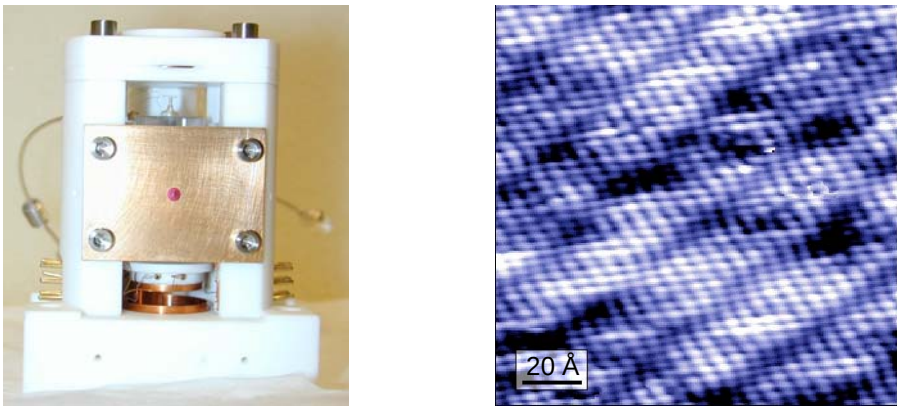
Appendix C

STM Construction

I constructed a new scanning tunneling microscope and low-temperature probe with the intent to study high-T_c superconductors near their critical temperatures, around 90 Kelvin.

Because all of the studies reported in this thesis were done at $T = 4.2$ K, maintaining the ultra-high vacuum necessary for clean surface studies was not a challenge. However, when planning an experiment at higher temperatures, one has to pay more consideration to the cleanliness of the system in order to maintain proper vacuum. Therefore, although I borrowed heavily from the existing 4.2 Kelvin STM plans, I redesigned some components for better vacuum compatibility. Specifically, I redesigned all plastic parts, and all solder joints. I also designed a lower impedance pump path between 300 K and 4.2 K.



(a) (b)

Figure C.1: New STM construction: (a) photograph of the newly assembled STM (b) first atomic resolution topography acquired with the new STM. This topography was taken at $T \sim 4$ K, on the surface of $Bi_2La_xSr_{2-x}CuO_4$.

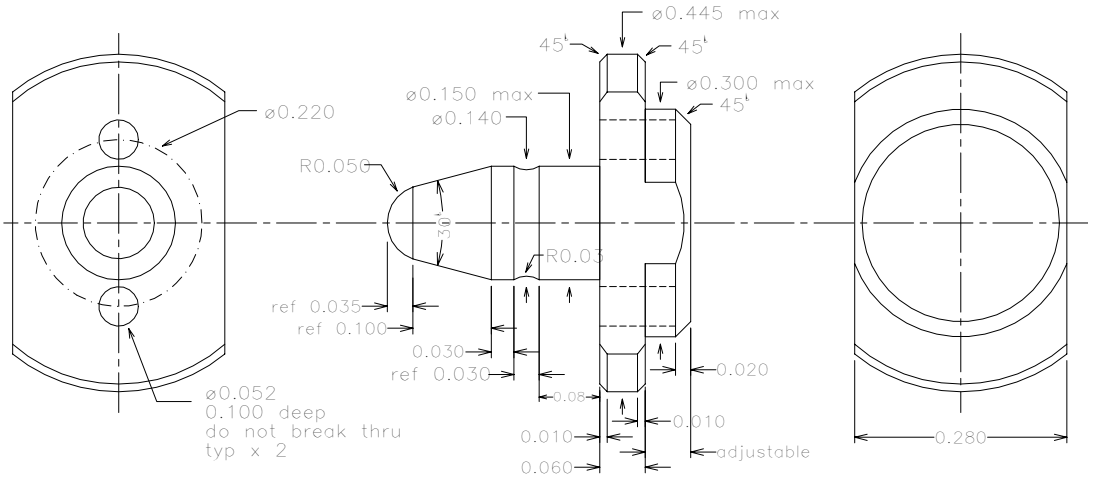


Figure C.2: Copper sample holder stud.

