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Cryogenic Pulsating Heat Pipes

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Pulsating Heat Pipes (PHP) are two-phase heat transfer devices consisting of a long capillary tube bent into many U-turns connecting the cold source to the hot source. They are thermally driven by an oscillatory flow of liquid slugs and vapor plugs. Due to their lightness, simple configuration and thermal performance, PHP are excellent candidates to be used as thermal links between superconducting magnets (the hot source) and cryocoolers (the cold source), maintaining an appropriate distance between both sources to keep the cryocooler out of the influence of the magnetic field.

Three 1 m long cryogenic PHP with 36, 24 and 12 parallel tubes have been tested in horizontal position (the closest configuration to non-gravity). So far, two different working fluids have been tested: N2 (operating at temperatures between 75 and 90 K) and Ne (operating between 27 and 32 K). The PHP with 36 parallel tubes was able to transfer a heat load between 5 and 55 W achieving equivalent thermal conductivities of 85 kW/m.K for N2 and 70 kW/m.K for Ne.

A simulation model with ANSYS Fluent is being developed to compare experimental and numerical results in order to determine and understand the operating limits of the system for a future implementation of the device in a superconducting magnet.

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