CORC Common Coil Subscale

Heater Integration

January 7, 2021

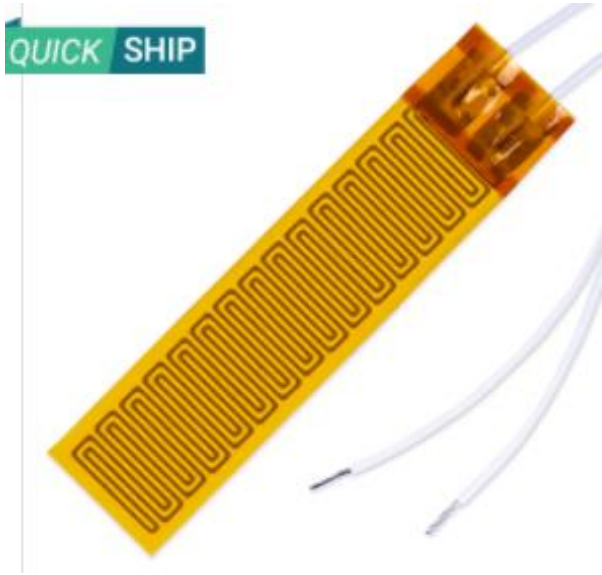
Overview

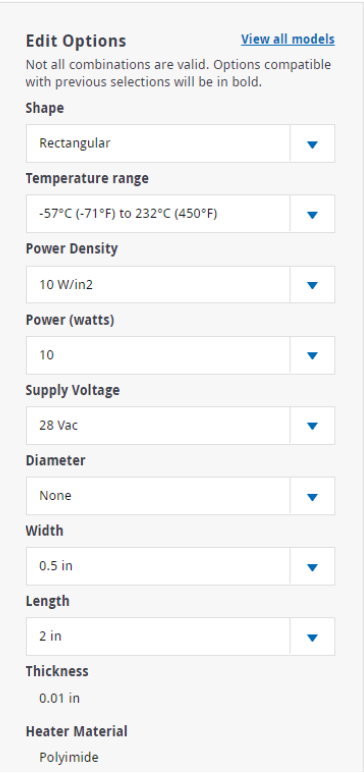
- Want to include heaters in CORC common coil test
  - Need to induce quench / normal zone for diagnostics R&D
- Danko gave helpful advice on heater locations
  - Reduce risk – place on inside plates, away from Lorentz force
- Today's slides: design details on possible heater implementation
  - 1) Heater locations
  - 2) Heater implementation
  - 3) Installation procedure

Recap: Heater option

- Omega Polyimide film heater (~$50)
  - 0.5” width x 2” length
  - 10 W (at 28 V)
  - https://www.omega.com/en-us/industrial-heaters/surface-heaters/flexible-heaters/p/PLM-Series