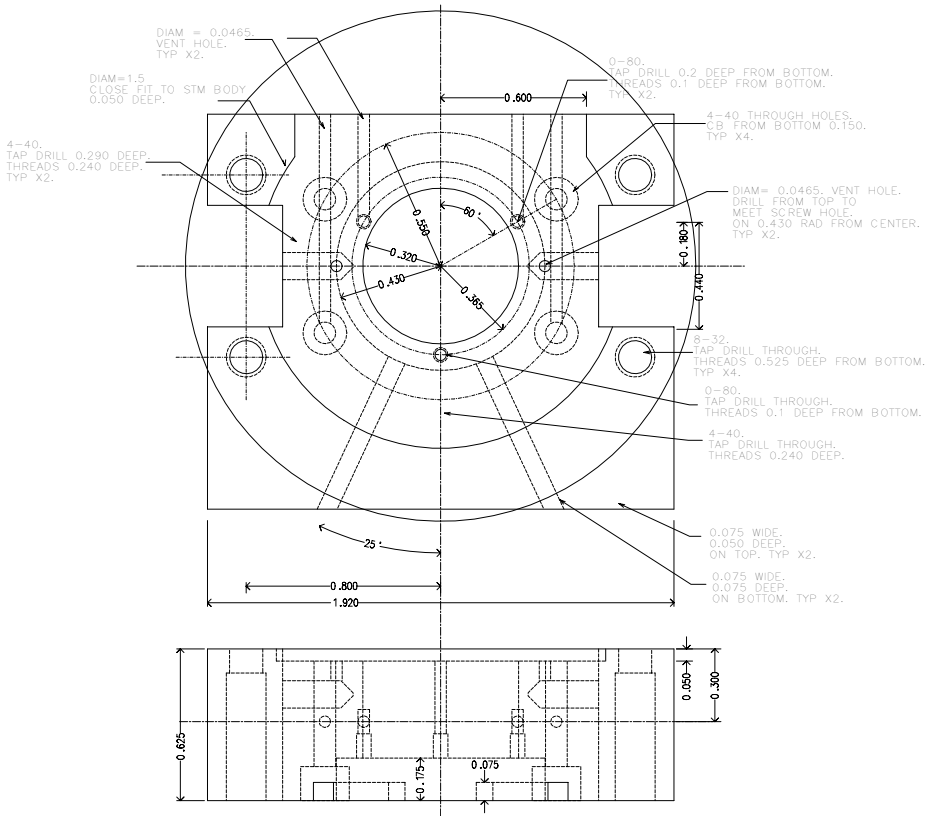


Figure C.3: Macor STM base.

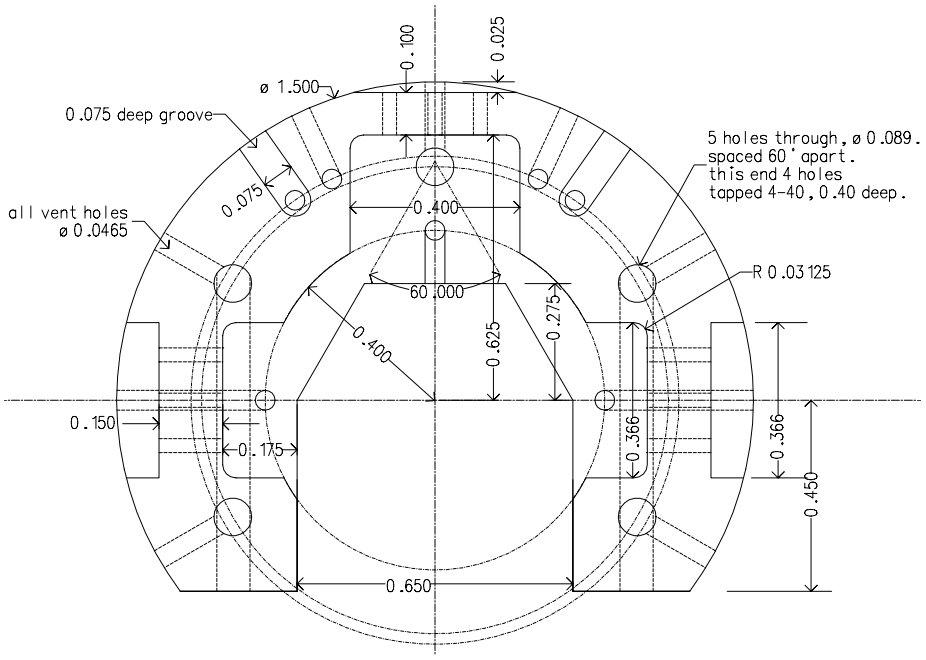


Figure C.4: Macor STM body, bottom.

