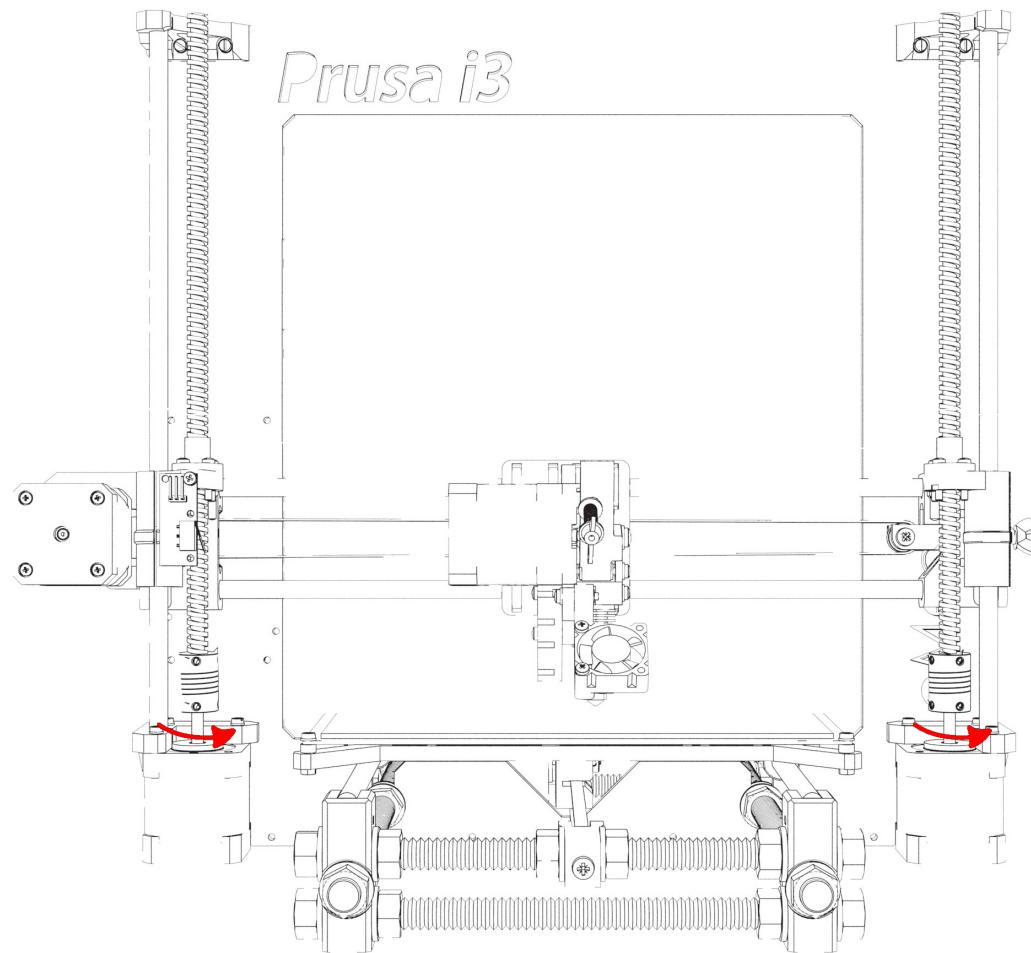
Manual moving of axis

Push your carriage X and Y to the center of their axis, -if you feel resistance don't force! -, You only need to unlocking your motors :



For Z axis, move up the extruder for at least 20 mm above the PCB heatbed by turning the two couplers at the same time.

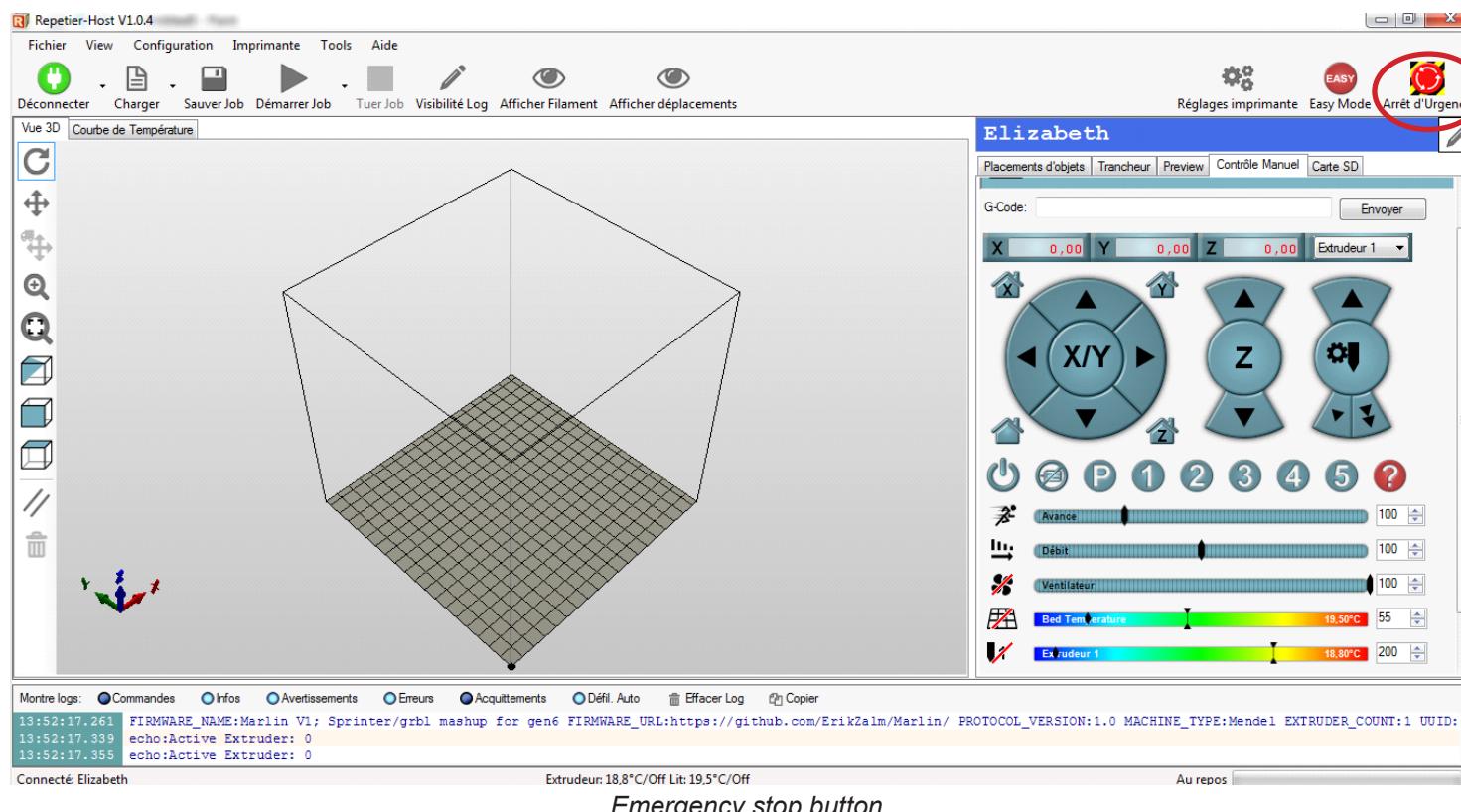
Be sure that axis X stay horizontal to not damage plastic piece.



Now you are ready to move safely.

Checking endstop

To know if your endstop is functional, connect them and check that the red LED switch on when you do a contact.

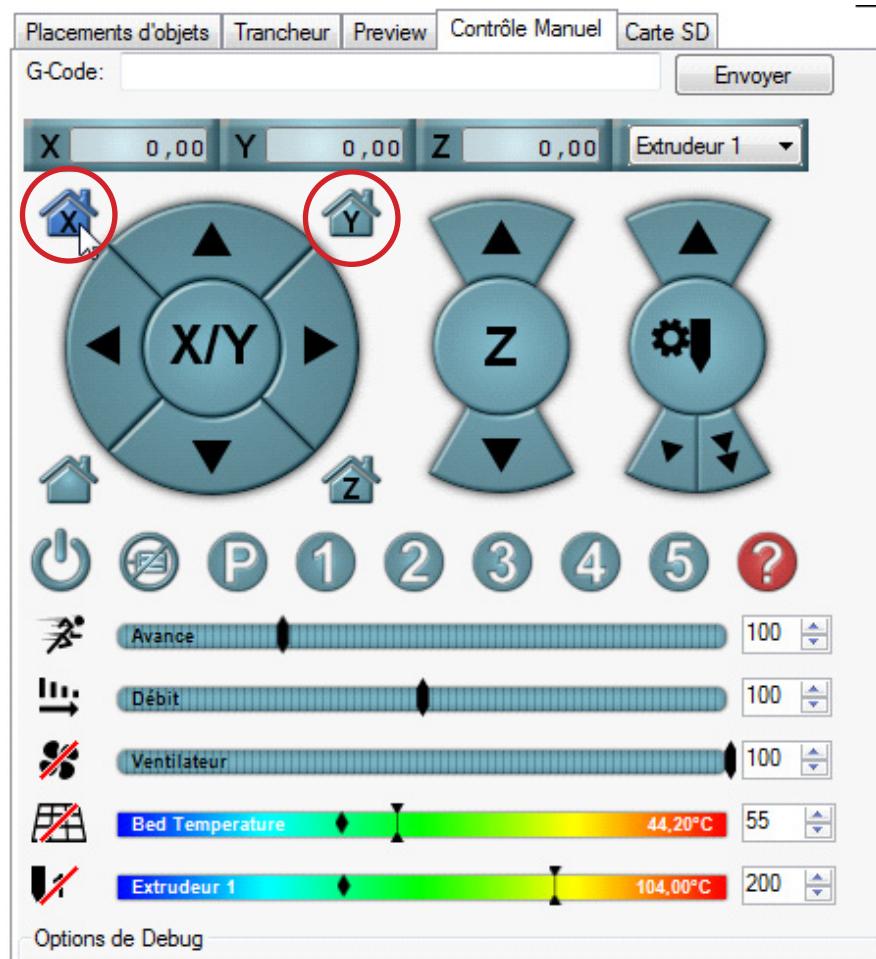


Press the X homing and check the X carriage stop to move after touching the endstop X.

