Reducing current noise in cryogenic experiment by cable study

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Increasing use of pulse tube cryocoolers, which create vibration induced current noise [1, 2], has made the study and minimization of vibrations and their coupling to the measurement lines important. Vibration induced noise can couple to the system through microphonic effect or by tribo- or piezoelectric effect. This noise can become significant for example in sensitive quantum nanoampere scale measurements and can in some cases even cause decoherence in quantum systems.

We study the effect of noise in a few different cryogenic cables in two different frequency ranges: (i) milliherz range and a (ii) few herz range. The first range is important for quantum metrology, where long averaging times are needed. The latter is used in characterization of quantum devices when measuring small dc electric currents. We show that vibration-induced noise can be efficiently suppressed by using vacuum-insulated cables between room temperature and the 2nd pulse tube stage. [3]

[1] T. Tomaru et al., Cryogenics **44**, 309 (2004).
[2] Riabzev et al, Cryogenics **49**, 1 (2009).
[3] E. Mykkänen et al. Review of Scientific Instruments **87**, 105111 (2016).