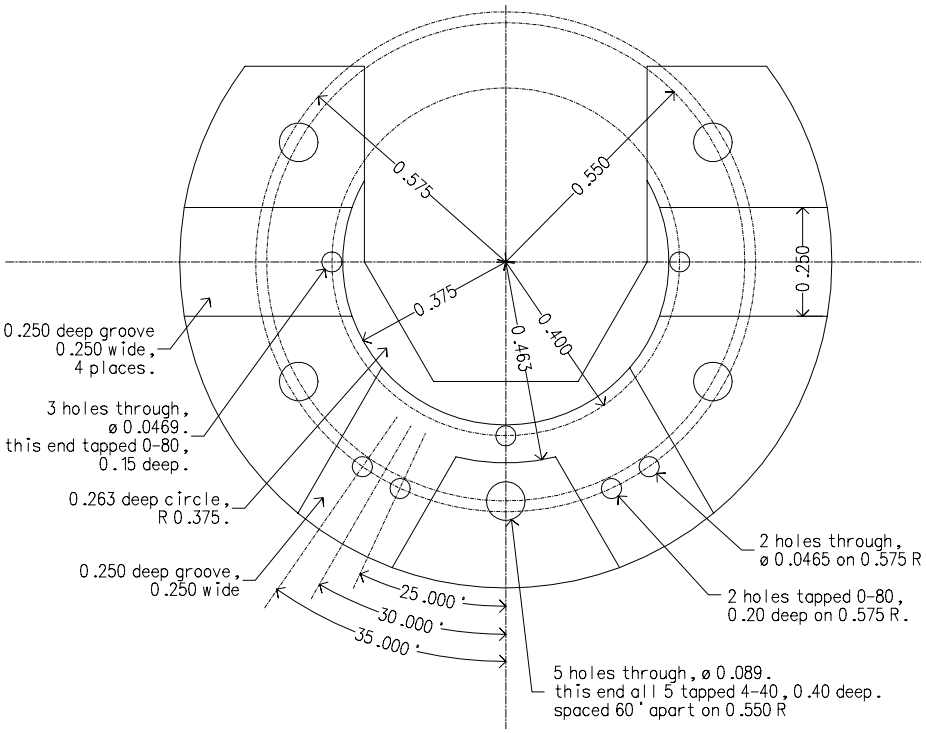


Figure C.5: Macor STM body, top.