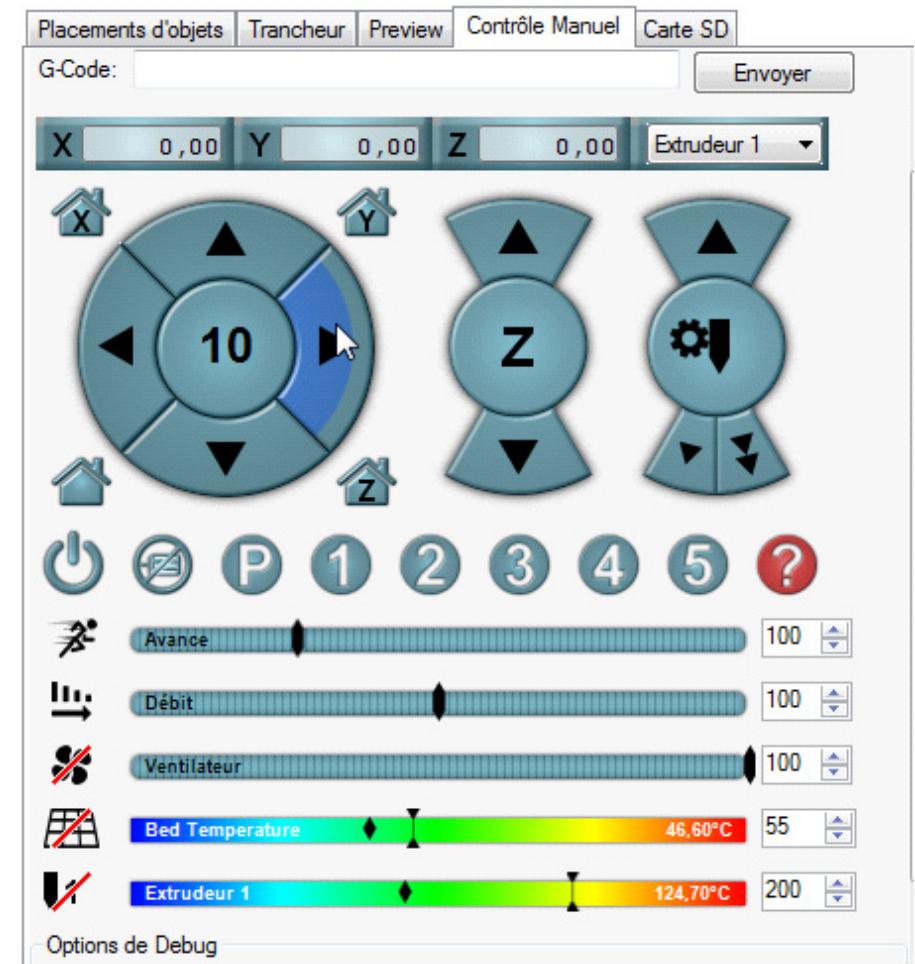
If there is a problem you can press on the emergency stop button to stop motors.

Repeat the operation for Y axis.

For Z axis, we will explain the prober in the fifth parts (« using of the paper »).



X and Y homing



Moving command axis

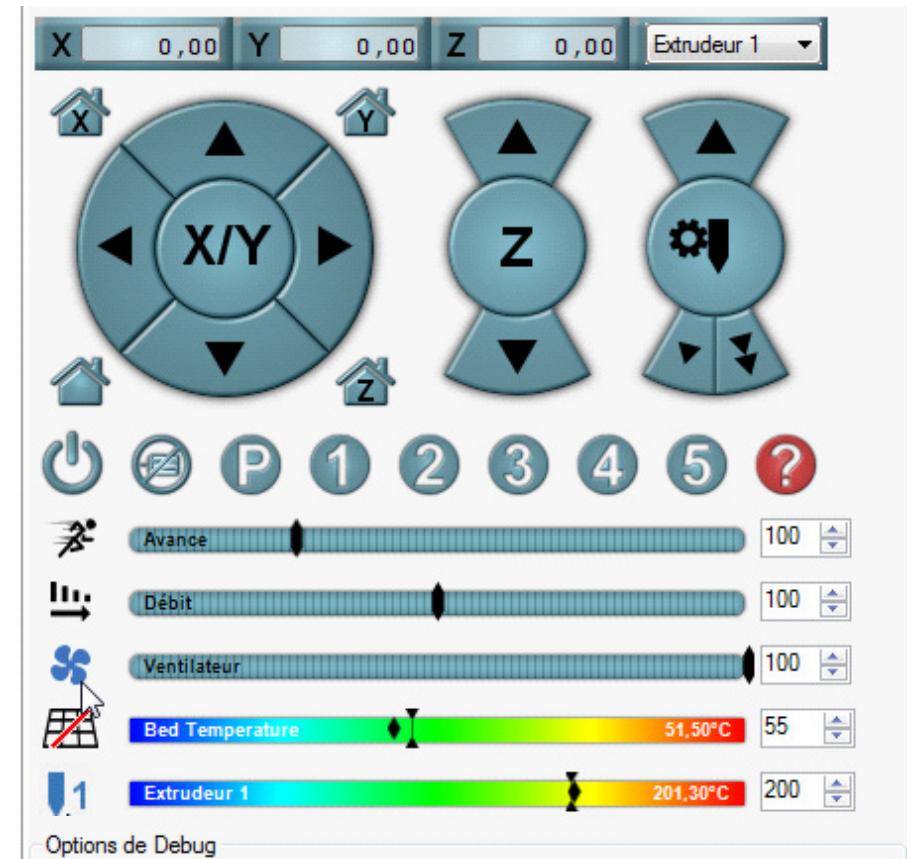
Invert motor's direction

Disconnect Repetier Host and all power sources (power supply 12V and USB). Then invert your motor plug on the RAMPS card. Reconnect your machine.

Repeat the operation for Y and Z axis. For Z axis the positive direction means a vertical rise.

Fan checking

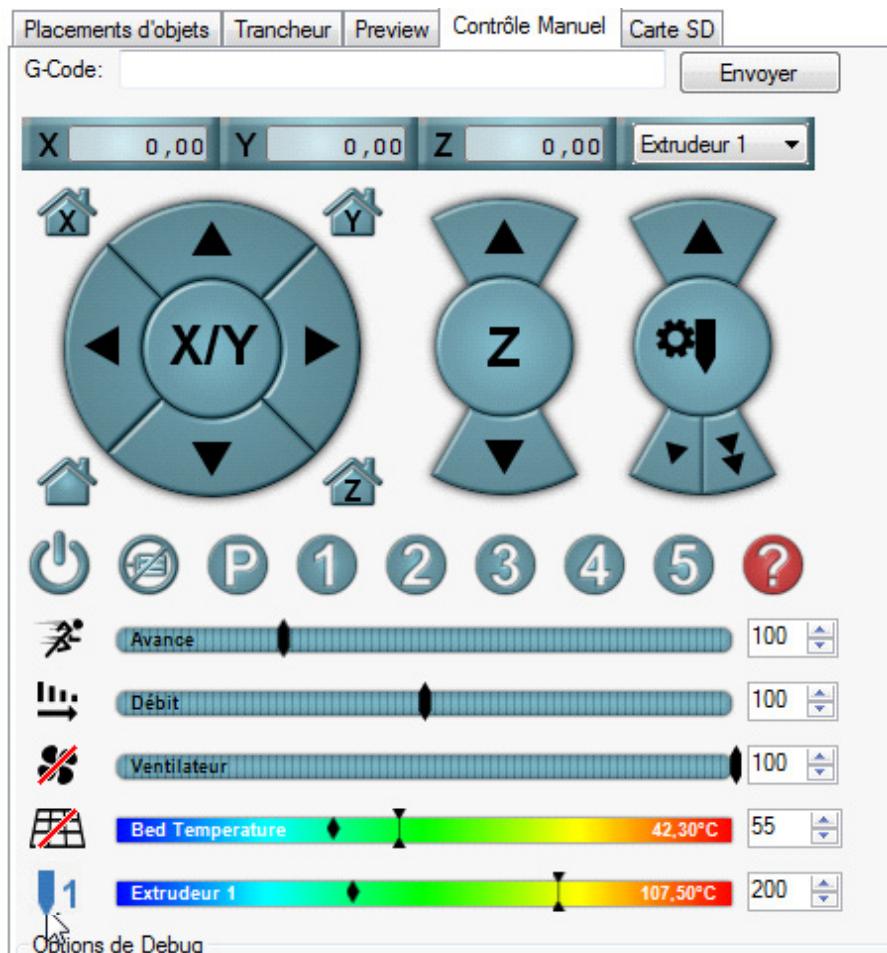
The extruder has two fans. One cool the extruder body and other one cool the piece. The first is above is activate when you connect the 12V supply. The second will be activated automatically or through the manual control interface (see below).



If a fan does not work, check the polarity.

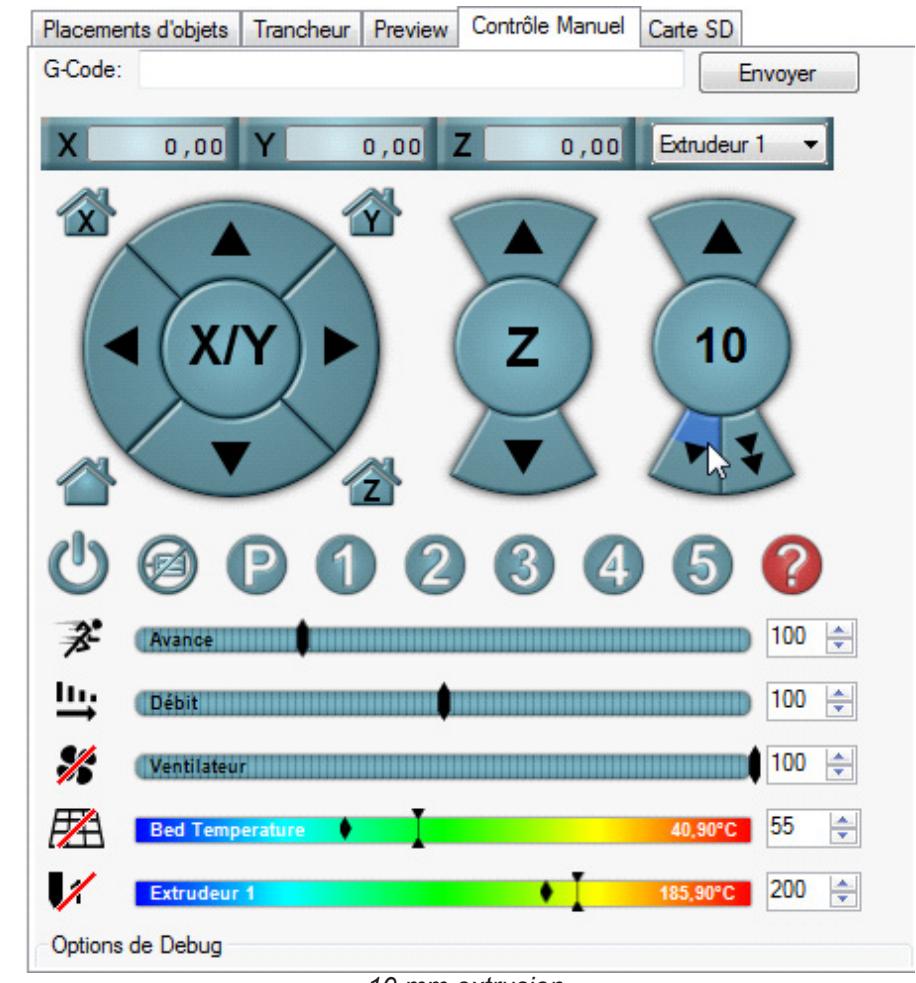
PCB heatbed and cartridge heater checking

