

Portfolio Supplement - Aaron Beckman

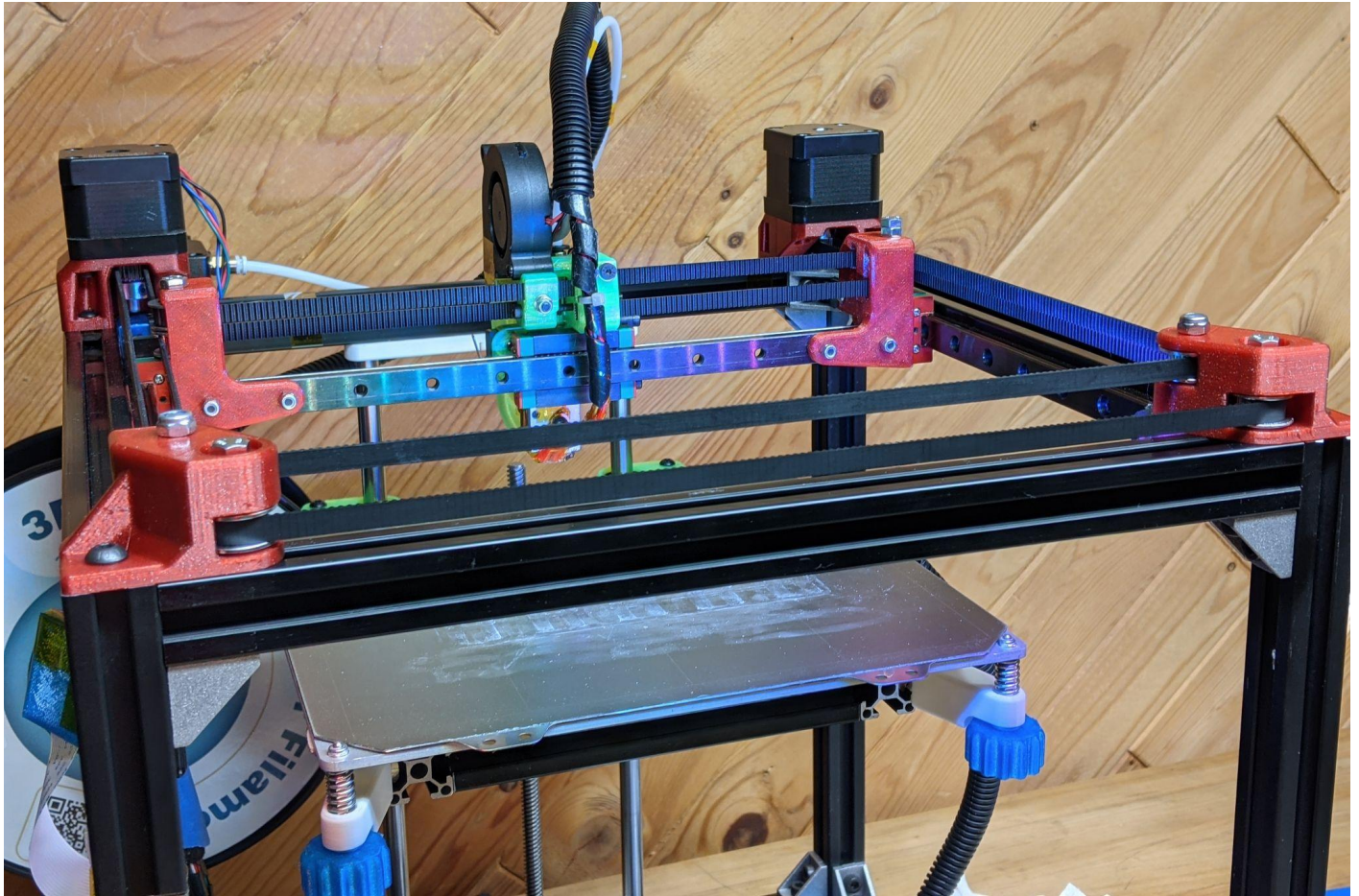
Custom 3D Printer Concept

For more personal projects and design files, see [this link](#) or my application