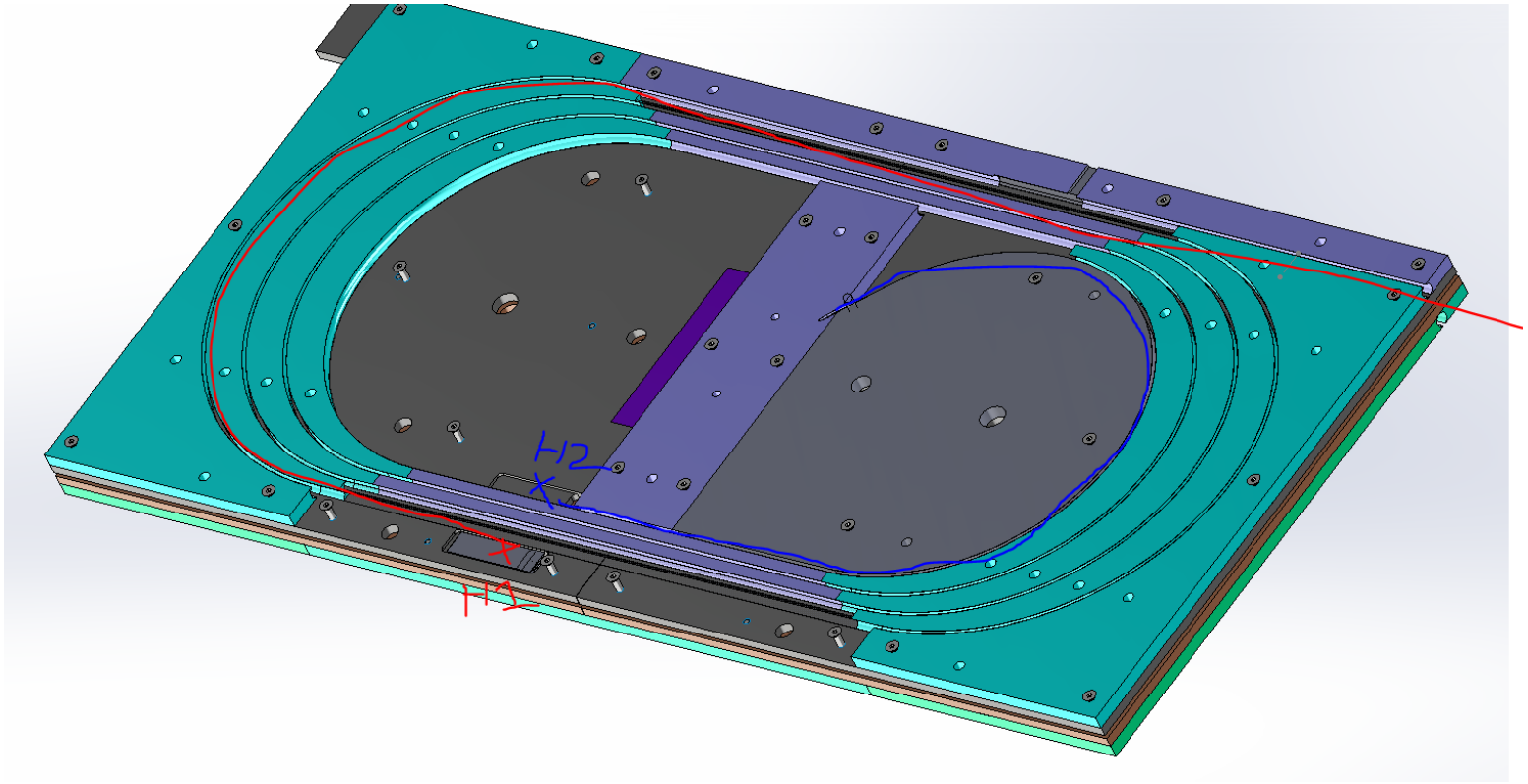
- Heater wire in plate is also a promising option, but film heater is more straightforward to implement