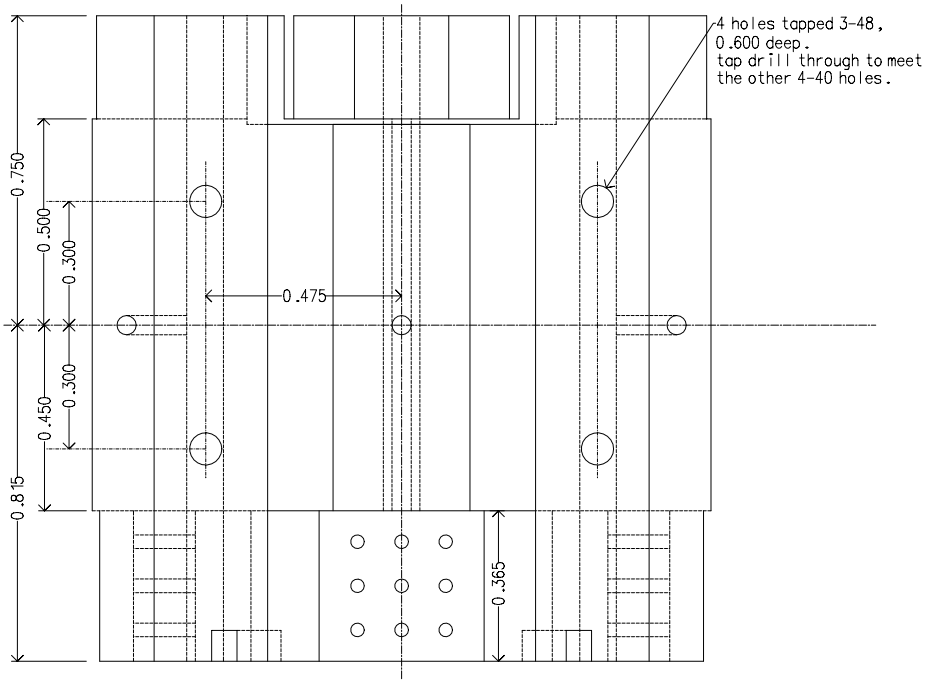


Figure C.6: Macor STM body, front.

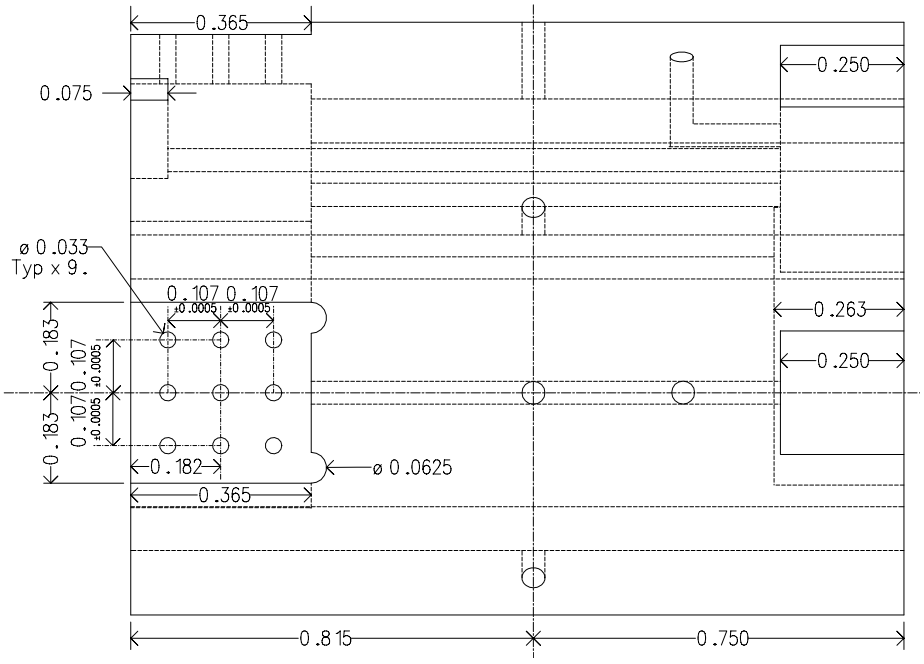


Figure C.7: Macor STM body, right.

