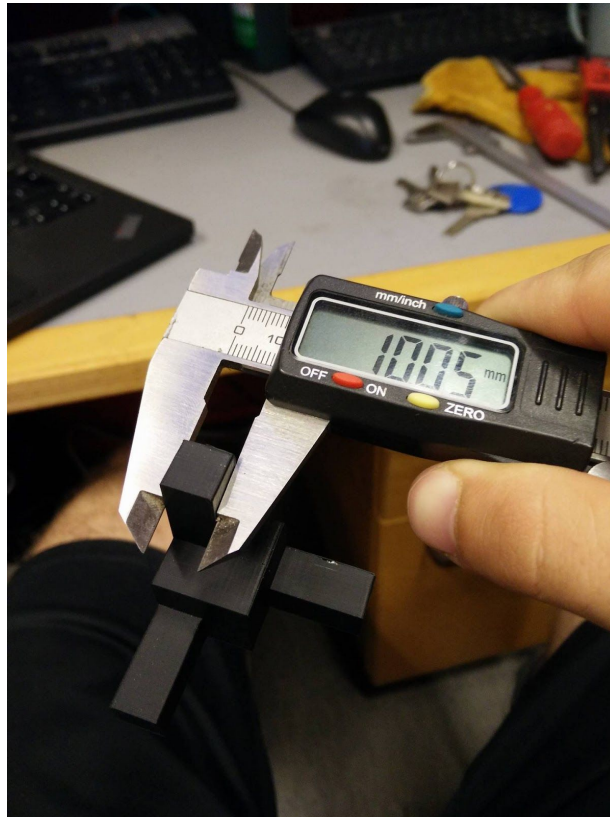


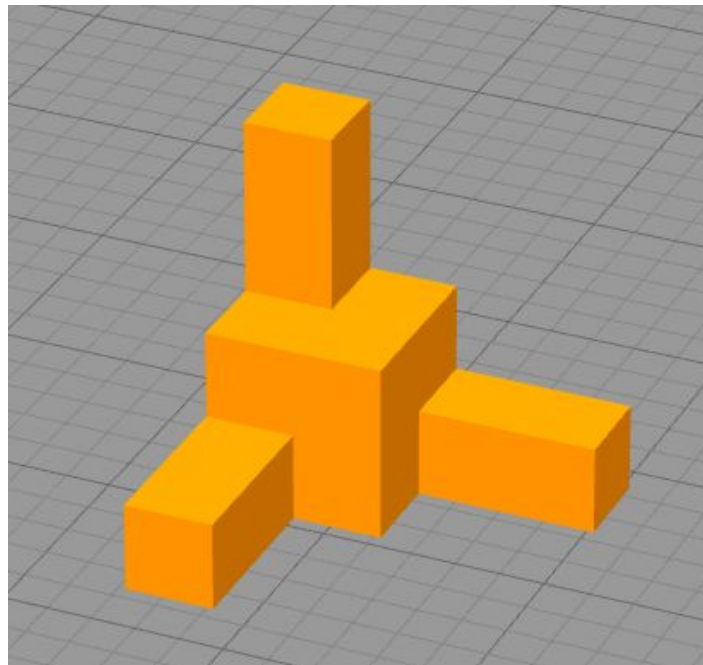
The precision of hobby 3D printers



This year the 3D printing facility of SDU campus Sonderborg got a lot of request about precision of hobby machines we are using. In case to determine the precision the testing procedure was developed and testing was made. The steps of testing are following:

1. 3D print calibration object "10x20x40 calibration object" (Using Ultimaker2)
2. Measure dimensions of it using digital calliper
3. Put values in a table
4. Repeat the procedure
5. Repeat procedure with different printing resolution

The calibration object is 20x20mm cube with 10mm beams going from it in x-y-z axis directions. It gives an opportunity to check the deviation of different lengths of the part from desired lengths in all three axis. It is important to measure the deviation in all three axis, because particularities of construction of FDM printers may give a different deviation in each of directions.



For testing were used two materials: **PLA** and **ABS** plastic. As two most common materials they are most often used in 3D printing facility.

Setting used for 3D printing are following:

1. Extrusion height 0.2 mm / Extrusion width 0.4mm (Medium resolution)
2. Extrusion height 0.1mm / Extrusion width 0.25mm (High resolution)

The rest of setting were default settings.

The testing object was printed twice in each of resolutions for both ABS and PLA plastic. The results of the test can be find in table below. In a table you can find measured dimensions in x-y-z planes and deviation from desired result. After testing was made, the dimensions were corrected using x-y "Dimensional adjustment" in Simplify3D slicer.

The observations from test are following:

1. The precision of machine in z-axis is very high, in range of 0.05mm (due to use of screw drive for this axis)
2. Printing with PLA plastic the better precision can be achieved in comparison with ABS plastic.
3. Printing with ABS we the same error of machin's presented + effect of shrinking
4. Shrinking of ABS plastic is uneven and hardly predictable (it is dependant on shape, infill etc.) Also, it increases increasing the size of the part.
5. Printing with higher resolution in x-y plane (smaller extrusion width) gives better precision and better surface finish for both ABS and PLA plastics
6. For practical applications +/- 0.2 mm should be considered for PLA plastic. Doing that you can ensure that precision of parts will be high enough to use them for development of mechanics for the project.