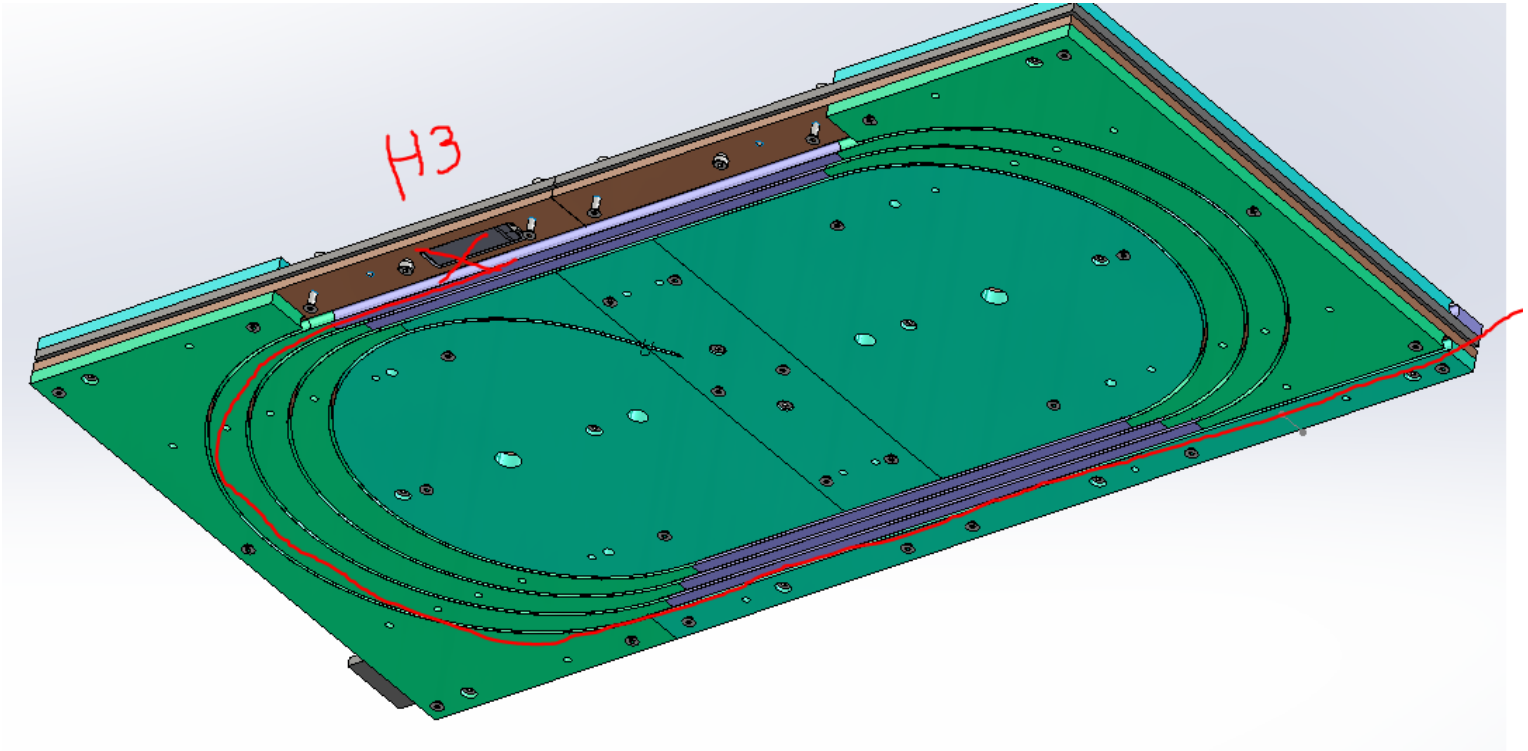
Heater Locations

- Top plate – heaters 1 (H1) and 2 (H2)
  - H1 close to injection (lead), H2 close to middle



