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## Next-generation microwave SQUID multiplexer for metallic magnetic calorimeters

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Today microwave SQUID multiplexing appears to be the most suitable cryogenic multiplexing technique for reading out large-scale detector arrays based on metallic magnetic calorimeters. Here, each detector is read out by a non-hysteretic, unshunted rf-SQUID that is inductively coupled to a superconducting microwave resonator with unique resonance frequency. Due to the magnetic flux dependence of the effective SQUID inductance as well as the mutual interaction between the SQUID and the associated microwave resonator, the detector signal is transduced into a resonance frequency shift of the related microwave resonator which can be measured by standard homodyne or heterodyne detection techniques.

In this contribution, we report on our progress in developing a microwave SQUID multiplexer with 400 channels that is optimized for reading out metallic magnetic calorimeters and that provides a bandwidth of 1 MHz for each detector channel. It covers the frequency range from 4 GHz to 8 GHz which is set by the cryogenic low-noise HEMT amplifier that is used for boosting the multiplexer output signal. Compared to our previous multiplexer version, our latest generation is based on a different type of superconducting microwave resonators which allows for a significantly higher packing density. Moreover, the rf-SQUID is optimized with respect to the magnetic coupling between the SQUID and its input coil to overall enhance the energy resolution of the multiplexer as well as with respect to parasitic couplings, e.g. between the input and the modulation coil used for flux ramp modulation. Furthermore, we discuss the readout power dependence of the shape of the resonance curves, the peak-to-peak frequency shift as well as the overall noise performance of a microwave SQUID multiplexer. Finally, we present an advanced multiplexer model that is able to predict the observed power dependence.

### Less than 5 years of experience since completion of Ph.D

Y

### Student (Ph.D., M.Sc. or B.Sc.)

N

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