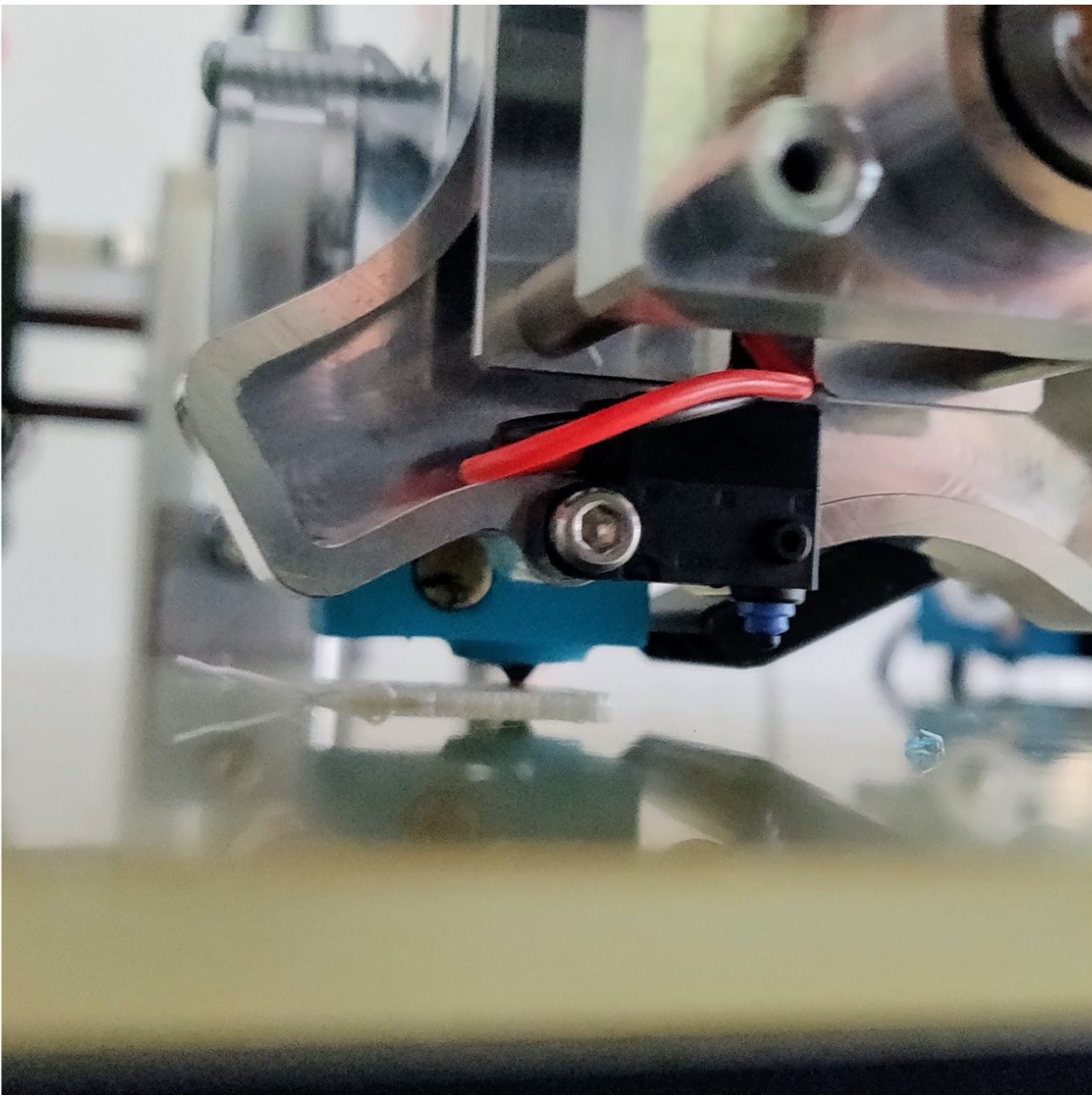




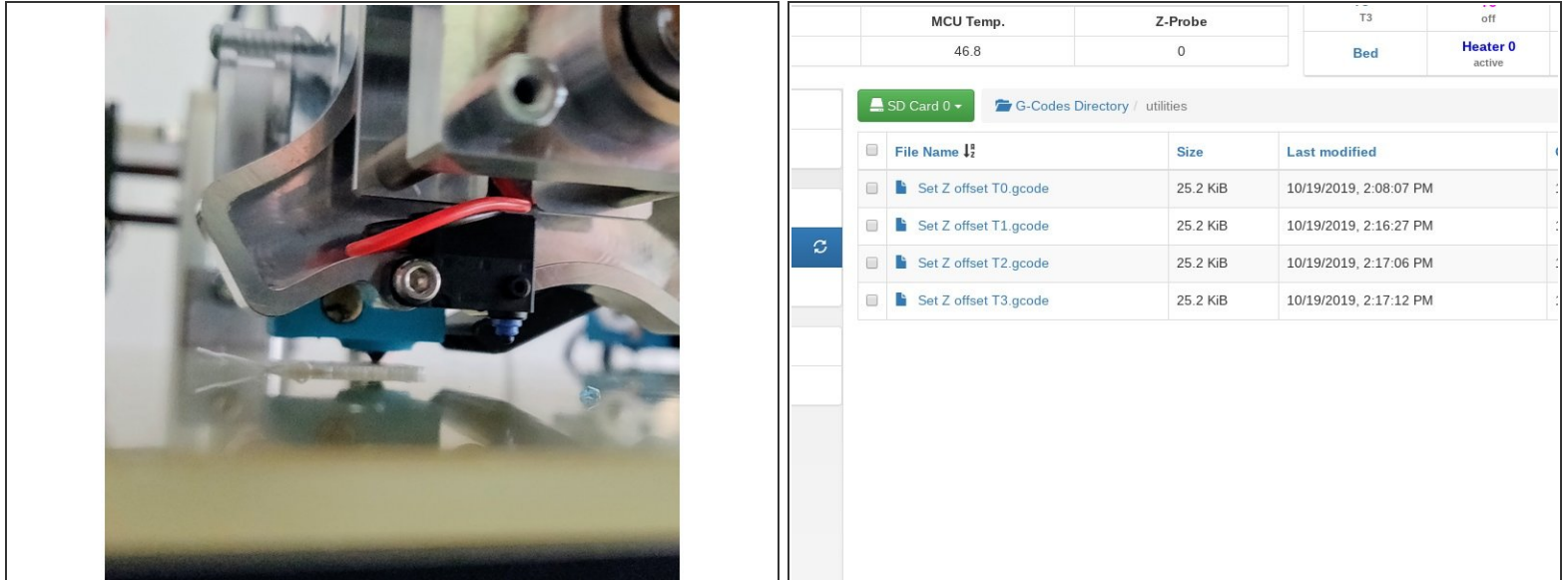
# Fine Tune Z offsets

Process to fine tune the Z offsets with as much precision as possible.

Written By: greenlee

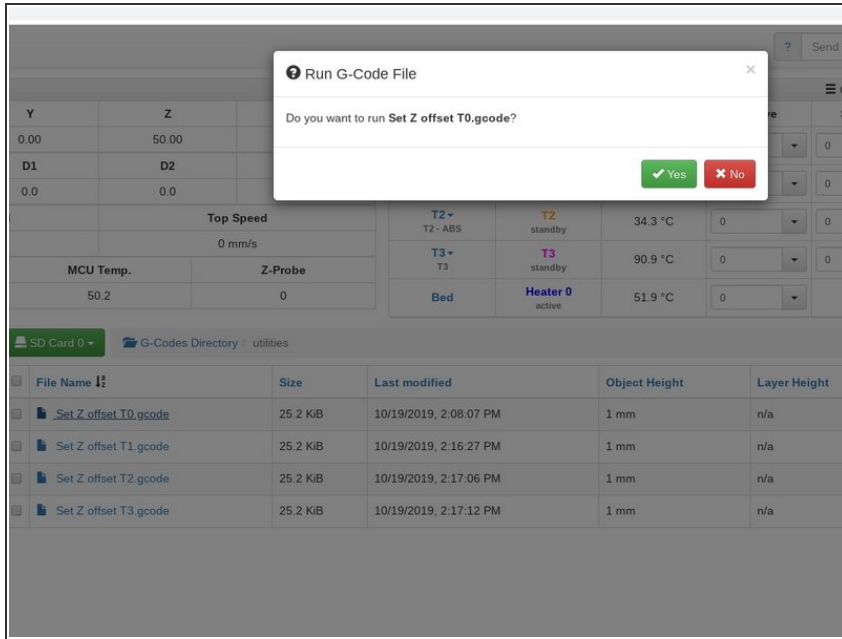


## Step 1 — Load the files and prepare the machine



- Grab a copy of the calibration G-Code here [https://drive.google.com/file/d/1DW\\_tS3g...](https://drive.google.com/file/d/1DW_tS3g...)
- Extract and copy the four files to your Duet.
- The G-Code assume PLA so load PLA in to the tool heads.
- Home all axis

## Step 2 — Run the Gcode



- Run "Set Z offset T0.gcode"
- Here is what the code will do.
  1. heat bed and nozzle
  2. park nozzle and re-home Z axis with a hot bed for better accuracy
  3. build a raft 1mm tall
  4. iron the top flat
  5. park the tool
  6. measure the height of the top of the raft and display the results in the G-Code log
  7. move the head out of the way and shut off the bed heater.

