

Design of a magnetic refrigeration for future particle accelerators

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PhD may follow: No

Summary :

High-field superconducting RF cavities of the FCC project may require superfluid helium refrigeration down to 1.6 K. Magnetic refrigeration working below 4.2 K can be an alternative to standard compression/expansion helium refrigeration. This technique of magnetic refrigeration also called adiabatic demagnetization is currently used in our Low Temperature Laboratory (SBT) for space activities to reach temperatures lower than 1 K at low heat load (a few mW) for space detector cooling. SBT is now developing magnetic refrigeration around 1.5 K and has designed a laboratory small-scale prototype (W-range). A better understanding of internal heat losses and transfers and their influences on magnetic refrigeration performances is now required to improve the present design.

The proposed internship will have two objectives. First, the trainee will perform experimental tests to quantify and to improve the internal heat losses (magnet with variable field) and transfers (boiling, condensation, insulation) in a dedicated test cell simulating the magnetic refrigeration cycle (see picture). Second, the intern will have to improve the design of the small-scale prototype integrating optimized magnet and heat transfer solutions.

Requested skills :

Basic knowledge in thermal, mechanics and magnetism