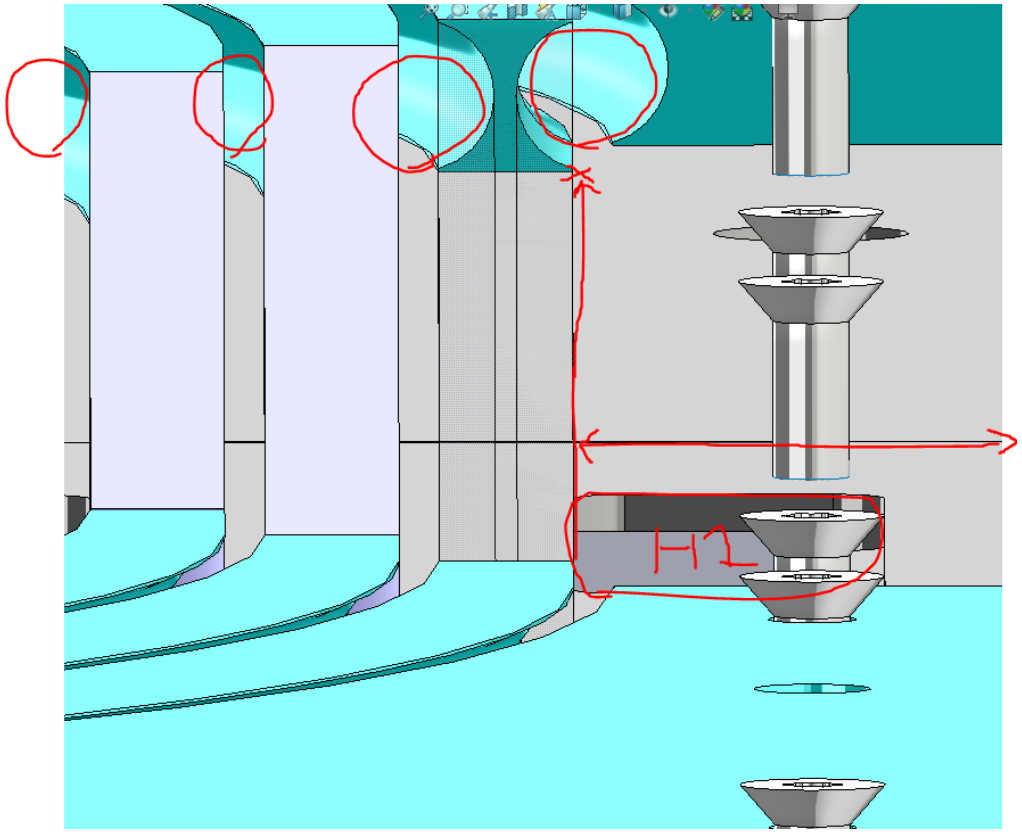
Heater Locations

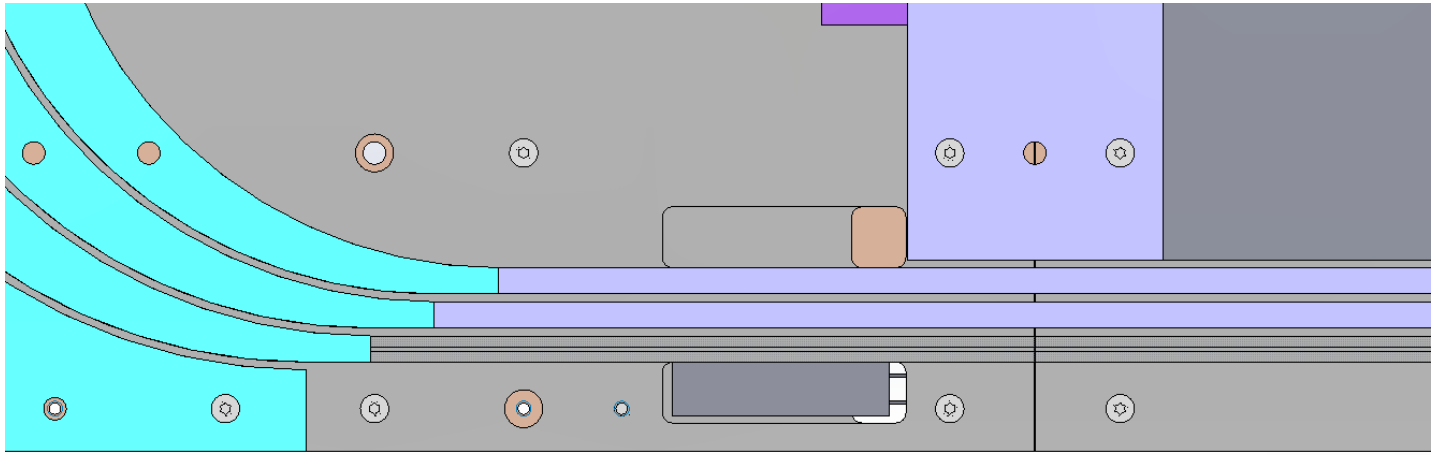
- Bottom plate – heater 3 (H3)
  - H3 close to extraction (lead)
  - It would be best to have 3 heaters, but if needed we could only modify single plate and just use heaters 1 and 2 (no H3)