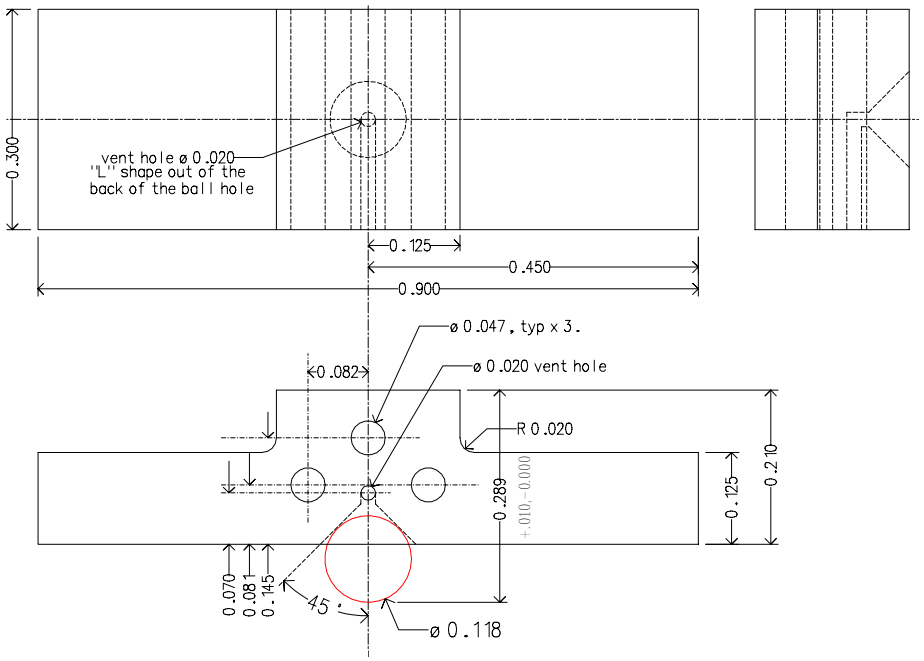


Figure C.8: STM front ball cover.

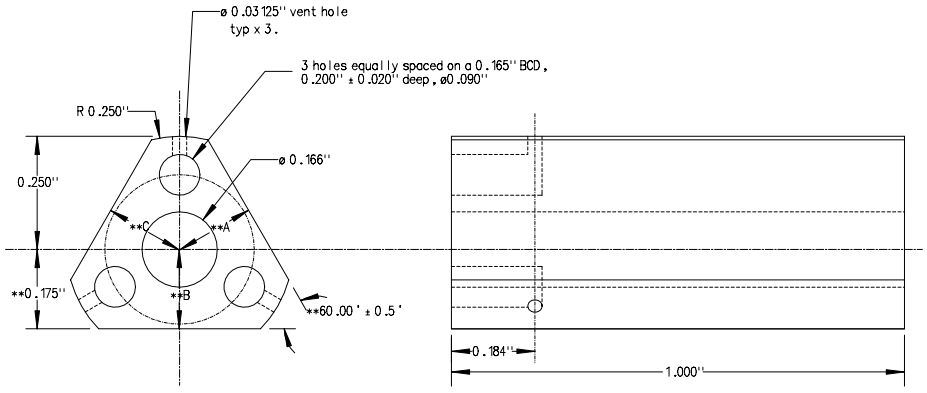


Figure C.9: Sapphire prism.

