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Low-field SQUID MRI: To tune or not to tune? MICHAEL HATRIDGE, WHITTIER MYERS, MICHAEL MÖßLE, NATHAN KELSO, JOHN CLARKE, UC Berkeley / LBNL, BEN INGLIS, UC Berkeley, ANDREAS TRABESINGER, 110 Stapleton Hall Rd., London N4, UK — Our magnetic resonance imaging (MRI) system detects protons precessing at 5.6 kHz in a 132-μT field using a superconducting quantum interference device (SQUID) coupled to an untuned superconducting second-order gradiometer with 65-mm diameter coils. The magnetic flux noise of the SQUID corresponds to a magnetic field noise of 0.4 fT $\mathrm{Hz}^{-1/2}$. We consider whether the use of a tuned input circuit could reduce the noise. The high intrinsic quality factor of the superconducting circuit must be damped to obtain the bandwidth required for MRI. The simplest approach is to insert a resistor in series with the gradiometer. However, the associated Nyquist noise causes this configuration to underperform the untuned version at frequencies below 100 kHz. In a more sophisticated approach Seton and coworkers damped the input circuit by coupling the SQUID output to the pickup coil. In principle, such feedback damping enables the tuned detector to achieve a field noise of 0.05 fT $\mathrm{Hz}^{-1/2}$ at 5.6 kHz. The relative merits of these approaches over a wide frequency range are discussed. Work supported by USDOE.

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