Demonstration of time domain multiplexed readout for magnetically coupled calorimeters

Magnetically coupled calorimeters (MCC) have extremely high potential for x-ray applications due to the inherent high energy resolution capability and being non-dissipative. Although very high energy-resolution has been demonstrated, until now there has been no demonstration of multiplexed read-out.
We report on the first realization of a time domain multiplexed (TDM) read-out. While this has many similarities with TDM of transition-edge-sensors (TES), for MCCs the energy resolution is limited by the SQUID read-out noise and requires the well established scheme to be altered in order to minimize degradation due to noise aliasing effects.
In our approach, each pixel is read out by a single first stage SQUID (SQ1) that is operated in open loop. The outputs of the SQ1s are low-pass filtered with an array of low cross-talk inductors, then fed into a single-stage SQUID TD multiplexer. The multiplexer is addressed from room temperature and read out through a single amplifier channel.
We present results achieved with a new detector platform. Noise performance is presented and compared to expectations. We have demonstrated multiplexed X-ray spectroscopy at 5.9keV with $\Delta_{FWHM} \approx 10$eV.
In an optimized setup, we show it is possible to multiplex 32 detectors without significantly degrading the intrinsic detector resolution.

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