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Performance of Digital SQUID with Sub-Flux Quantum Feedback Resolution fabricated using 10 kA/cm² Nb process

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The digital SQUID with Single Flux Quantum (SFQ) feedback operates as a delta-type oversampling A/D converter. Magnetic flux resolution at Nyquist frequency can be improved by taking sub SFQ feedback resolution and large oversampling ratio. Using high critical current density Nb process for fabricating SFQ circuits, we expect more higher operation speed of 13 GHz for the digital SQUID and resulting to higher magnetic flux resolutions. In this study, we report on the expected performance of the digital SQUID magnetometer fabricated using 10 kA/cm² Nb process based on CAD layout, with an up/down counter using T²FF cells and parallel SFQ feedback. For the clock frequency of 13 GHz and the Nyquist frequency of 0.793 MHz, the magnetic field noise is lower than 1.5 fT/Hz^{1/2} and the slew rate is exceeded 0.5 T/s. The most promising application of the digital SQUID will be the SQUID transient Electromagnetics (TEM) and these values satisfied the requirements.

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Keywords: digital SQUID, Single flux quantum circuit, high-Jc Nb process, sub-SFQ feedback