Heater Locations

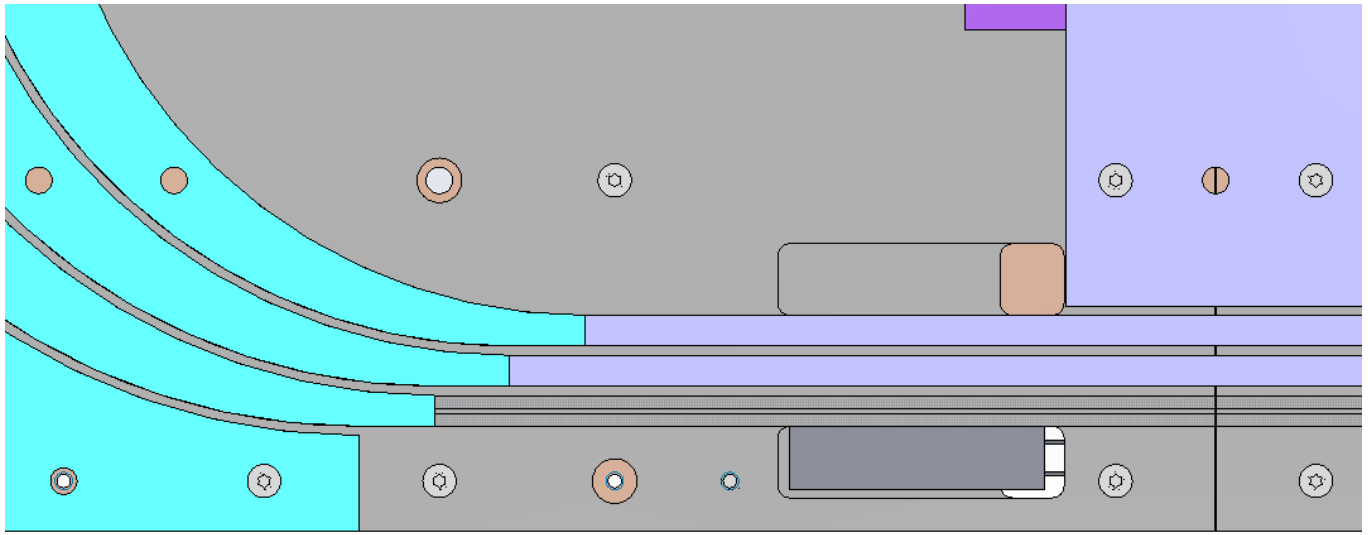
- Heater 1 and 3: aligned to barely overlap with outer-most turn
  - Want to avoid heating all cable sections
  - Open to suggestions

