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An Experimental Design for Testing STJs in Dilution Refrigerators for BeEST

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Dilution refrigerators, in contrast to the single-shot adiabatic demagnetization refrigerators previously utilized in the BeEST experiment, provide continuous cooling power, resulting in a nearly indefinite experimental runtime and a colder, more thermally stable base temperature—properties beneficial for STJ operation. Here, I discuss a bespoke experimental design for testing STJs in dilution refrigerators at both PNNL and Mines, and outline the steps taken toward validating this design and its associated components, including detailed calculations of the thermal load at each cooling stage and the derivation of a generalized equation for thick Helmholtz-like configurations.

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