Launch the heating of the cartridge heater:



Extrusion

Check if the motor turn in the good direction (do not set up the filament). Use manual commands to extrude 10 mm:



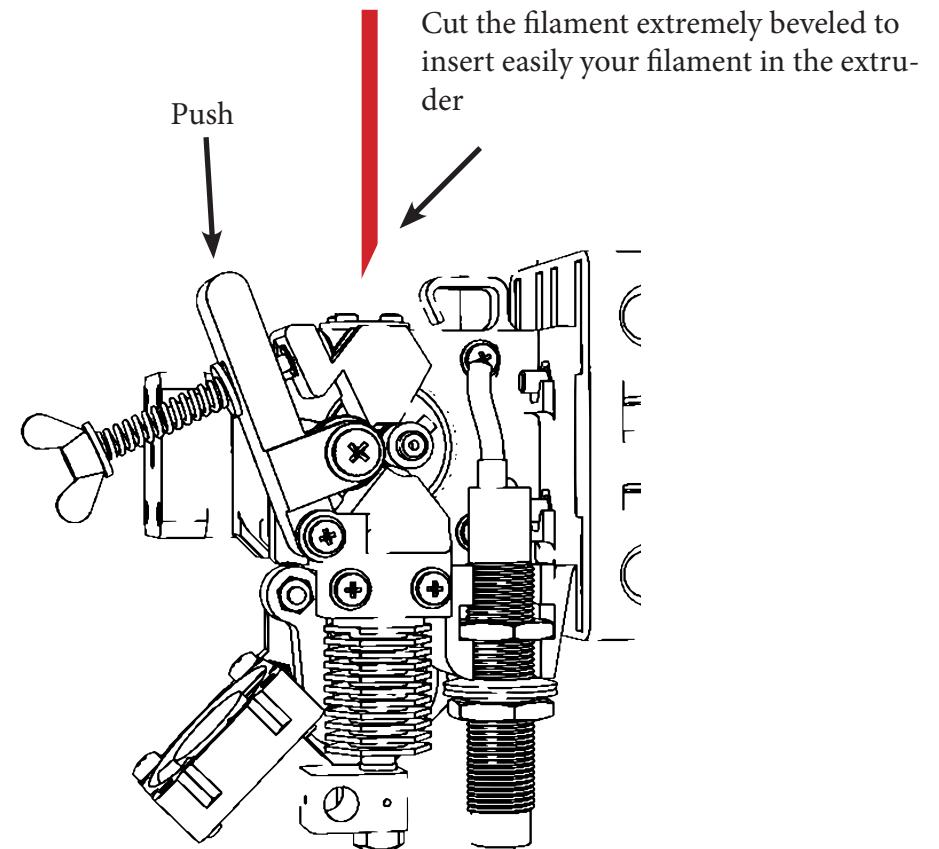
If it is necessary, invert the direction connection of the motor connector on RAMPS board.

Launch the heating according to the sort of plastic filament:

- For PLA : from 200° to 210° and 50° for the PCB heatbed (Cover the plate with Polyimide for a better adhesion)
 - For ABS : from 230° to 250° and 90° for the PCB heatbed, (spread ABS juice*, on the plate cover of polyimide, with a brush to have a better adhesion)
- * ABS juice: Dissolve ABS filament in some acetone to obtain a liquid mixture.

For instance : In a glass, pour 10 cl of acetone and add 10cm of ABS filament, thicken with more filament if the adhesion is not sufficient.

Insert plastic filament 1.75 mm in the extruder by pushing on the Extrudeur Idler (fixed on a spring) to free access to the filament.



When you have reach the temperature, use manual command to extrude.

Check that your hotend have no leak, if it is, it means that you had not well build or tighten your extruder.

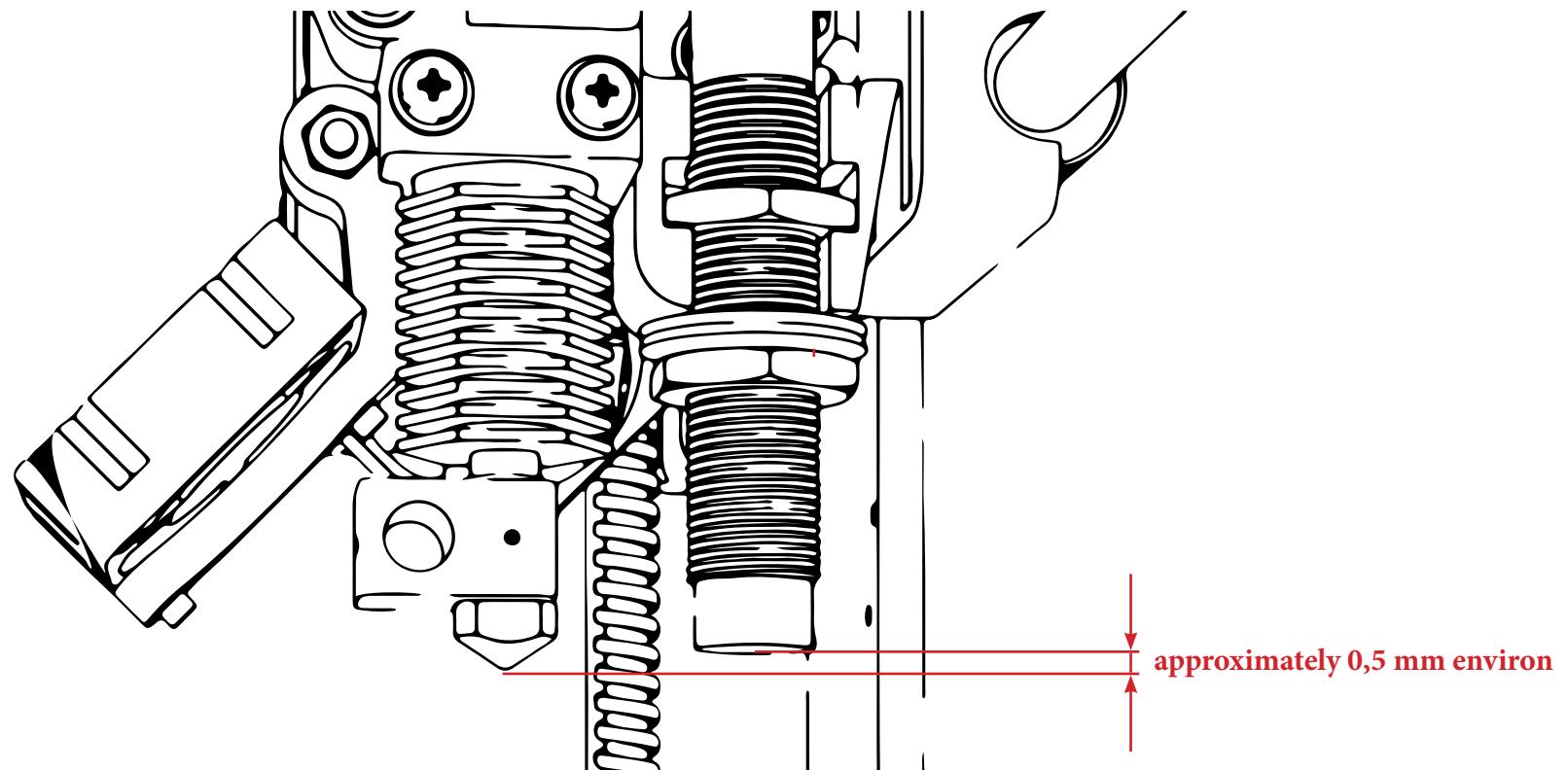
Check also that the drive wheel well train the filament continuously and without slippage. In a first time, you can re-tighten the spring.

Using Z Sensor

The inductive sensor will allow you to automatically palpate 4 calibration points to correct mounting imperfections. This only detects metals (detection ~ 1mm for non-ferrous metals (aluminum, ...) and ~ 3mm for ferrous metals (steel, cast iron, ...)).

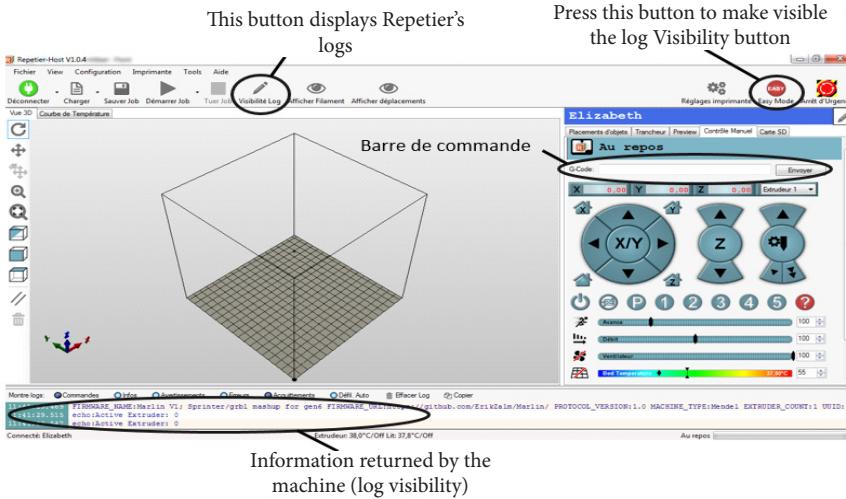
Caution: use of a glass plate is prohibited with the use of the bed of aluminum.

Position the inductive sensor slightly above the nozzle.



Step 2 : checking sensor operation

View the feedback (logs) :



Note: on some sensor model, the indicator light remains on power supply and not sign detection.

Position a metal object in your sensor and type «M119» in the command prompt of «manual control» tab.

Type of response expected in the logs:

Reporting endstop status
 x_min: open
 x_max: open
 y_min: open
 y_max: open
 z_min: TRIGGERED
 z_max: open

→ inductive sensor

This command allow you to check operation of printer's sensors.

Note: try the M119 command when you do not have a metal part to recover the «open» mention in z_min.

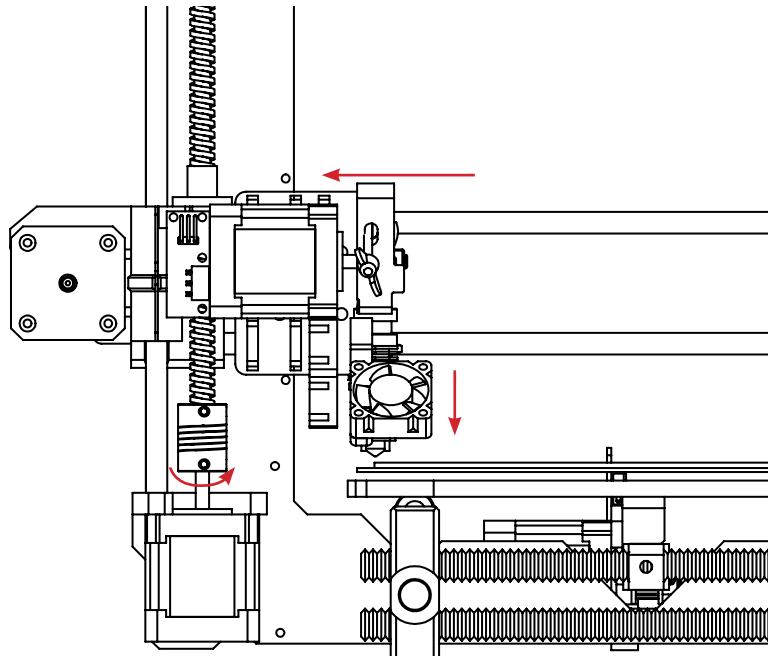
If you do not have feedback of your inductive sensor, check the orientation of the sensor connector and a possible false contact on RAMPS card + adapter board + inductive sensor.

