



# Cooling

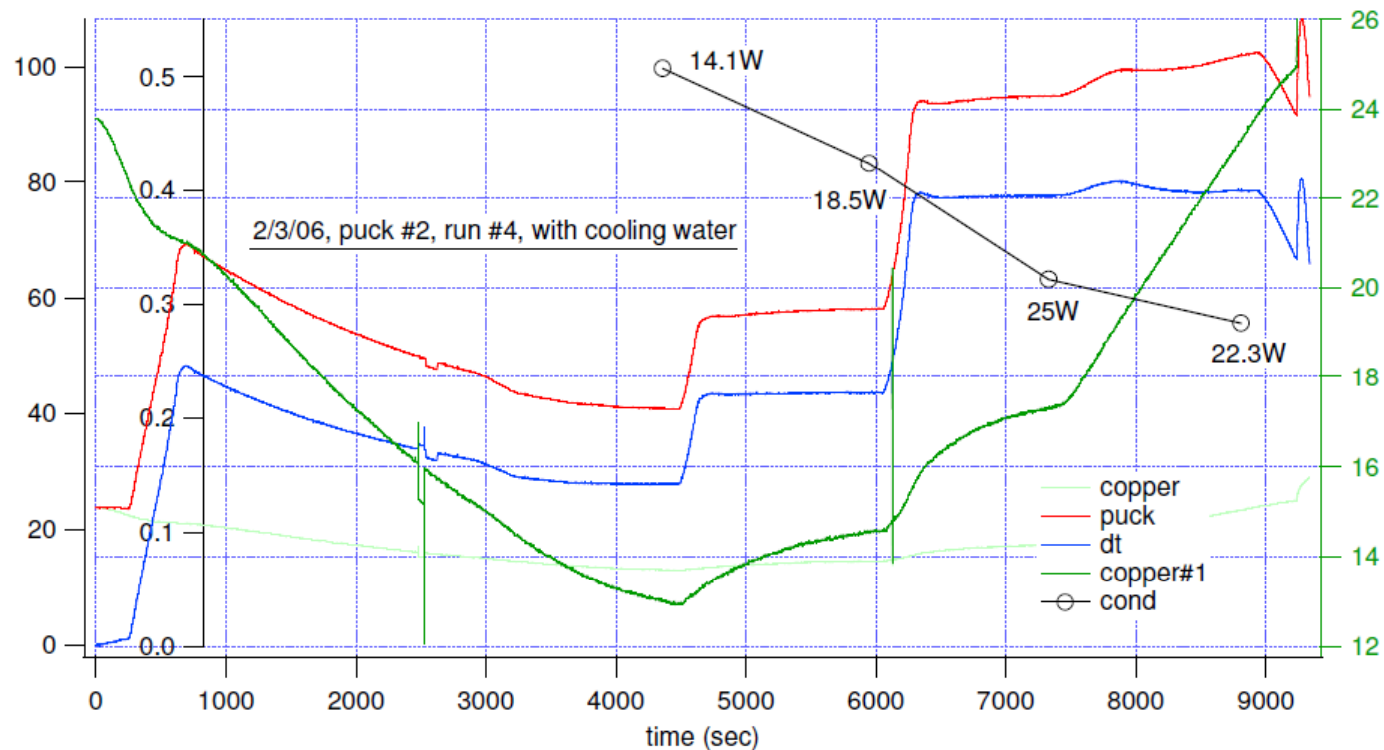




- Perhaps 20 W of laser power incident on cathode surface (and a large fraction absorbed)
- Embedded solenoid may require an additional 20-60W without adverse heating of cathode.
  
- Options:
  - Pass coolant (SF6?) into copper rod
  - Copper rod is replaced by heat pipe
  - Peltier cooling (TEC) of cathode locally, waste heat removed by copper rod (want thermocouples and controls)