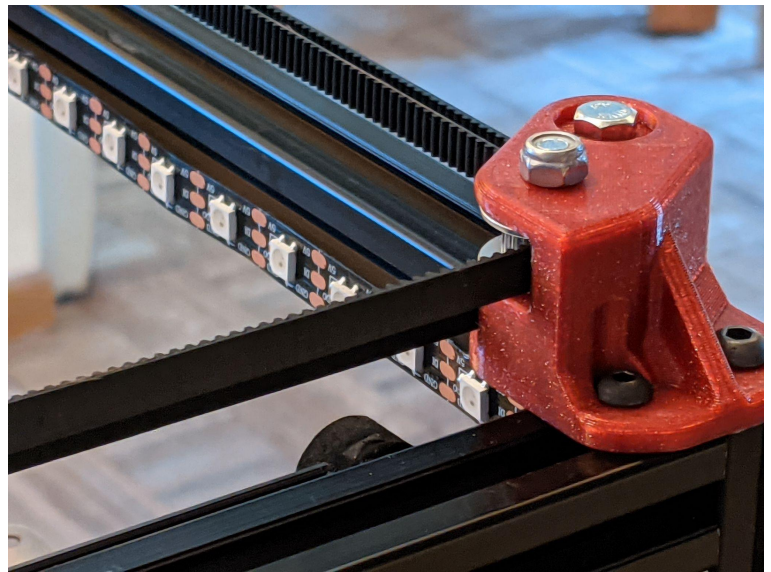
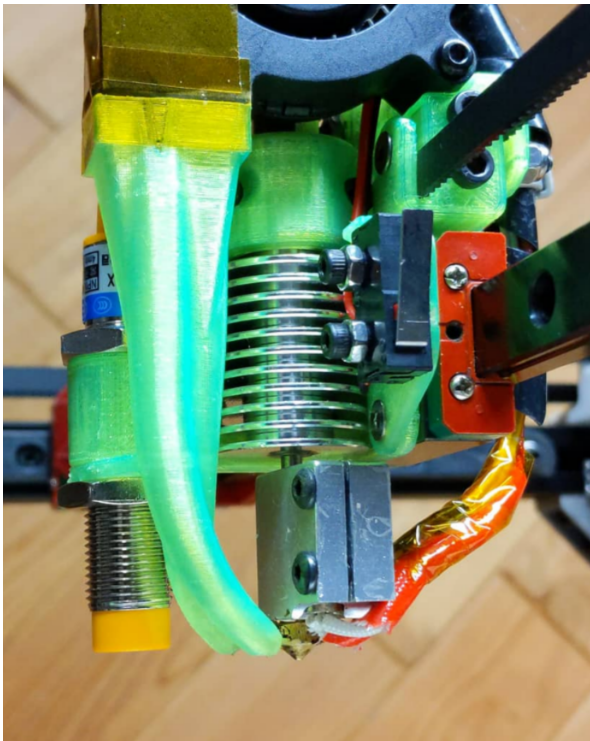
My 3D printer is iteration 9.2 of a long project to make a functional and fully custom machine for mid scale production. It is a core XY kinematic system, running Marlin 2.0 on a (now upgraded from 8 bit) 32 bit board. It uses standard RepRap NEMA 17s, belts, and pulleys. Taking advantage of the inherent stability and lack of racking in a core XY system when both traveling pulley pairs are collinear, it uses a single unsupported rail for the X axis and has over 150mm/s straight line travel speed as well as high acceleration. With a volcano extruder, it can produce batches of parts filling the build area, and was used to make 100s of parts for Cyclikal, the battery development startup I worked at. My design allowed us to make draft-quality parts at a much higher rate than with a commercial system.