Step 2 : Balancing Z motors

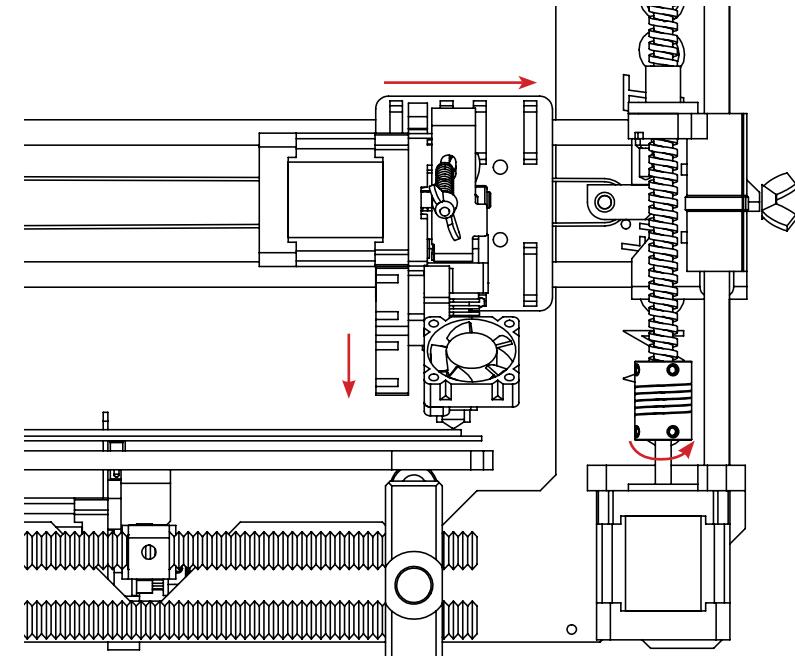
To reduce the correction of the auto-leveling, it is highly advisable to balance the height difference between the two Z motors.

With the power supply off, push the X carriage to the endstop and turn the coupler until your heating nozzle touches the bed:

Left :



Then, right :



Step 3 : Adjusting motor power

In manual control, make some upward and downward movement. If you find that motors struggle to move, adjust the potentiometer of the Z axis stepstick so that the movements are fluid and without missteps.

Step 4 : Z-Axis calibrating

What is the target ?

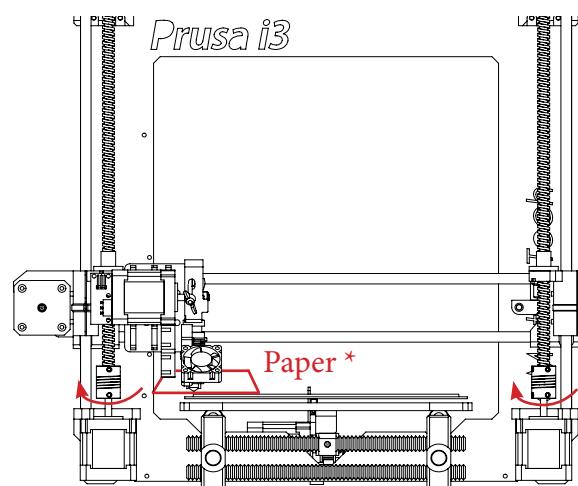
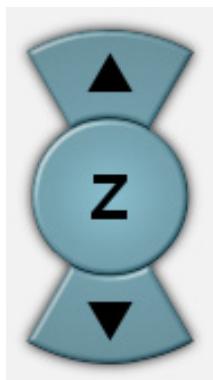
To properly calculate the correction of the auto-leveling we need to determine the difference of our printhead with the heating bed when palpated with our sensor.

Note: This difference is therefore a negative value because it will lower the heating head of measurement recorded up to get the point Z = 0.

Note: the heat tends to influence the sensor signals, it is best to calibrate thereof taking care beforehand that the heating elements are already at target temperature.



- 1 - Initialize X and Y axes by clicking the house icon
- 2 - Send the following GCODE command : **G92 Z100**
This sets the current Z axis point to Z = 100 so it can move down.
- 3 - Place a paper's sheet under the heating head.
- 4 - Using the cursor dedicated to the Z axis, move it down until the paper is slightly blocked.



Note * : standard sheet
of paper (80 grs)

5 - Type the «G92 Z0» command to set the point Z = 0 of your printer

6 - Using the arrows, move your Z axis 30mm upward, so you will be at Z = 30

7 - Type the «G30» command to perform a probe and detect your metal bed

8 - Here is a typical example of a response in your logs:

```
11:08:50.105 N150 G30 *62
11:08:56.813 Bed X: 50.00 Y: 50.00 Z: 0.49
11:08:58.123 echo:endstops hit: Z:0.49
```

Note: For this example, we just measure a difference of 0.49mm from our printhead

9 - To set the value of the specified gap type the following command :

In our previous example :

M851 Z-0.49

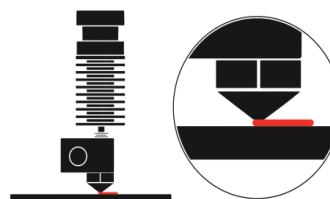
Note: Replacing «-0.49» with the value you received without forget to mention the «-» sign.

10 - Type the «M500» command to save permanently in the memory of your machine.

Note: At any time you can use the «M851» command to retrieve the last saved value and modify it to adjust the height of the first print layer.

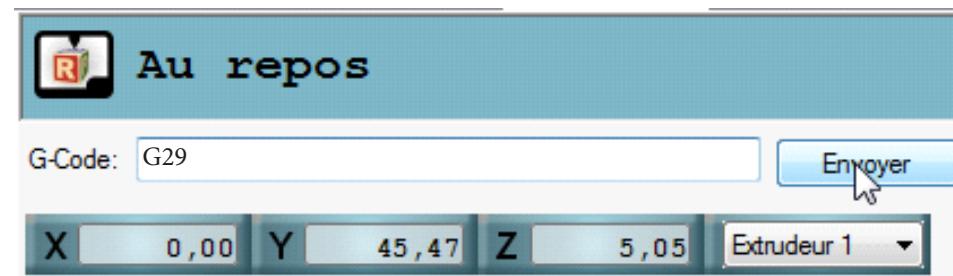
The proper height of the nozzle corresponds to the fact that the top of the molten plastic strand either at the same level as the bottom of the nozzle.

This is illustrated by the following scheme:

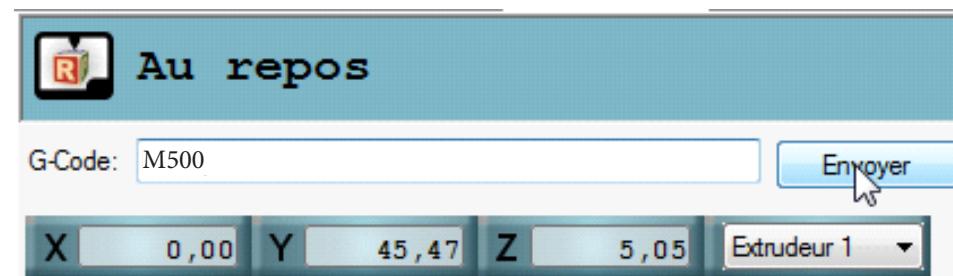


Auto-leveling

The «G29» command launches probe of four calibration points. It is strongly recommended to do an initialization of the machine in the manual control before this command (or type the command «G28»).



The «M500» command save the calibration in the memory of your printer:

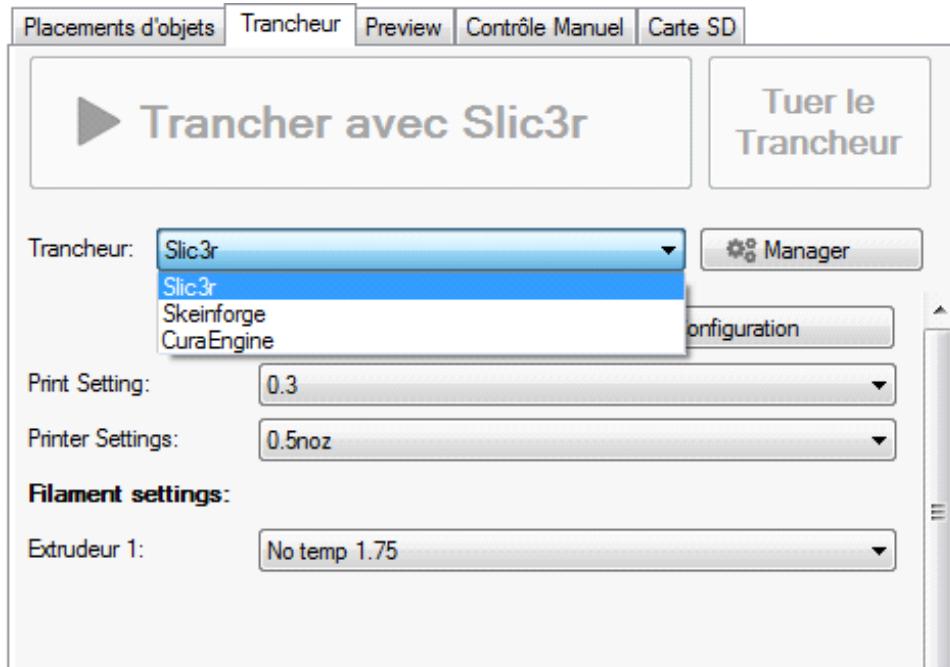


ANNEX

Adaptation of the Start G-code

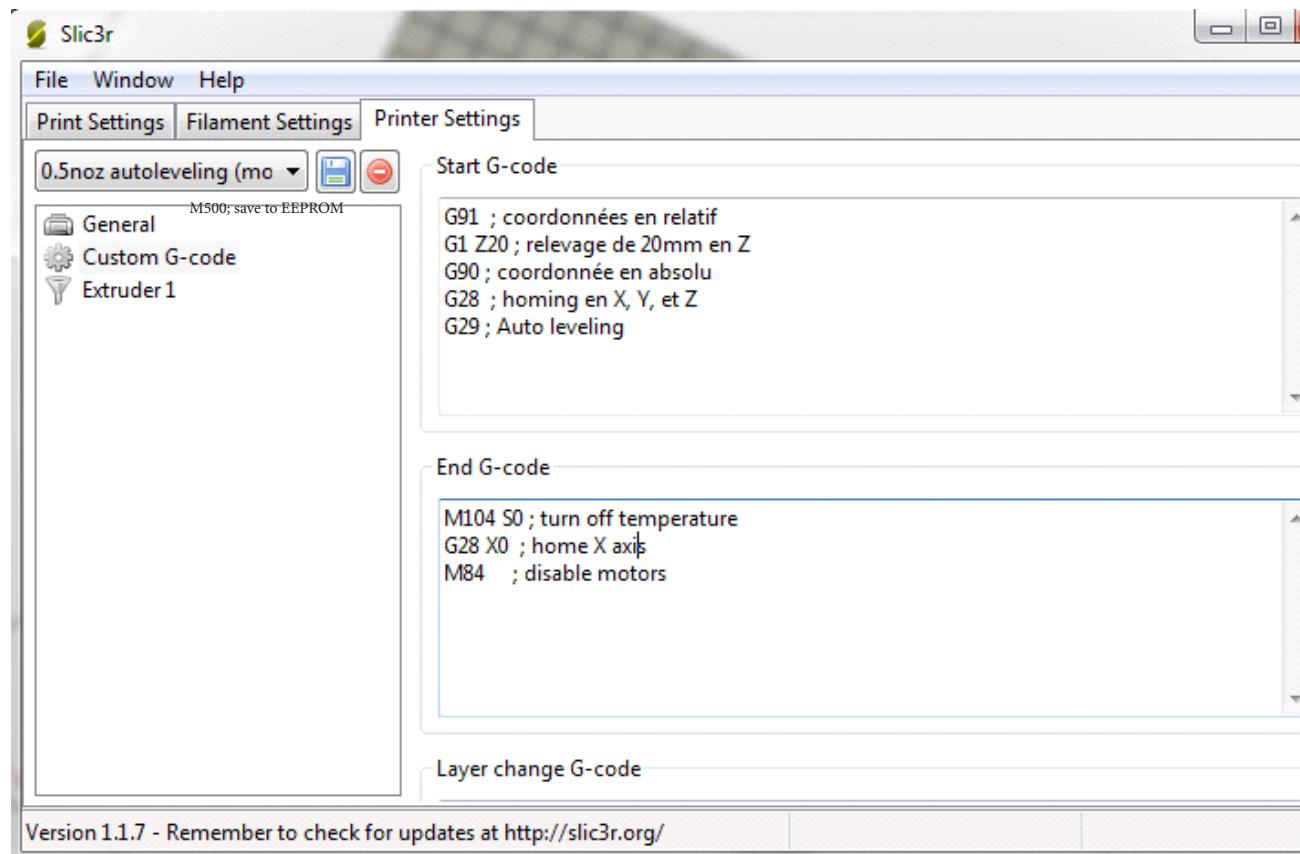
Go in the tab « Slicer » and select the slicer « Slic3r ». Next click on « configuration », and go in the tab « Printer Settings », click on « Custom G-code ».

After that, write in « Start G-code » the command below :



Copy paste the following sequence :

G91 ; using relative distance
G1 Z20 ; go to position Z 20
G90 ; absolute positioning
G28 ; X, Y and Z homing
G29 ; Auto leveling

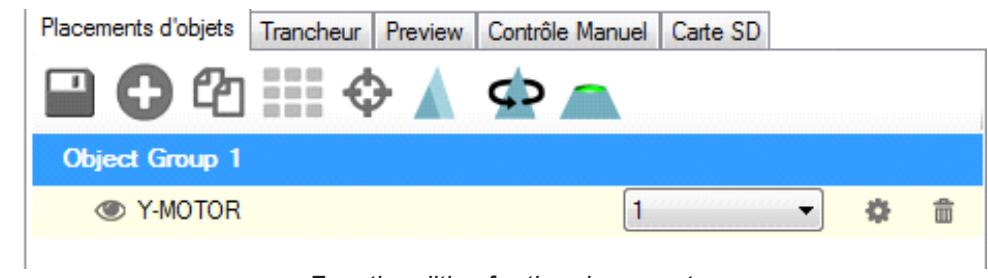
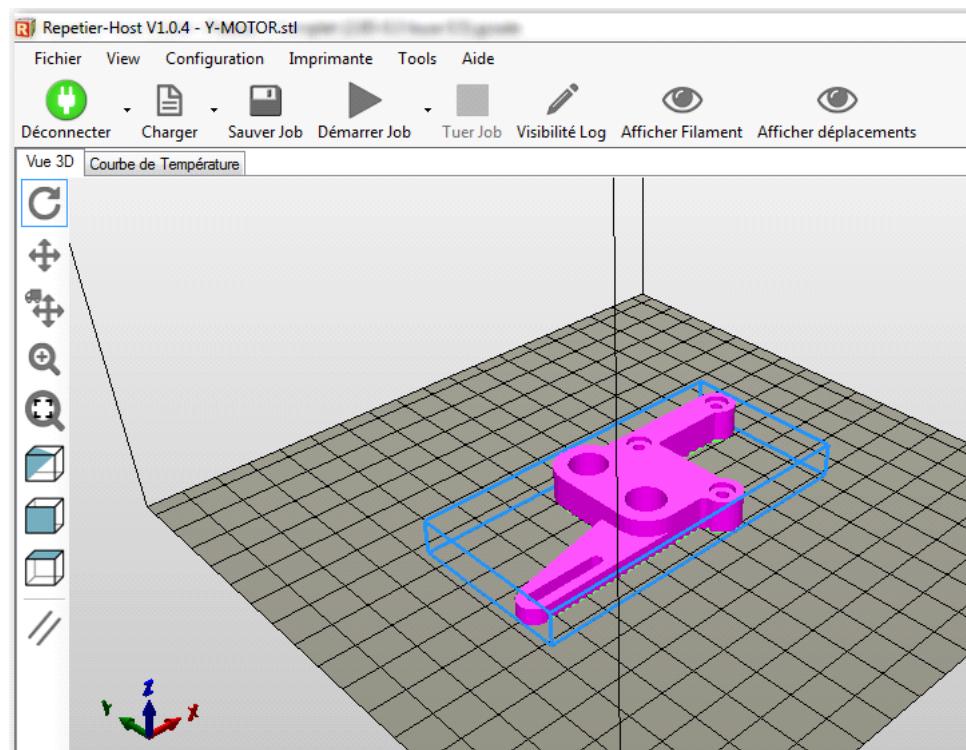


Printing of a piece with Repetier Host

We will first choose a 3D model to print. We suggest you to start with a simple object like the «Y Motor», with a fairly large plate surface to be able to observe the printing of the first layer (decisive) as comfortable as possible.

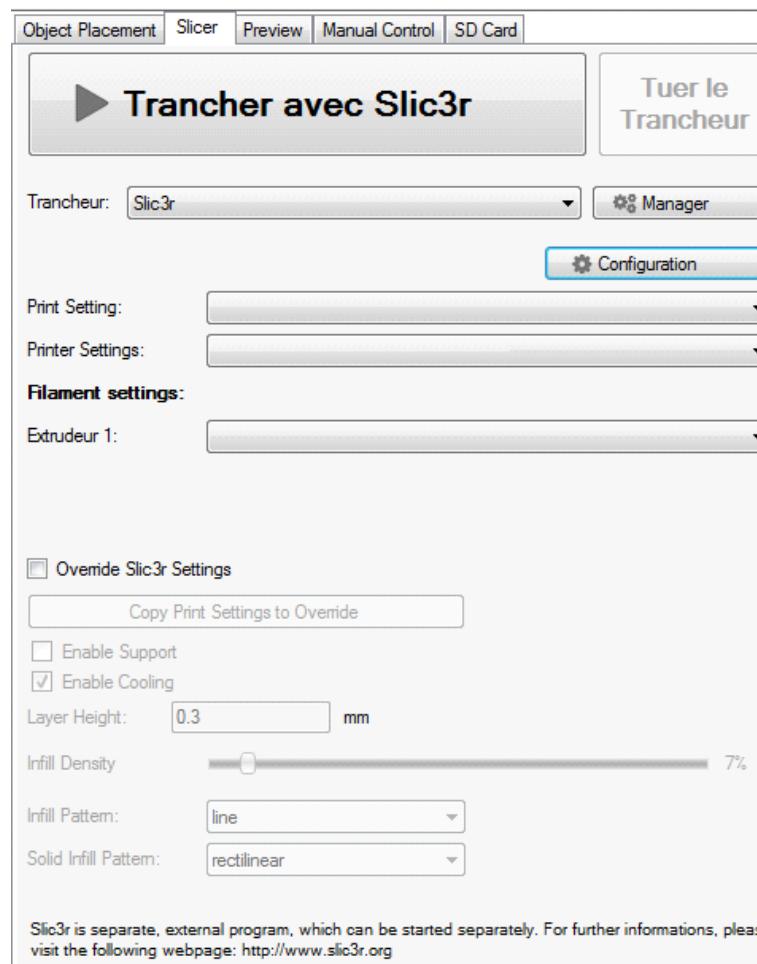
You can also go to the Thingiverse website and find a simple object to print (cube or another simple object without difficulty).

