Quench Location in Cavities

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The proposed International Linear Collider (ILC) will provide physicists with a new window into the exploration of energy regimes beyond the reach of current state-of-the-art accelerators. A proposed electron-positron collider, the ILC will complement the Large Hadron Collider, a proton-proton collider at the European Center for Nuclear Research (CERN) in Geneva, Switzerland. Together these accelerators would be posed to uncover some of the deepest mysteries in the universe. The ILC will consist of two opposed linear accelerators that will collide electrons and positrons (the electrons anti-particle) at approximately the speed of light. To do this the ILC accelerators require 16,000 superconducting-niobium cavities, operating at temperatures near absolute zero, with surface electromagnetic fields rarely achieved in the lab today. You will help with this effort by participating in the development of a defect location system for the required 16,000 superconducting cavities that will aid in the rapid acceptance testing/repair of these cavities.

By testing a superconducting cavity in a superfluid helium bath it is possible to observe second-sound temperature waves driven by the conversion of stored electromagnetic energy into thermal energy at a defect. By measuring the time-of-arrival of the second sound wave at three or more detectors the defect location can be determined. You will be designing a tool for the accurate placement of the second sound wave detectors. Here, we use Cornell oscillating superleak transducers, which measure the fluctuating counterflow of superfluid and normal fluid in the helium bath to detect the time-of-arrival of second sound waves. You will be exposed to many aspects of experimental physics: superfluid Helium, thermodynamics, hardware design, hardware fabrication, low-noise electronics, RF superconducting cavities, cryogenics, high-vacuum systems, data acquisition, and data analysis.