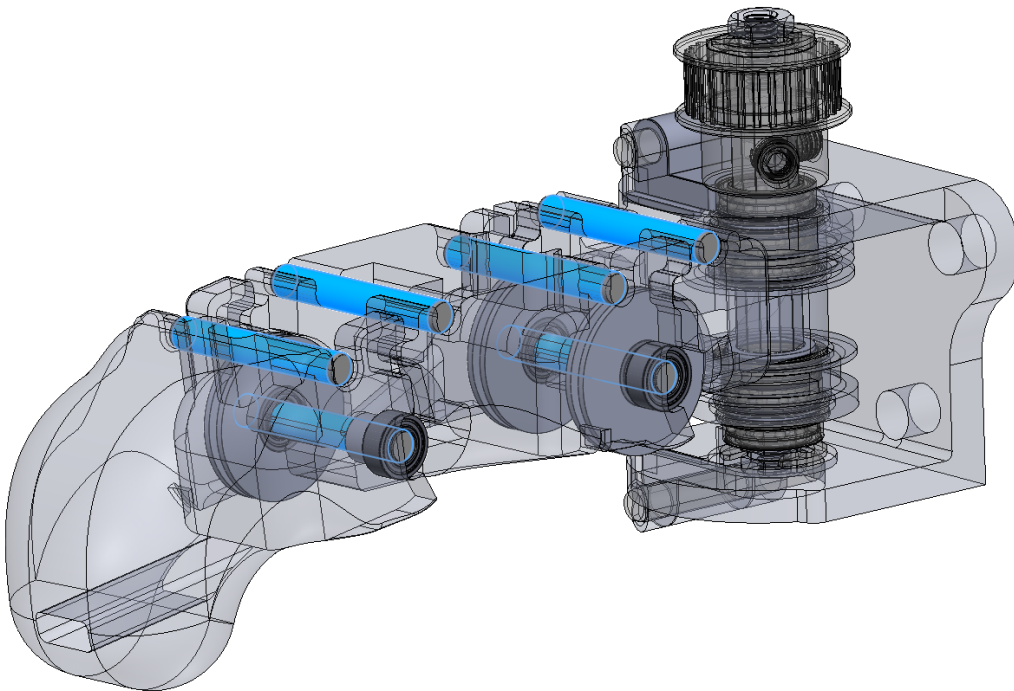


Mechanical Design Decisions

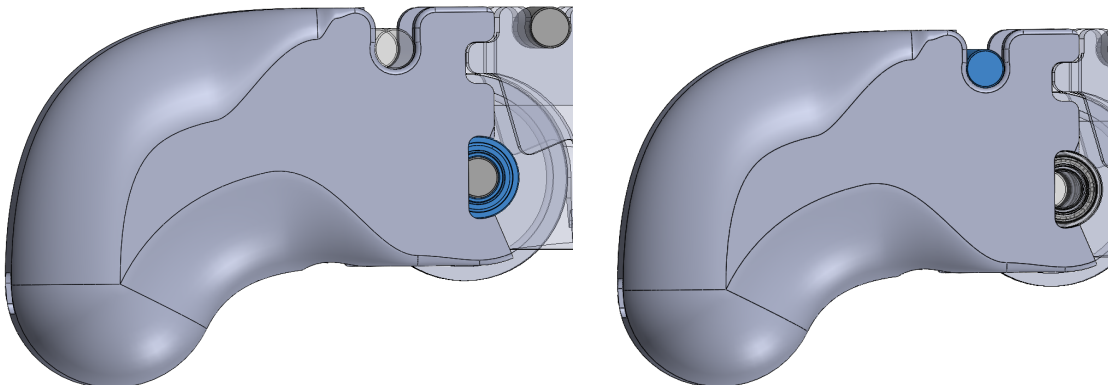
We defined minimalism by two tenets - the ease of repair/assembly, and the minimization of parts/complexity.

