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# Operation and control of superfluid helium in a Healthcare device

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While the search for novel superconductors toward higher current carrying capacities and lower transport losses in different types of superconducting wires continues, so far, there is no record of any "liquid superconductor".
Superfluid helium, however, "conducts"heat without thermal resistance due to its very high thermal conductivity below its Lambda transition point.
For superconducting magnets, different cooling schemes are employed using superfluid helium. These systems usually relate to internal or forced convection modes capable of transferring high heat loads. The inherent hydraulic quantum properties of He-II, like viscosity and density e.g., are therefore used in pumps (so-called fountain effect pumps (FEPs)), as described by the London equation, and enable the generation of a self-sustaining forced flow when using filters, optimized to work as "Superleaks". Those pumps have successfully been integrated in large superconducting applications e.g., like fusion magnets, accelerators, or dedicated gyroscopes. All these applications primarily depend on the peculiar flow characteristics of the superfluid helium component.
As of today, there is no technical application that solely relies on the high thermal conductivity of the superfluid helium film as a heat transfer medium through copper/steel interfaces at temperatures below 1 K.
To fully utilize that specific physical quantum property however, the interposing superconducting film needs to be well controlled in static, as well as transient cryogenic operating conditions.
In this paper we present cryogenic engineering insights of trials and tribulations faced, when implementing, containing, and operating those thin superfluid helium films in a clinical environment for a medical Healthcare platform, that takes full advantage of this unique thermal conductivity and sound properties, that superfluid helium provides.

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