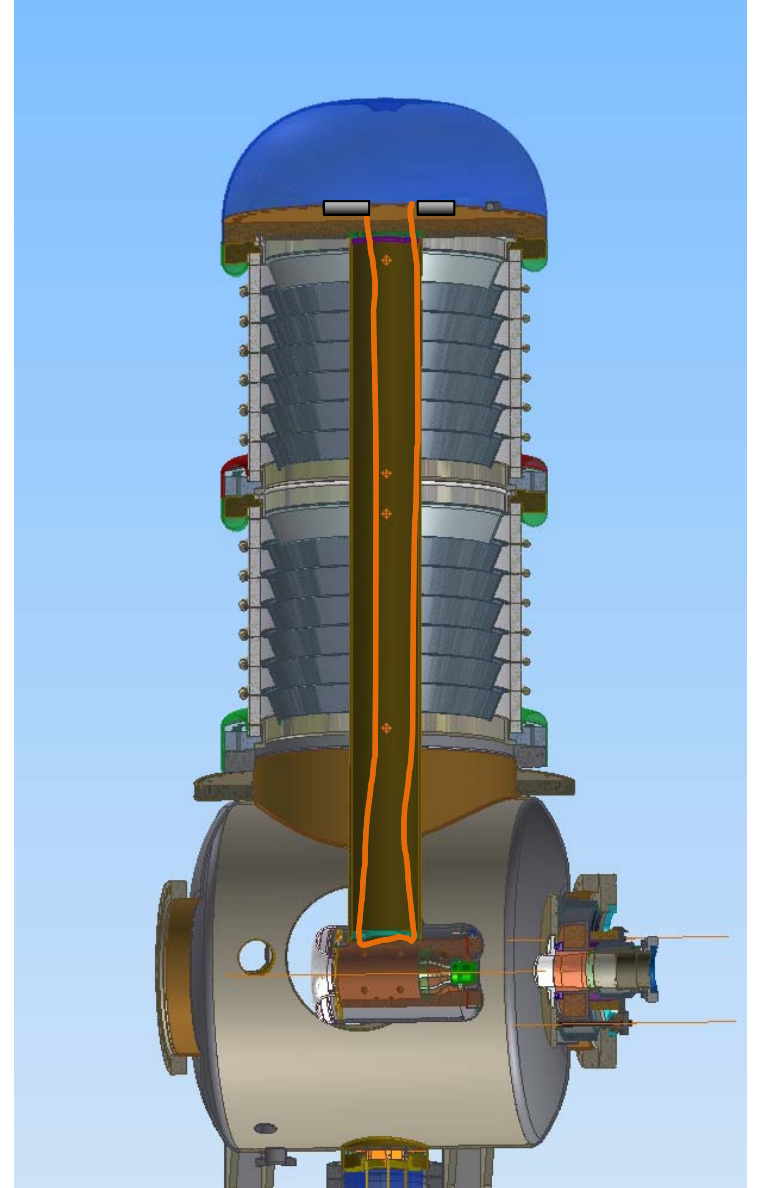
- Measurements of thermal contact resistance between Cathode Puck and Copper Support shows room for improvement





## SF6 “coolant”

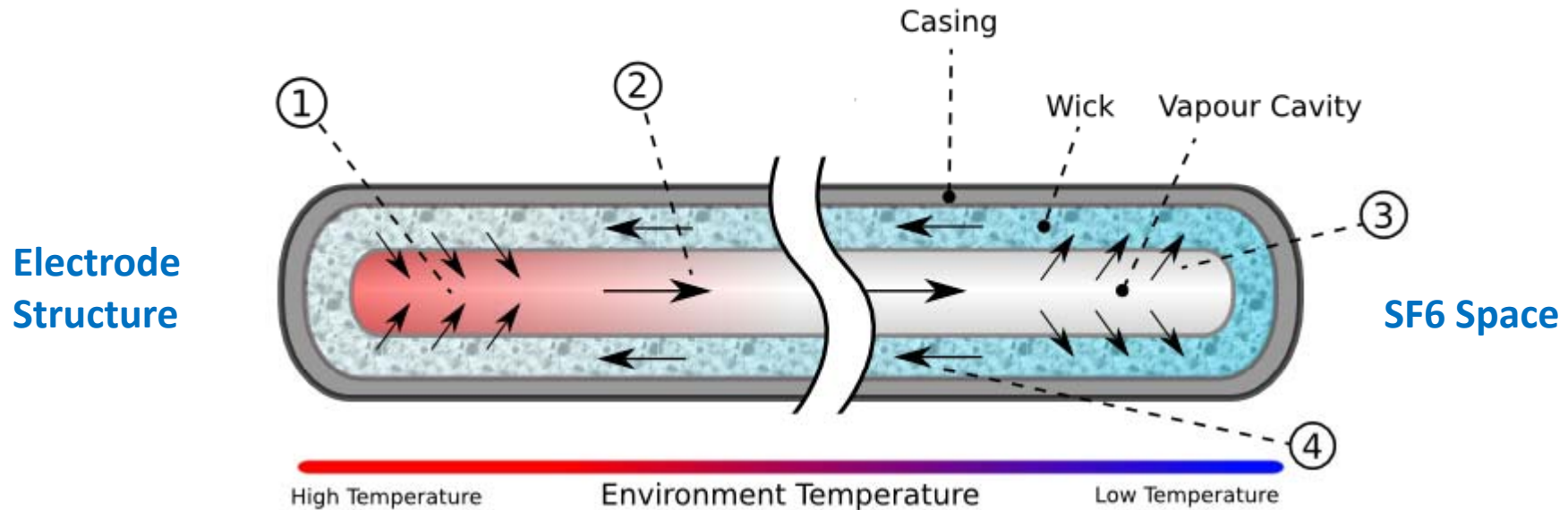
- Open bore of Copper conduction rod to allow SF6 “coolant” deep into vacuum space of gun
- Flange pair on top flange
- Could always refrigerate SF6 to further reduce cathode temperature