Ease of Repair/Assembly

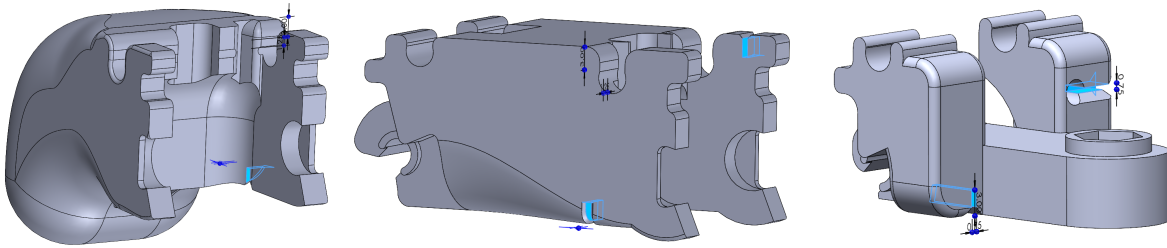
The elimination of fasteners on the finger drastically reduces assembly time. Instead, the pins we use allow us to easily and rapidly access springs, bearings, and pulleys on the finger.



Another optimization which made assembly/disassembly especially rapid was the implementation of snapfits throughout the finger.

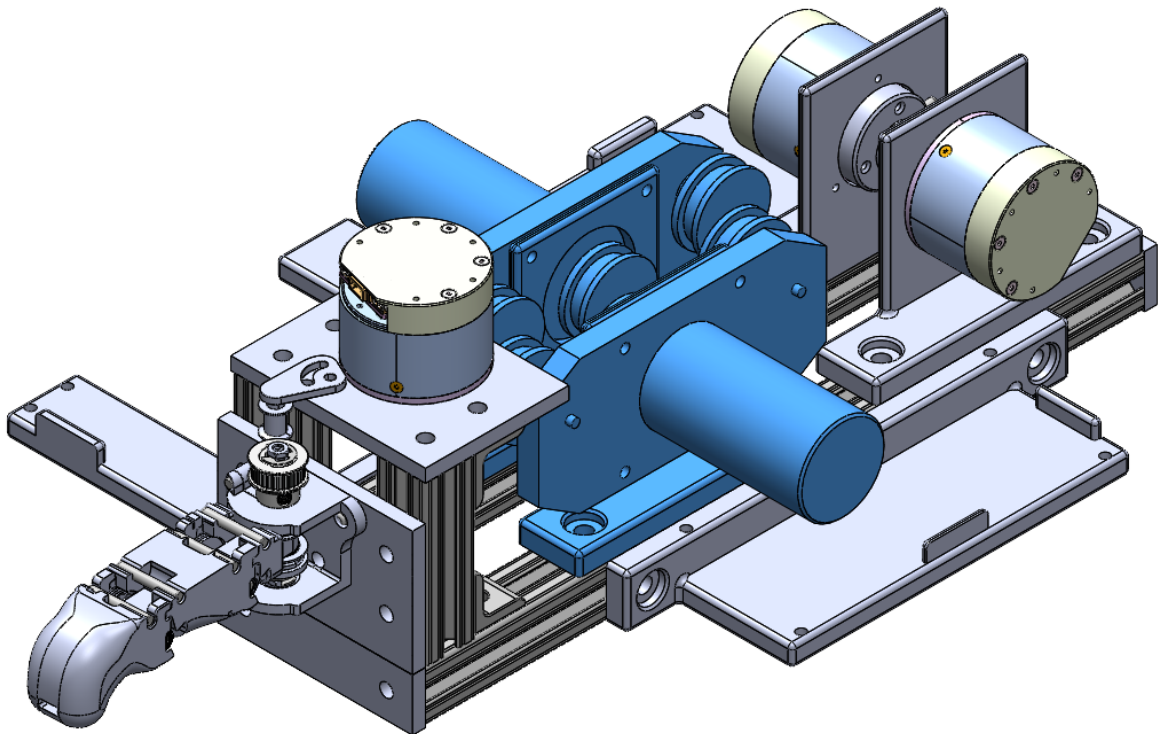


An optimization which made tendon routing easier during assembly was the inclusion of grooves to hold the tendon while snapping in the next parts. The location of the grooves facilitated the correct placement of the tendons as well.