Photos are shown here with descriptions. If you would like a CAD model, please reach out to me! I can send a STEP format or native Creo/ProE files. *My printer showcased at the Midwest RepRap Festival, 06/2021:*

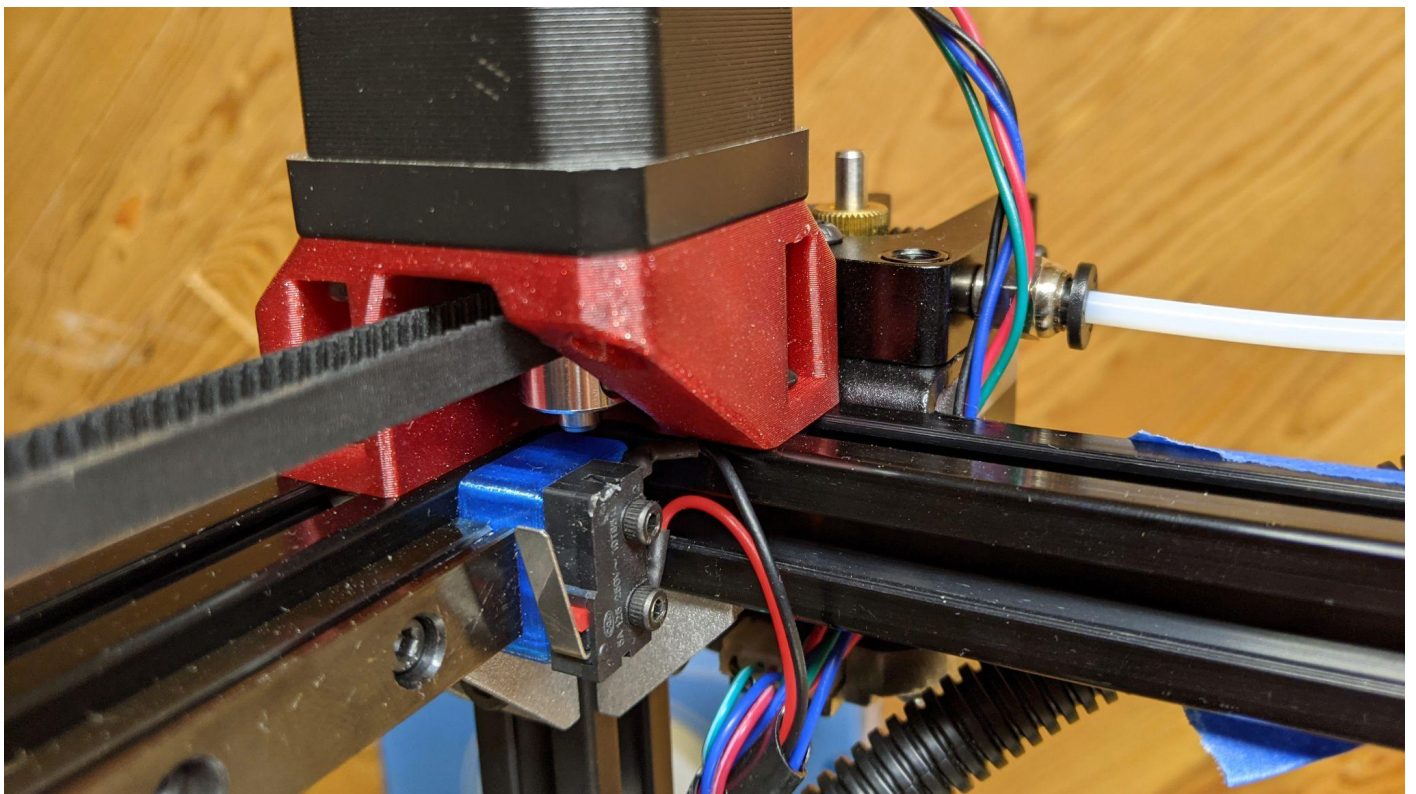
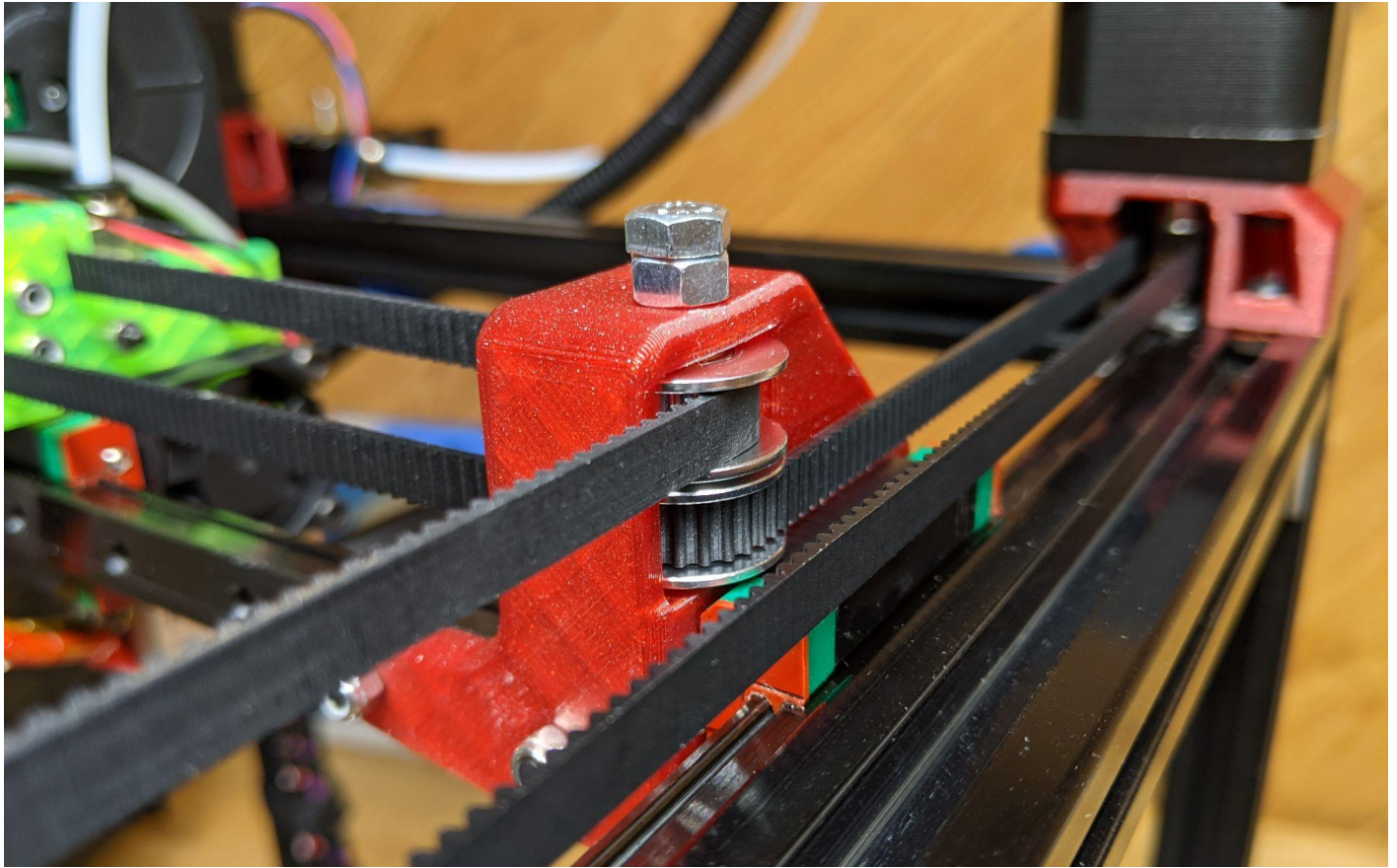