### Step 3 — Time for some maths

| Z                |        | C       |  |
|------------------|--------|---------|--|
| 50.00            | 123.00 |         |  |
| D2               | D3     |         |  |
| 0.0              | 0.0    |         |  |
| <b>Top Speed</b> |        |         |  |
| 0 mm/s           |        |         |  |
| MCU Temp.        |        | Z-Probe |  |
| 51.9             |        | 0       |  |

| Tools / Heaters / Extra | Tool     | Heater          | Current  |
|-------------------------|----------|-----------------|----------|
| T0                      | T0       | T0 standby      | 154.9 °C |
| T1                      | T1       | T1 off          | 34.1 °C  |
| T2                      | T2       | T2 standby      | 34.4 °C  |
| T3                      | T3       | T3 standby      | 39.7 °C  |
| Bed                     | Heater 0 | Heater 0 active | 56.4 °C  |

```

4:33:56 PM Finished printing file 0/gcodes/utilities/Set Z offset T0.gcode, print time was 0h 7m
4:33:52 PM Stopped at height 1.001 mm
4:27:09 PM T:33.2 /200.0 T0:33.2 /200.0 T1:33.7 /0.0 T2:34.2 /0.0 T3:47.5 /0.0 B:59.1 /60.0
4:26:58 PM T:33.1 /0.0 T0:33.1 /0.0 T1:33.8 /0.0 T2:34.2 /0.0 T3:47.8 /0.0 B:43.1 /60.0
4:26:54 PM M32 "utilities/Set Z offset T0.gcode"
File utilities/Set Z offset T0.gcode selected for printing
4:15:25 PM Finished printing file 0/gcodes/utilities/Set Z offset T3.gcode, print time was 0h 7m
4:15:21 PM Stopped at height 0.975 mm
    
```

```

Editing 0:/sys/config.g

; Define tool 1
G10 P1 X0 Y0 Z0 ; Reset tool 1 axis offsets
G10 P1 R0 S0 ; Reset initial tool 1 active and standby temperatures to 0C

; Define tool 2
G10 P2 X0 Y0 Z0 ; Reset tool 2 axis offsets
G10 P2 R0 S0 ; Reset initial tool 2 active and standby temperatures to 0C

; Define tool 3
G10 P3 X0 Y0 Z0 ; Reset tool 3 axis offsets
G10 P3 R0 S0 ; Reset initial tool 3 active and standby temperatures to 0C

; Fans
M100 P0 S0 ; UNUSED
M100 P1 S255 M1 T70 ; T0 HE
M100 P2 S0 ; T0 PCF
M100 P3 S255 M2 T70 ; T1 HE
M100 P4 S0 ; T1 PCF
M100 P5 S255 M3 T70 ; T2 HE
M100 P6 S0 ; T2 PCF
M100 P7 S255 M4 T70 ; T3 HE
M100 P8 S0 ; T3 PCF

M500 F50 ; cancel ringing at 50Hz
M370 M5 ; bed compensation taper

;tool offsets
G10 P0 X-9.8 Y39.450 Z-4.729 ;:2-4.77 ; T0
G10 P1 X-9.45 Y39.450 Z-4.787 ;:2-4.77 ; T1
G10 P2 X-8.95 Y39.25 Z-4.752 ;:2-4.81 ; T2
G10 P3 X-9.45 Y39.15 Z-4.772 ;:2-4.75 ; T3

;select tools
T-1
M572 _00_50_2 ; pressure_advance_T0
    
```

- From the log write down the number after "Stopped at height "
- There is more than one way to run the calculation for the correction needed, here is how I do it.
- (1-Stopped at height)+the value currently in G10 for the z axis with out the negative sign. For example
- 1-1.001= -.001 dont remove the sign on this number. Then add the result with the value in config.g e.g. -.001+4.729=4.728 .
- replace the tested tool's (T0 in this case) Z axis offset with the result, Keep the sign negative. e.g -4.729 becomes -4.728
- So what happened here, By moving the offset closer to 0 we are moving the nozzle closer to the heated bed which changes the first layer height.
- Note, I have not been chasing accuracy below .05mm/50micron. The omron switch used has no accuracy stats I have found and is marketed as a general purpose snap action switch. In other words 1 micron accuracy is probably overly optimistic for this.
- Now clear the bed and run the next tool head's G-Code or re-run to evaluate the result. The G-code provided does not shut down steppers so you should not need to re-home the machine unless it was left idle for awhile or if you reboot the duet board to apply the new values.