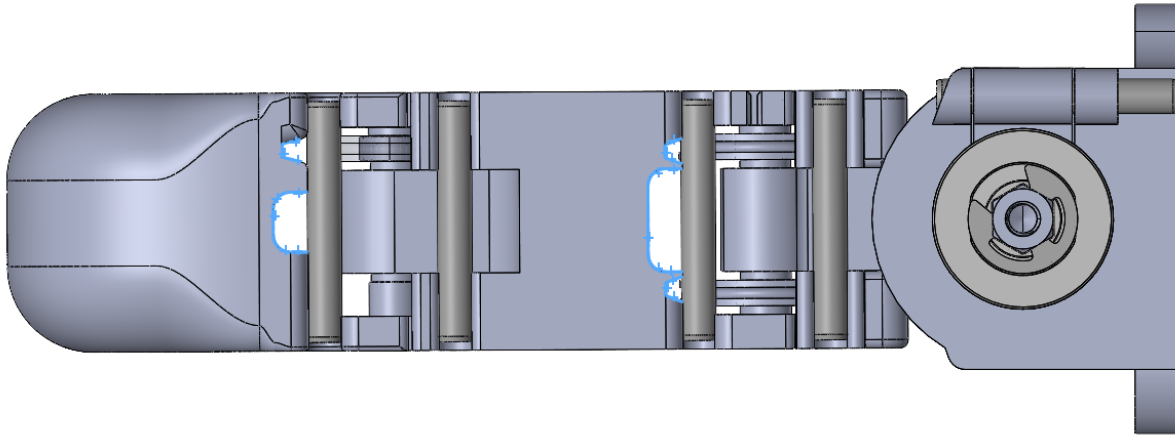


For tendon termination, slipknots were used for their self tightening and also self untying features. For higher load tasks, the boa constrictor knot (double constrictor knot) was used for its self tightening feature and higher load capacity. The termination of these knots on pins made retying and adjusting the knots very convenient.

Additionally, off the shelf tension sensors were used in order to simplify the assembly process and reduce the part count simultaneously.



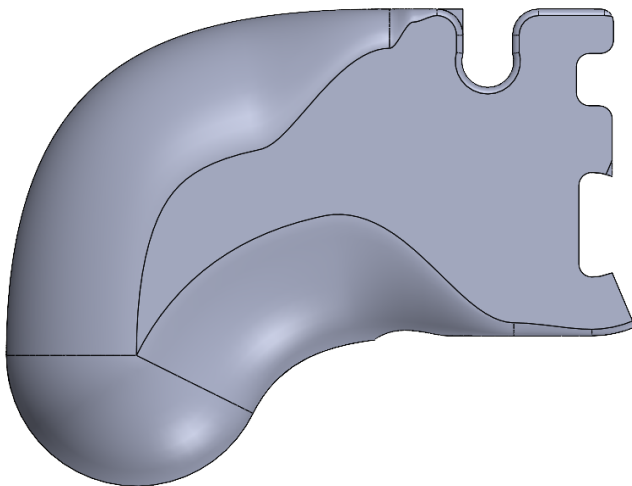
Finally, certain features on the linkages helped autolocate and position the springs and tendons on the finger.