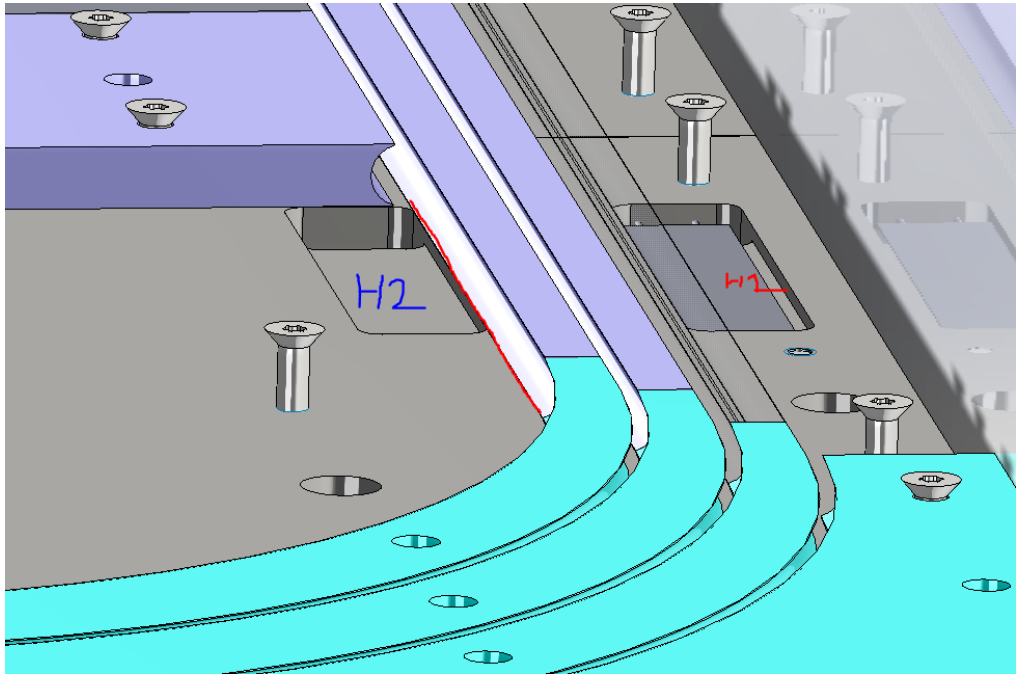




Heater Locations

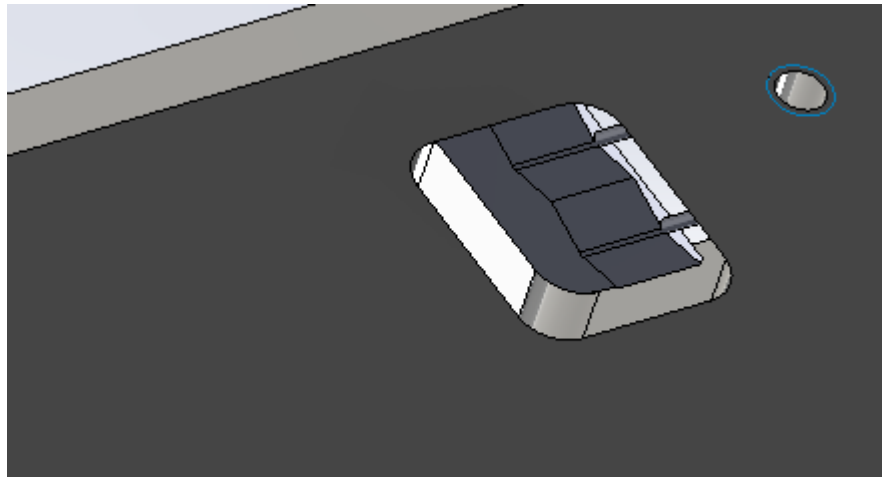
- Heater 2: aligned to barely overlap with inner-most turn
  - Want to avoid heating all cable sections

