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Experimental simulation of helium pressure rise during a quench of a superconducting coil cooled by a superfluid helium bath

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Experimental and numerical studies have been conducted with the aim of modeling pressure rises which occur in the helium, during quenches of the 11.7-T superconducting magnet named Iseult. Iseult is based on double pancake winding internally cooled by superfluid channels opening into a pressurized He II bath at 1.8 K. A scale mock-up has been built of 10 copper equivalent pancake slices and 7 helium channels per pancake. The heat produced by a quench of the Iseult magnet is simulated by electrical heaters put inside each copper plate. Cryogenic pressure and temperature sensors have been fitted in the helium channels and in the bath. Bath pressure measurements are given for various heating powers, various numbers of heated plates and various bath volumes. Different simple numerical models are proposed to simulate the pressure increases in helium. Comparisons with experimental measurements permit to identify the best model and the main physical mechanisms which drive the pressure rise during a quench.

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