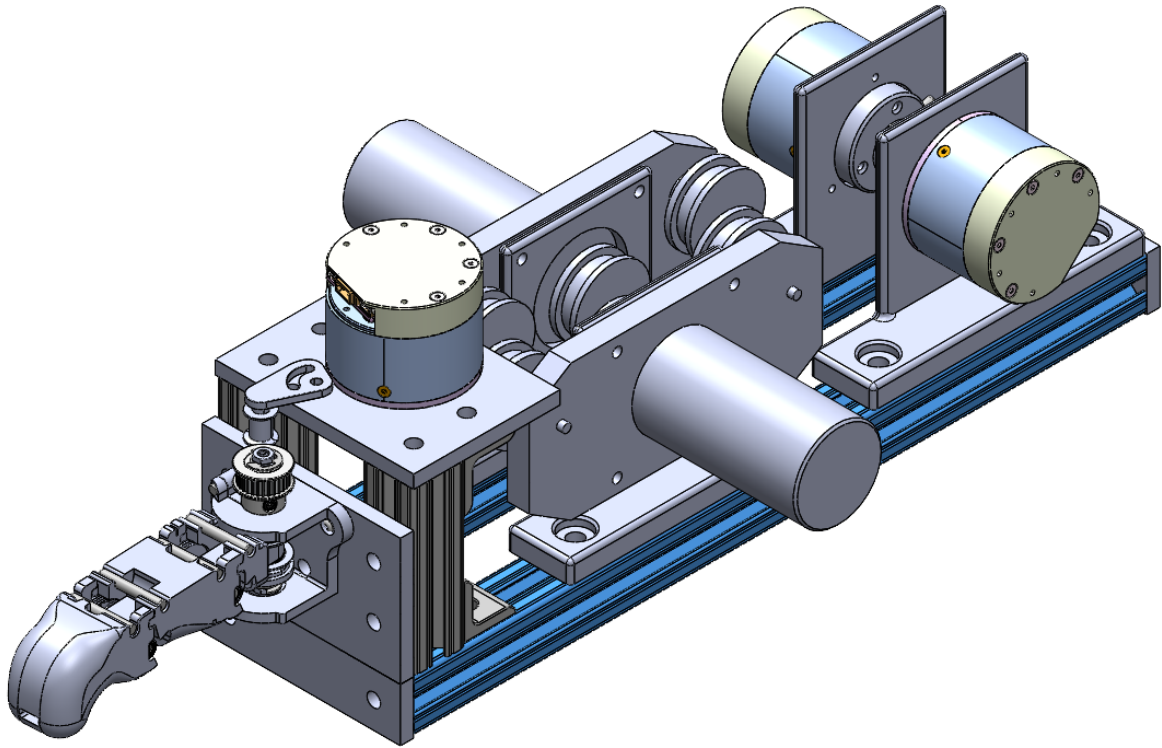
Minimization of Parts/Complexity

By using an N tendon routing scheme and replacing one tendon with a belt, our finger only has two tendons to route through the finger. The minimization of tendon count went a long way for both minimizing complexity as well as improving ease of assembly.

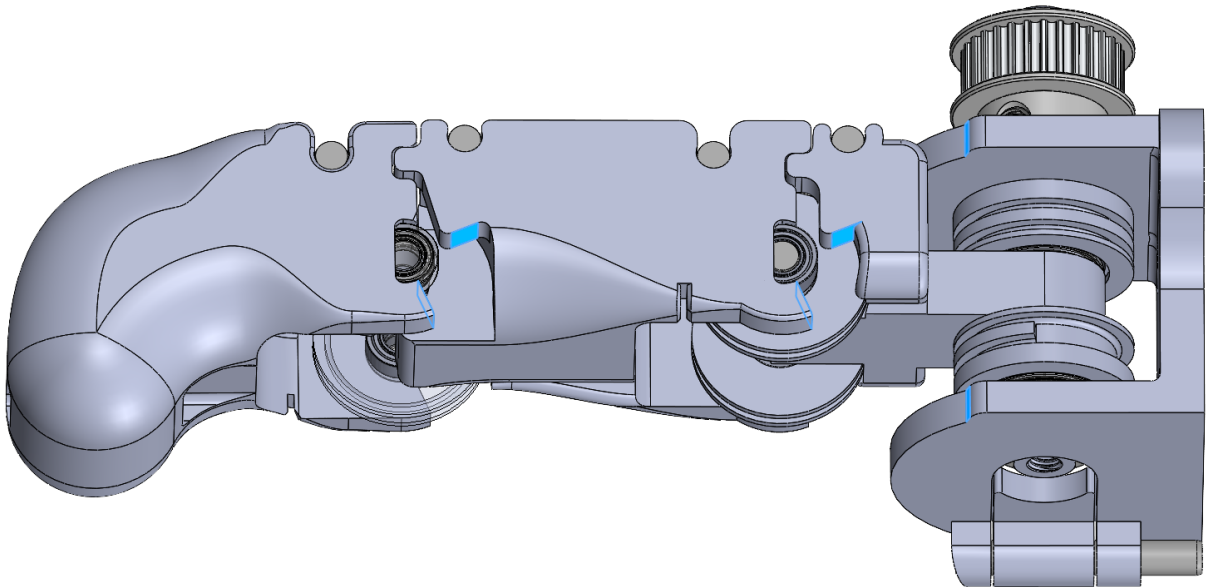
Additionally, due to the 3DOF requirement, the distal and intermediate phalanges could be merged, further reducing the part count and complexity.



Another minimization to complexity and assembly time was basing the entire motor/electrical mounting around two central 80-20 beams. 80-20 has a lot of established hardware and removes a lot of the complexity from mounting.



Joint encoders were forgone to further reduce complexity, instead using mechanical hardstops, motor side encoders, and a calibration sequence to home the finger.



Finally, careful design of the linkages and taking advantage of the pins allowed for the elimination of retaining rings and spacers respectively.