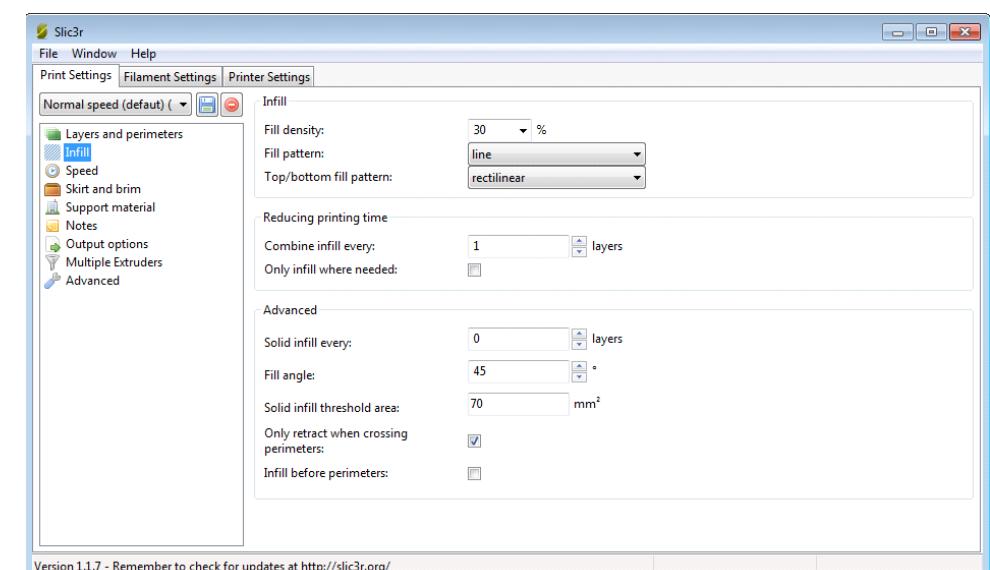
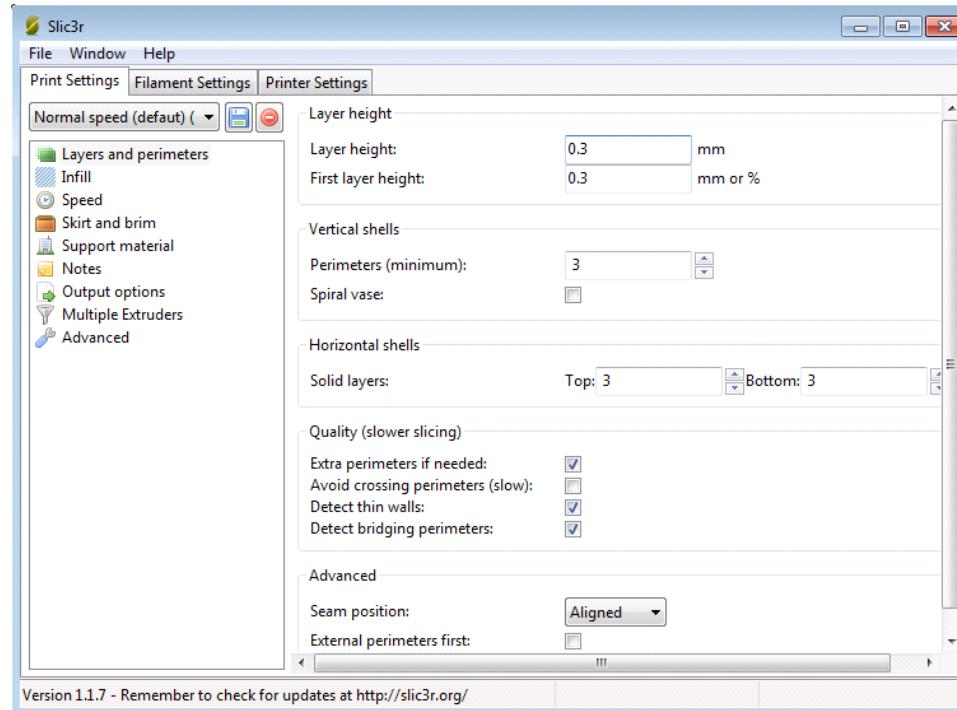
Also be sure to apply a grip coating (polyimide or blue tape) on the plate to optimize adhesion of the material, this is an important detail for a successful print.



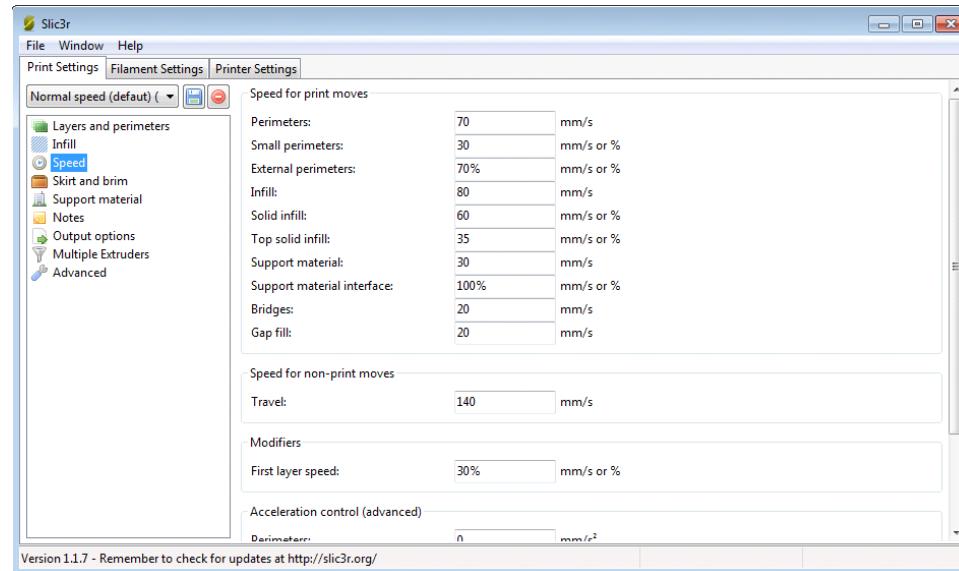
Select the tab « Slicer » and do the follow actions :

Note: We will only detail the main parameter of slicing.

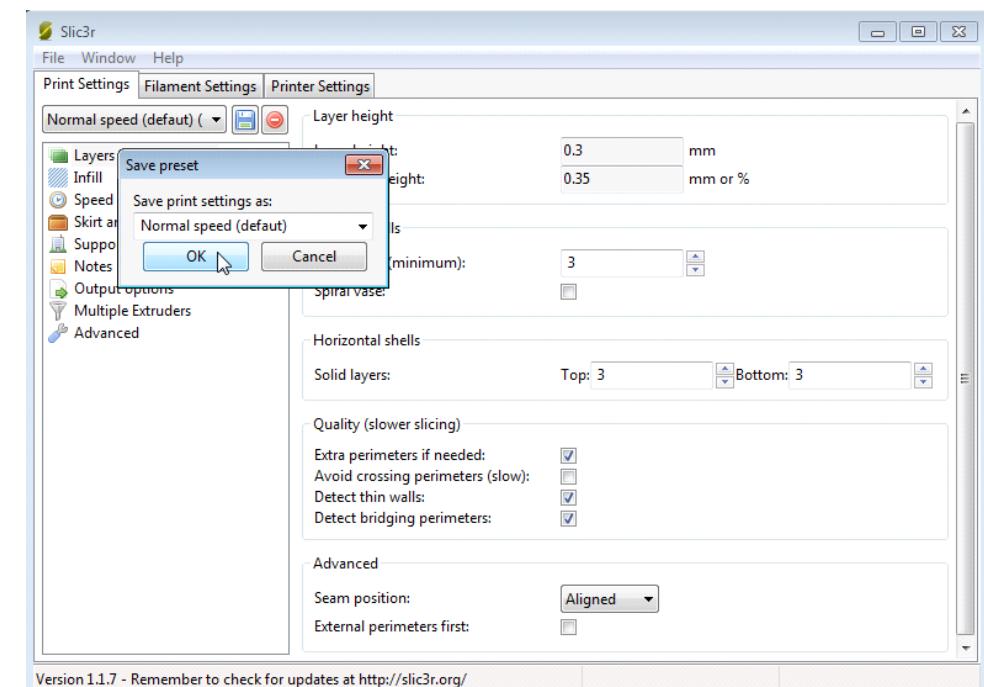




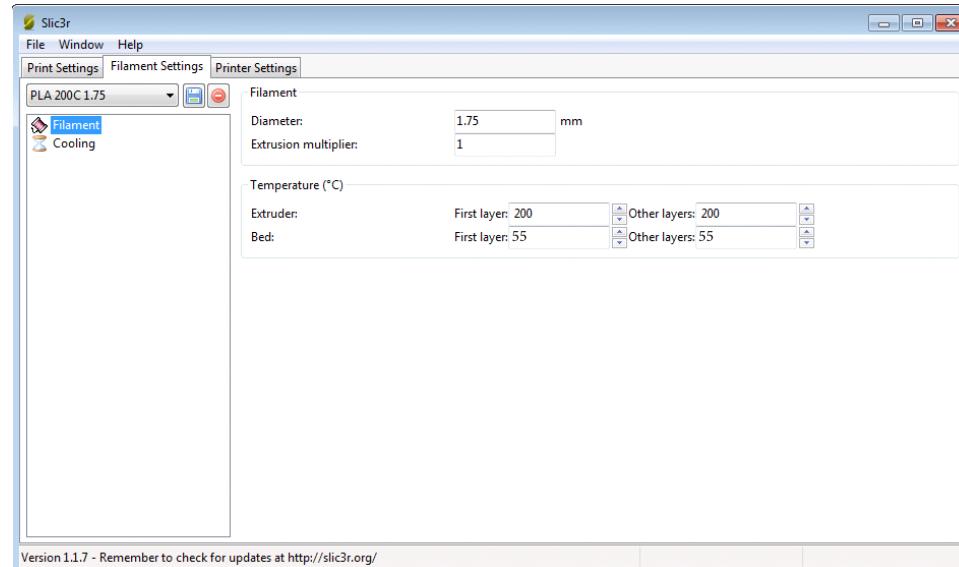
Infill settings



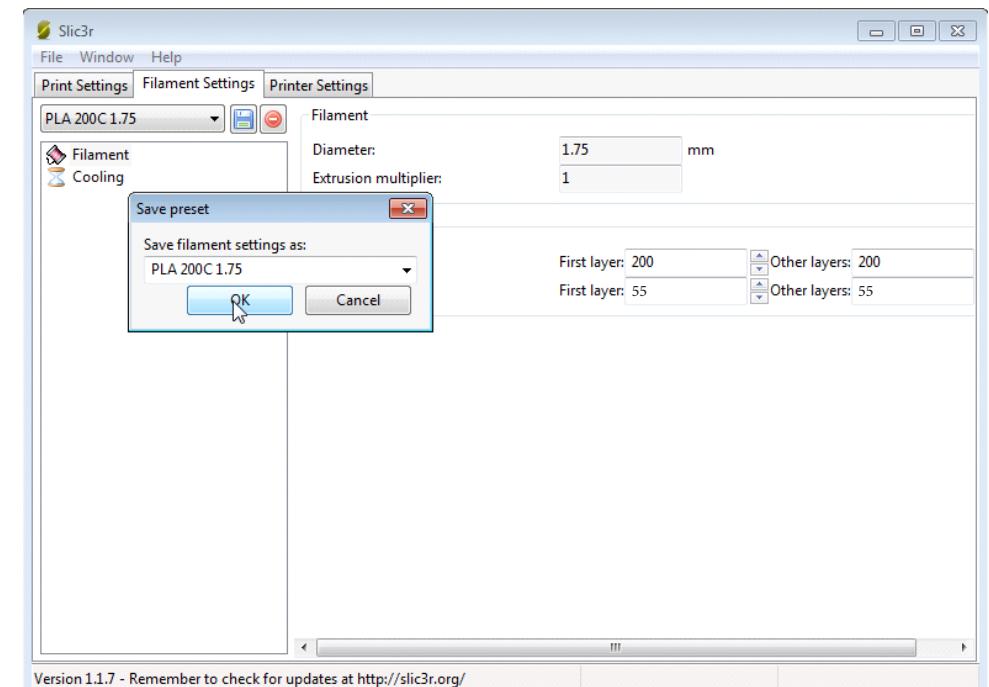
Speed settings



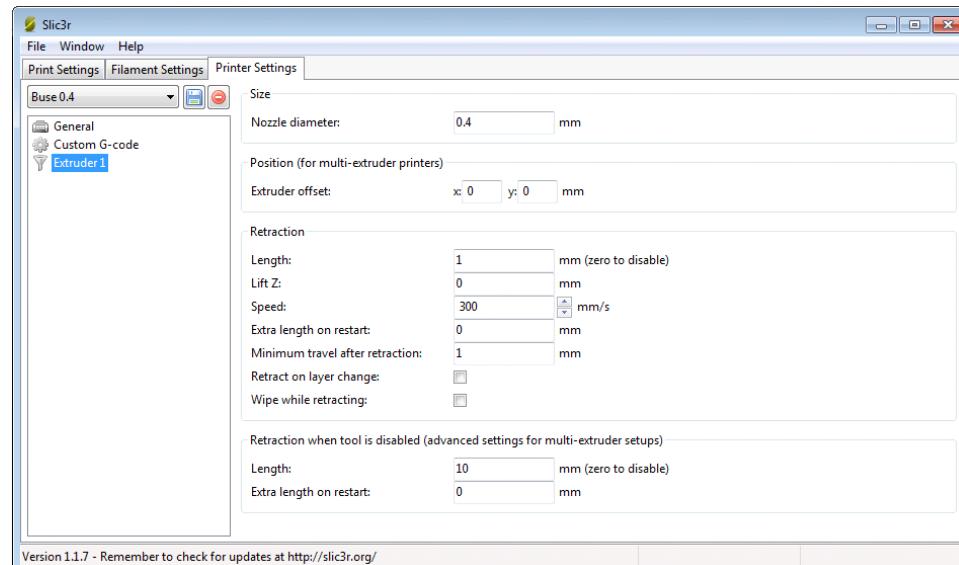
Saving of « Filament Settings »