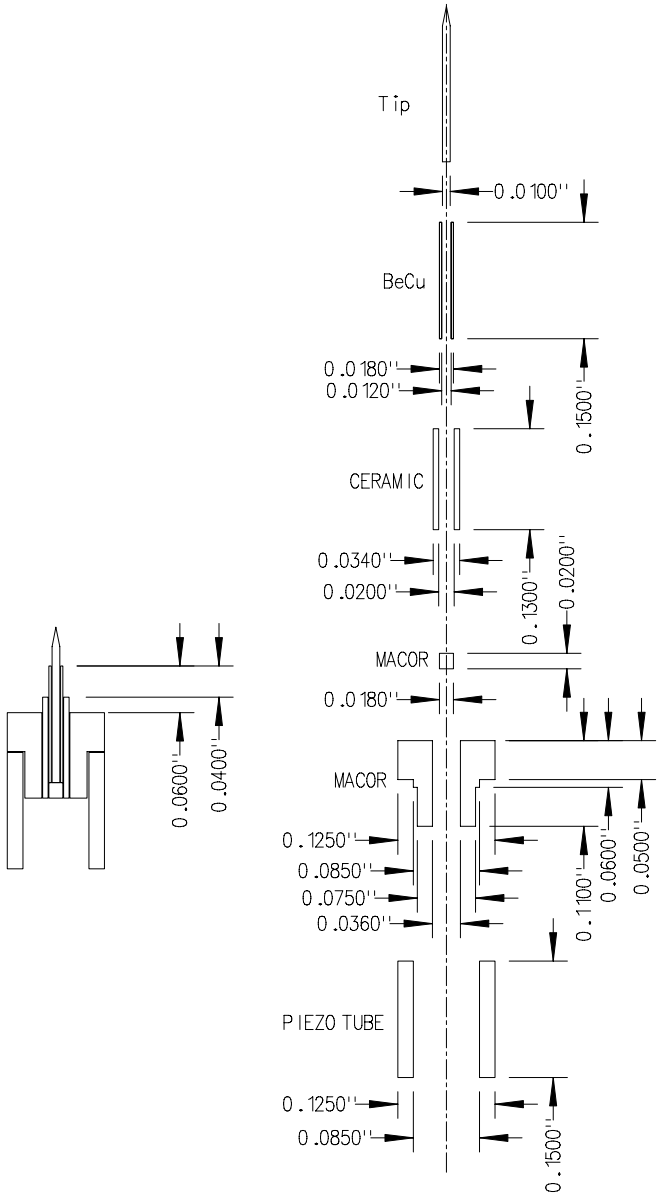


Figure C.10: Tip assembly.

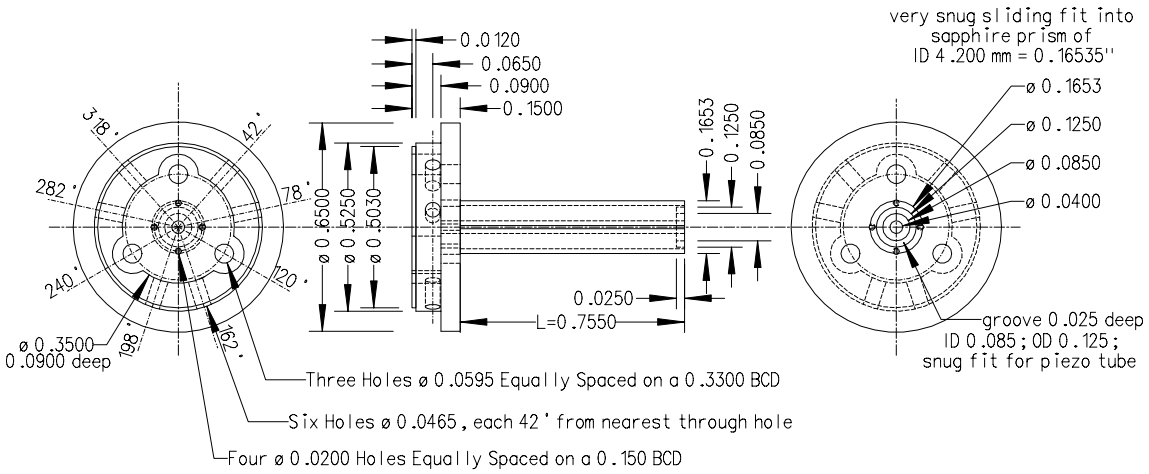


Figure C.11: Macor scanner holder.

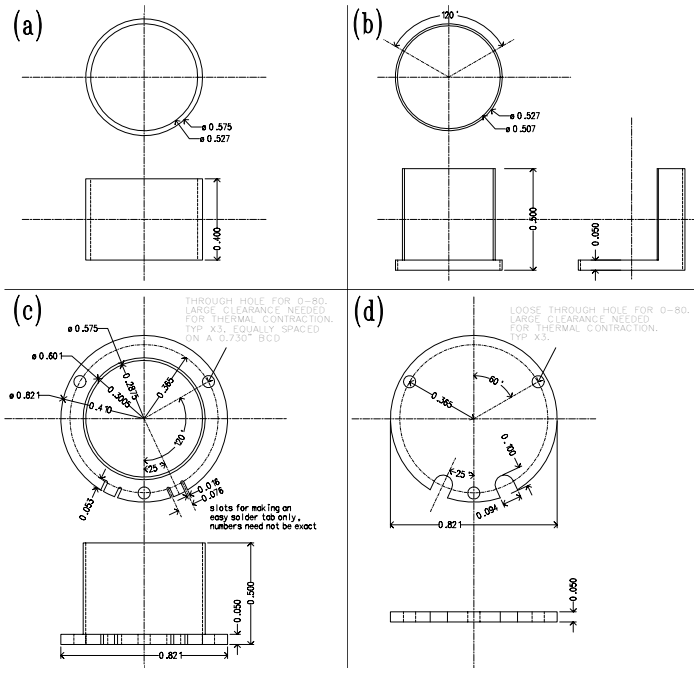


Figure C.12: Capacitive position sensor.