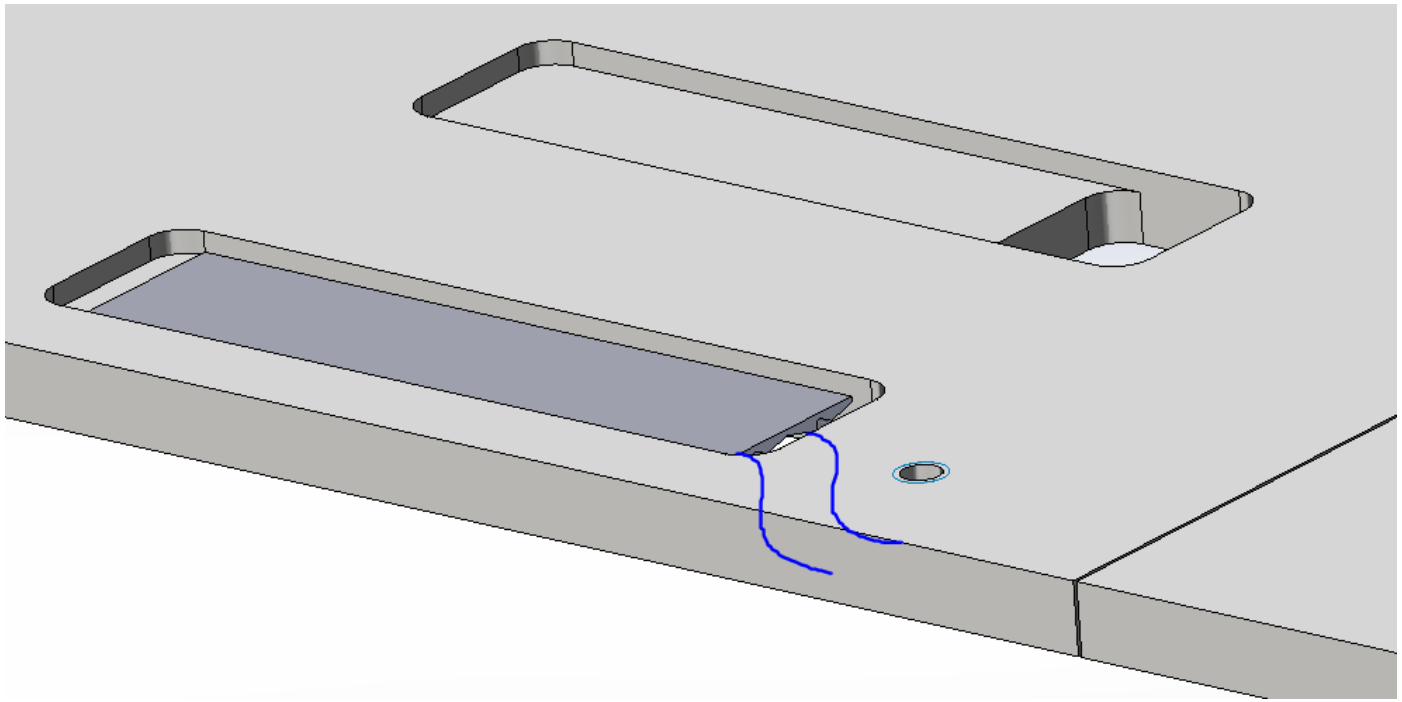




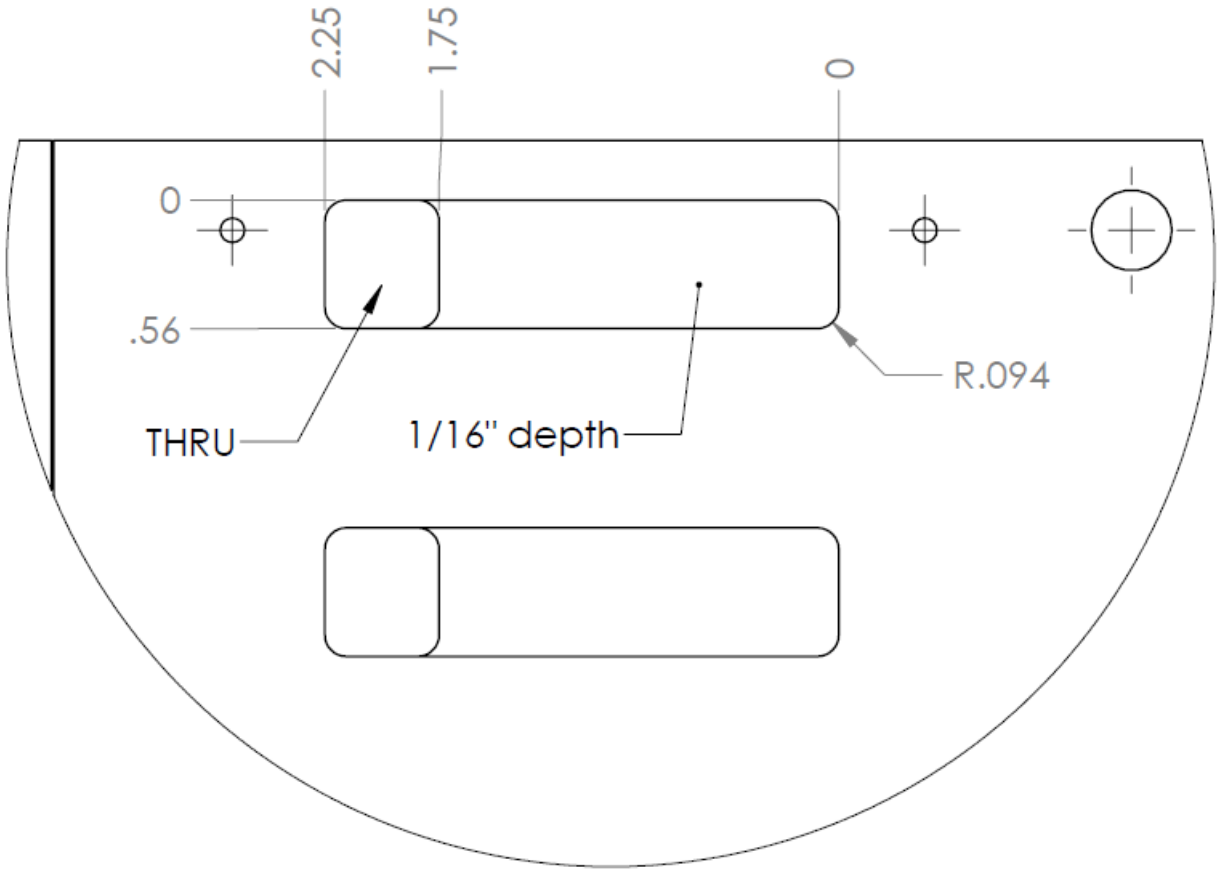
Heater implementation

- Small pocket with loose tolerance around heater
  - 1/16” deep blind pocket, allow room for epoxy (more details to follow)
  - Route wires out of pocket (machined through)



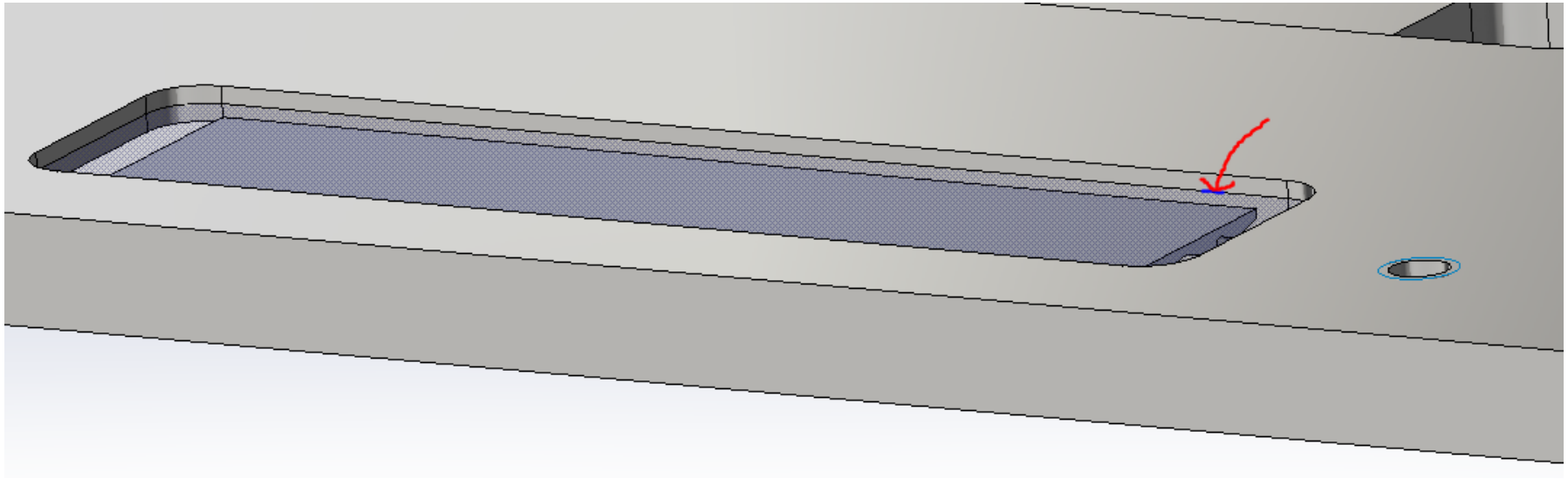


Heater implementation



Heater installation

- (1) Epoxy heater to plate
  - Need to route wires out of bottom & seal with tape to keep epoxy in pocket
  - Under-fill with epoxy and remove any excess – need top smooth!
  - Should probably solder long wires to heater before winding CORC
- (2) After curing, wind CORC on plate, allow excess epoxy to fill any gap



Final thoughts

- Pros:
  - Film heater in baseplate poses minimal intrusion to CORC
    - CORC cable will not be pushing against machined features
  - Simple design, straightforward implementation

- Cons:
  - Poor thermal contact with CORC
    - Much of heater energy will go to helium bath
      - Difficult to e.g. explore quench energy
    - Will somewhat reduce ability to rase CORC temperature
    - Heater may elevate temperature of multiple turns

- Implementation seems like a reasonable path forward
  - Input appreciated!