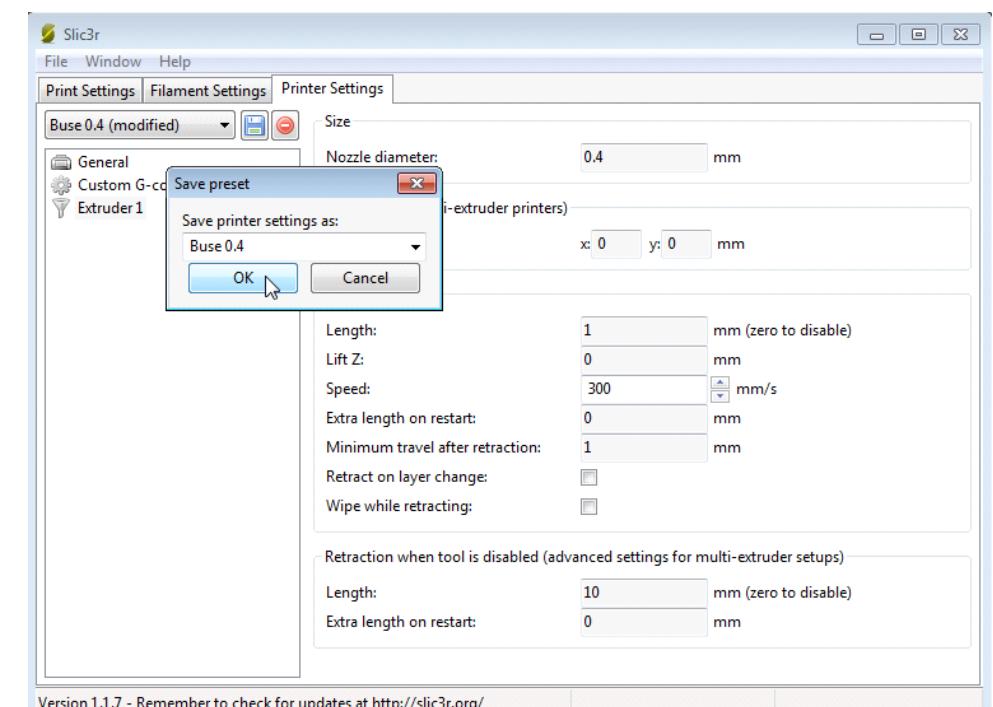
Filament settings



Saving of « Filament Settings »

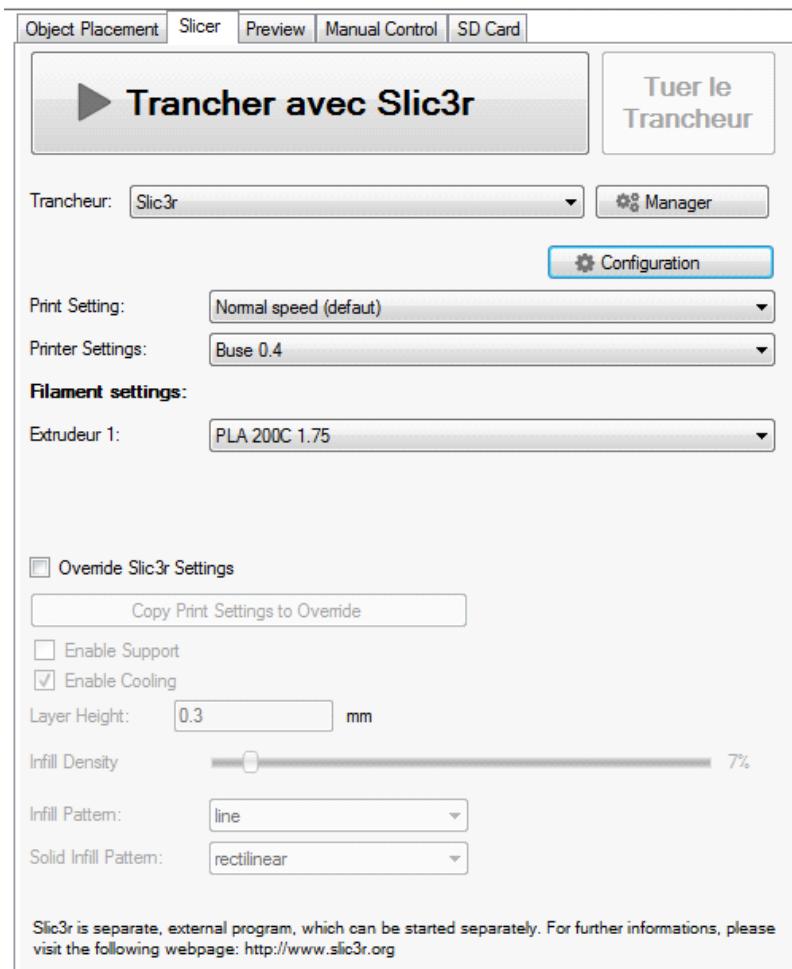


Extruder settings

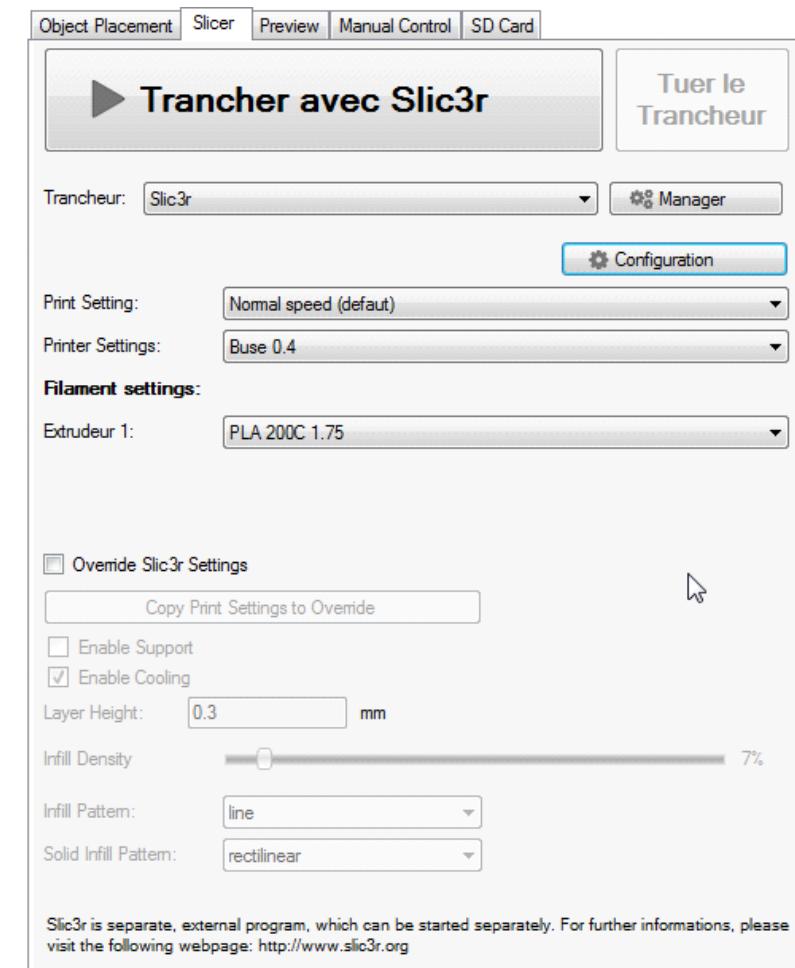


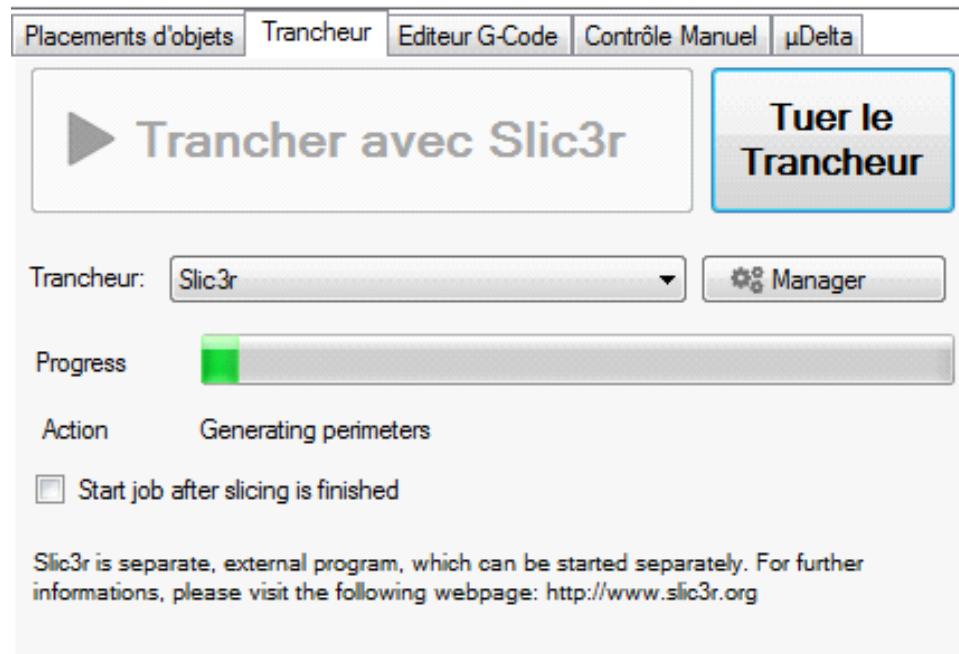
Saving of « Printer Settings »

