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# Measurement Platform for Assessment of Semiconductor-Superconductor Hybrid Systems

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## ABSTRACT

A major obstacle in the advancement of quantum computers is the susceptibility of quantum bits (qubits) to decoherence. Decoherence occurs when a system of qubits encounters local noise like gamma radiation and heat due to incomplete isolation from its surroundings. The noise causes the qubits to change their states, thereby losing information. A new type of quantum computer, called a topological quantum computer, will be built with qubits that use inherent properties to protect against decoherence. Excitations in two-dimensional electron systems can act as this type of qubit. Realizing such a system requires confining electrons to two-dimensional planes inside structures of semiconductor and superconductor layers. A variety of low temperature measurements can be taken in order to evaluate the quality and characteristics of structure samples. These measurements can take many hours at the temperatures necessary to evaluate the sample's properties. To streamline this process, a cryogenic measurement platform was designed that will allow for rapid assessment of new structures before they are measured at lower temperatures. A probe and a 32-pin sample mount were designed and constructed for the system. A 48 switch BNC panel was machined and wired, and magnet cables were made to charge the 5 Tesla magnet inside the cryostat. A 40-pin sample mount will also be constructed, and the system will be cooled to 4K to take measurements. This cryostat is expected to speed up the sample assessment process greatly.

## KEYWORDS

Condensed matter physics, quantum computing, semiconductor physics, heterostructures, cryogenics