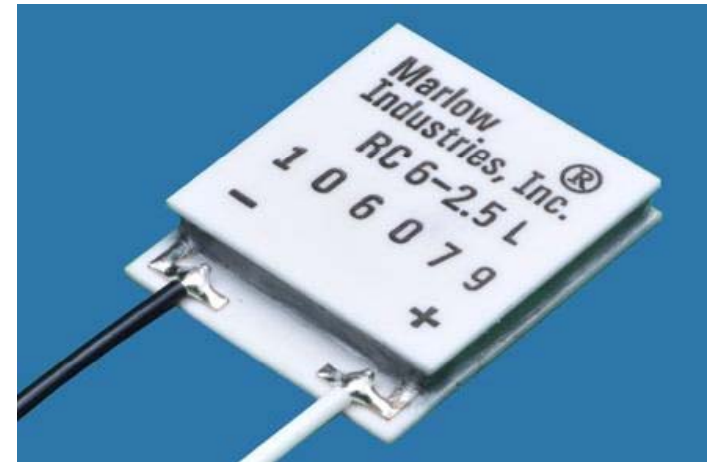
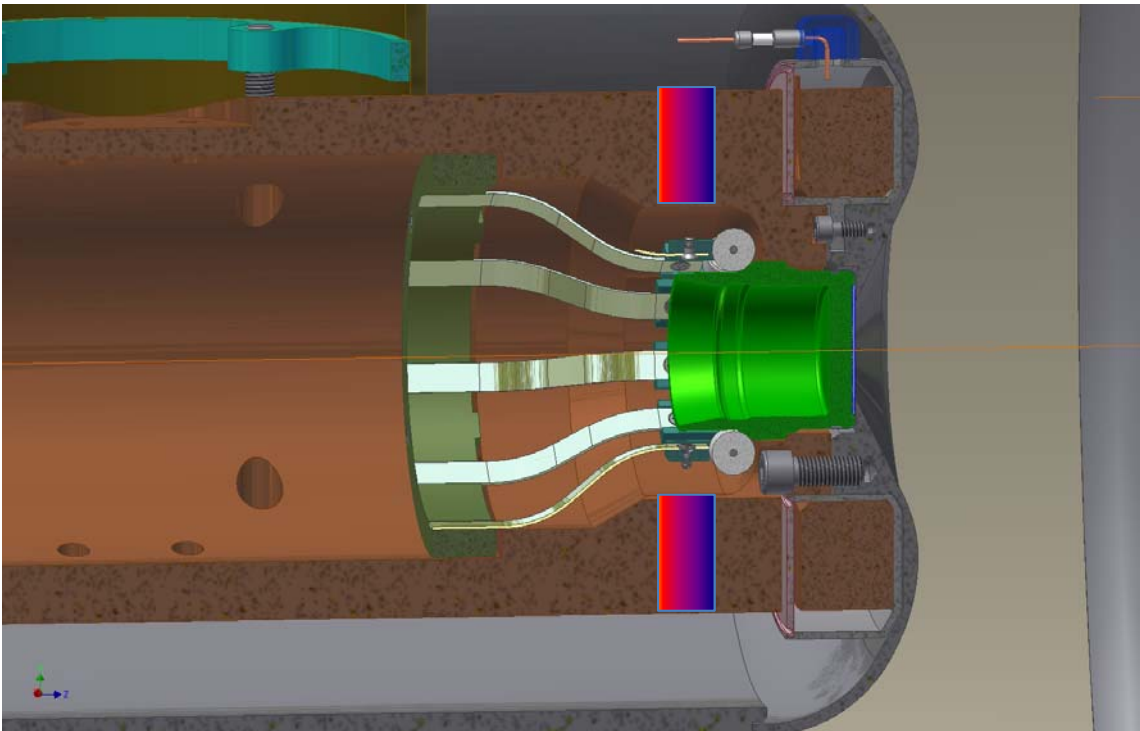
# Heat Pipes

- Replace copper cooling stalk with heat pipe
- Phase change cycle leads to extremely high heat transfer from end to end
- Lots of risks: bakability, hermeticity (into SF6 space)





- Started working with small TEC to control laser fiber temperature
- By breaking the inner copper electrode support and inserting a ring of TEC could reduce / control the cathode temperature
- Power required (with all related problems)
- Heat Sink for waste heat required





- Probably need to develop better scheme for removing 100W
- Does not need to be developed immediately but could be developed and replace static copper conduction rod
- Which directions to follow?