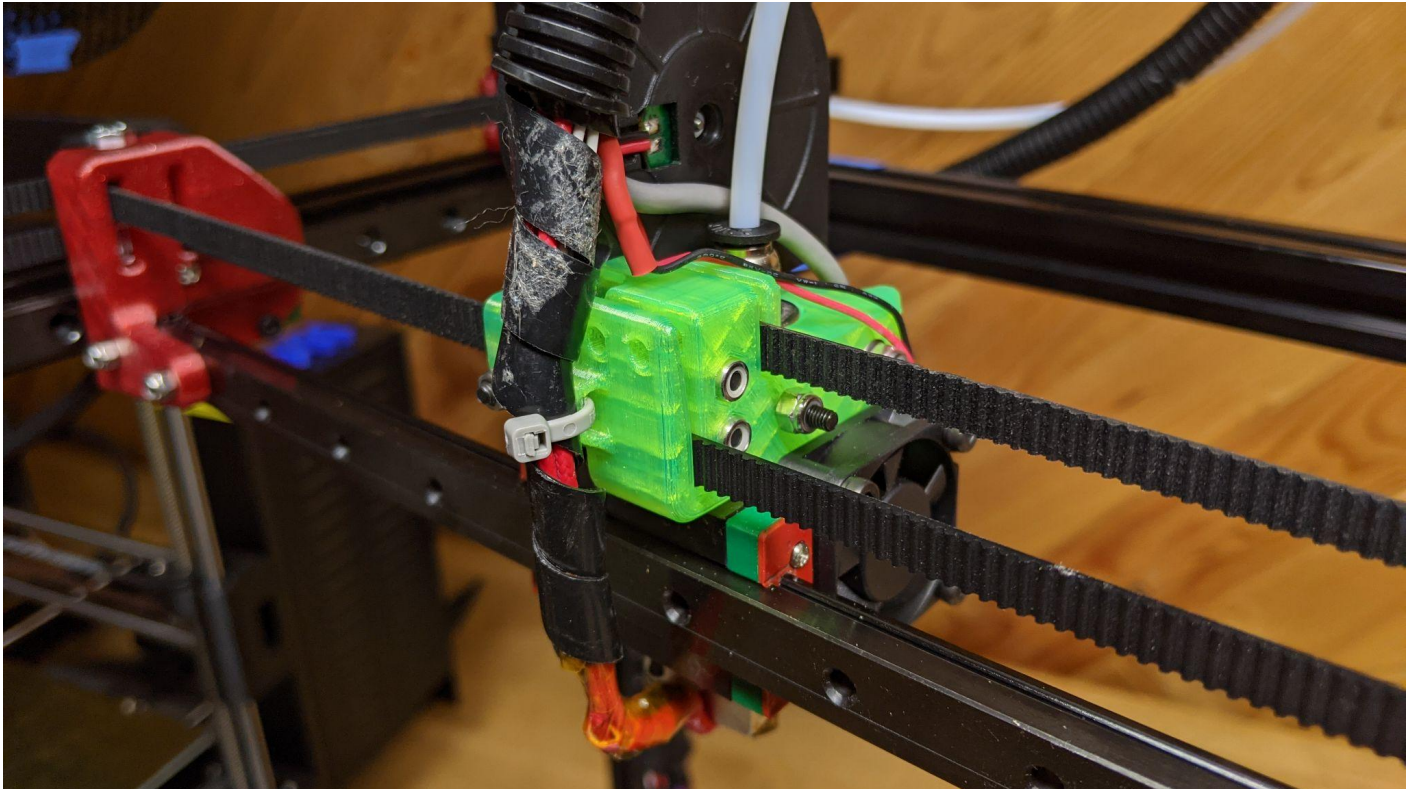
The motion system has LEDs on the inside of the closest aluminum extrusion, controlled automatically through an Octoprint interface. Lights turn on when printing, and off when complete. Shown below:



The effector (left) has a figure eight profile lofted extrusion to focus air. Through experimental CFD analysis, it's shown to work quite well given the length.



Motion system close-ups and belt paths. By stacking the pulleys on the X axis, any moment forces across the length of the unsupported rail “cancel out,” reducing the need for rigidity, which would add moving mass.



The slotted belt tensioner consists of a static and a bolt-anchored side each with two belt connections. Tensioning is as simple as tightening an M3 machine screw; belt clamps have double redundancy of printed teeth to mesh with the belts as well as additional machine screws (holes shown empty)



One batch of cell holders for my work (Cyclikal). These were later revised with print-in slots for the 4 wire connections. Development of parts and testing is greatly reduced with the use of an in-house machine.