Slice :

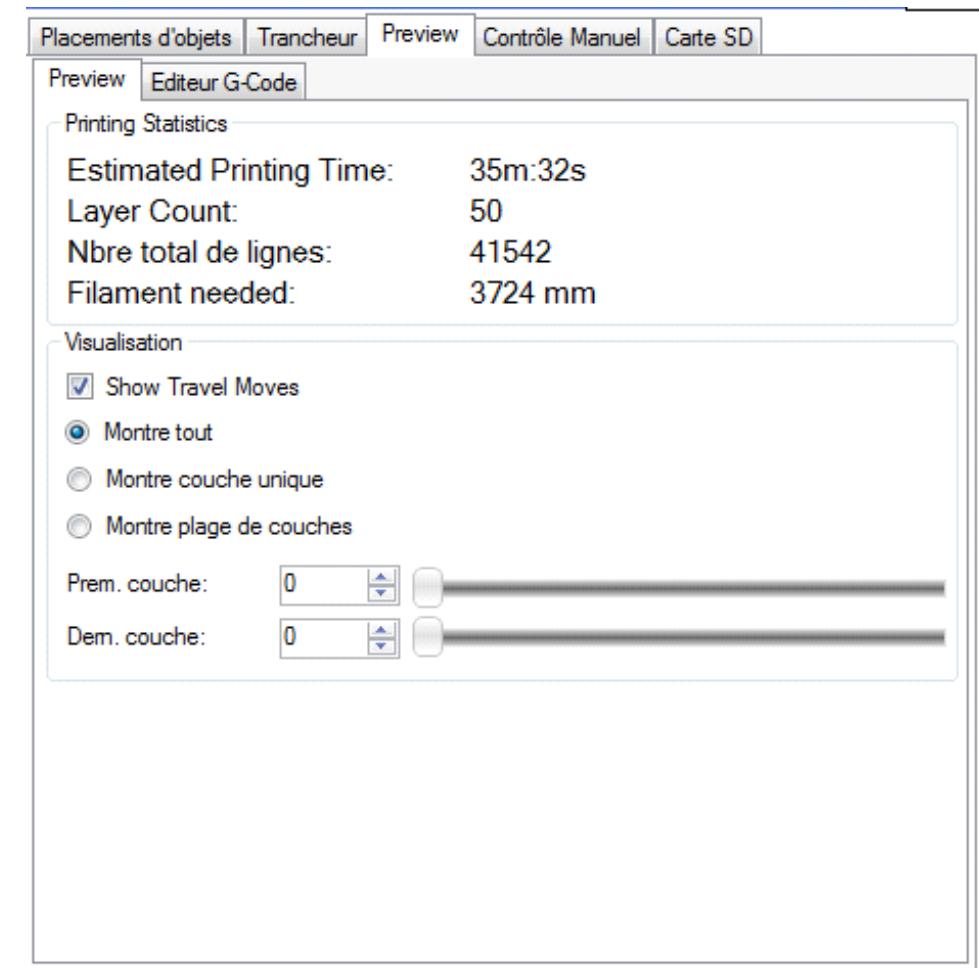


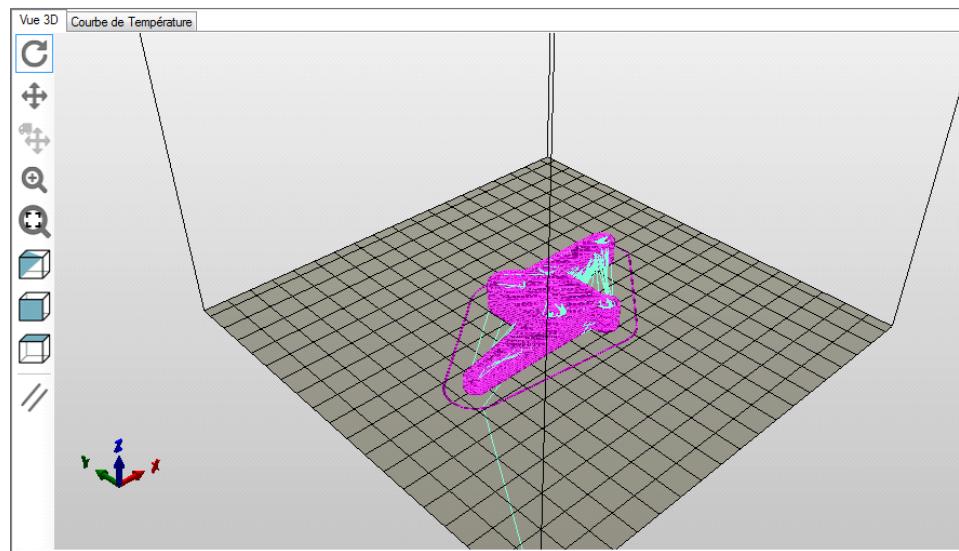
The slice transform a virtual polygonal meshed body into machine coordinates, It take several seconds (depend of the size and the complexity of the piece). You can follow the progression of the slice.





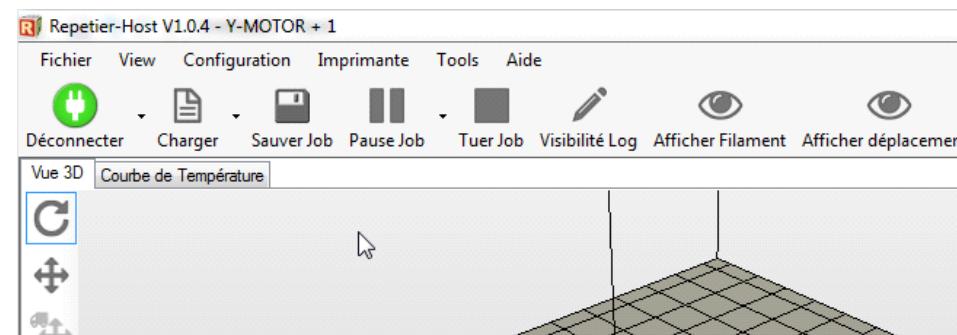
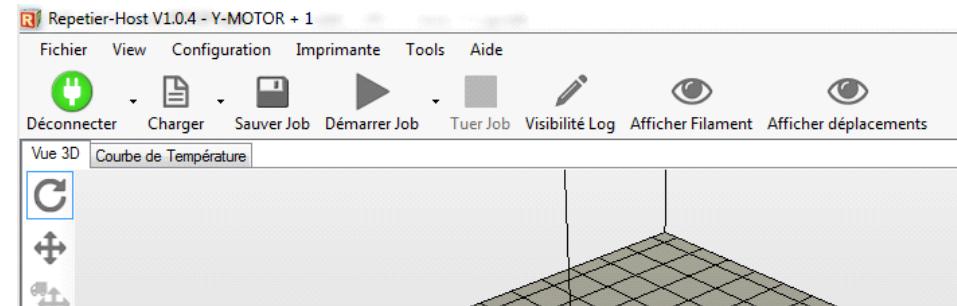
When the slice is finished, you are automatically send on preview's tab.





Piece drawn in machines' path

Now you can start the print :



Congratulation for your first print !!

Ccommandes GCODE

G1 : linear motion (ex : G1 X100 Y100 F3000)

G28 : back to home (ex : G28 X Y)

M500 : save l'EEPROM

M851 : define «Z Probe Height» value (ex : M851 Z-0.49)

M999 : restart printer

G29 : inductive probe at actual place

G30 : inductive probe at plate's corners

M110 : Set the current Line Number

M17 : Enable/Power all stepper motors

M410 : Quickstop. Abort all planned moves, stopping the printer.

M24 : Start/resume SD print

M104 S205 : heating the extruder at 205°C and doesn't wait

M109 S205 : heating the extruder at 205°C and wait until the temperature is reached

M140 S55 : heating bed at 55°C and wait until the temperature is reached

Note : all Marlin's GCODE at http://www.marlinfirmware.org/index.php/G-Code_in_Marlin

Maintenance

A monthly maintenance of the 3D printer is recommended.

Below are some recommendations:

with the help of a brush, dust the following elements :

- RAMPS board
- stepsticks heatsinks
- all fans and ensure that airflow is not blocked
- coldend of the print head

- clean the print head with the help of the guide dedicated to the Hexagon print head, here is the link: :

http://data.emotion-tech.com/highlights_en/Hexagon%20-%20Hotend-guide-v1.1.pdf

- clean the drive wheel's teeth with the aid of a needle, the end of a tweezers or a cutter blade

- check the tightening of each screw equipping the 3D printer

-lubricate all mechanical transmission elements with multipurpose grease or PTFE based oil spray
(avoid WD40 product that has a tendency to be too aggressive for the mechanical elements)

Recommendations

Shut down the 3D printer :

After printing, if you want to turn off the machine, wait until the print head has cooled to room temperature to ensure that the print head does not clog.

Transport :

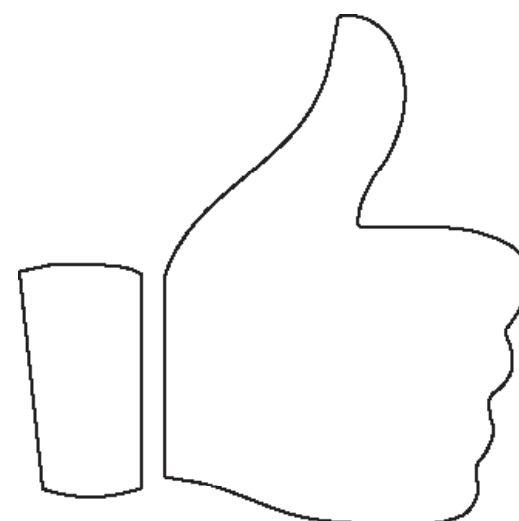
If you have to move the machine by car or other means of transport, it is recommended to unplug stepper motors off the Teensylu board to avoid damaging components.

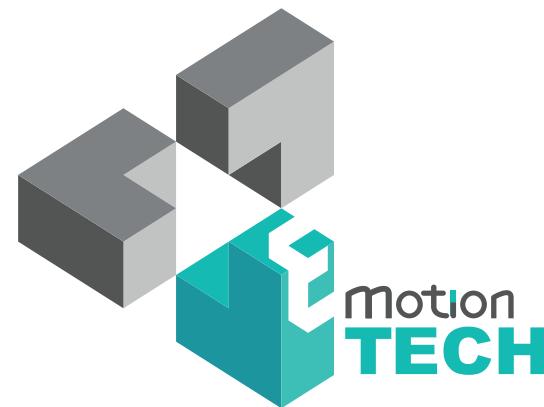
Troubleshooting :

A FAQ is available for the Prusa i3 Rework 1.5 on our website in the «Support» section, do not hesitate to consult it if you are having trouble with your machine, most failures are resolved through this tool, do not deprive yourself !

CONGRATULATION !

Your first print is a success !





Thank you for choosing Prusa i3 Rework rev. 1.5

www.reprap-3d-printer.com