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 $\Delta_{FWHM} = 10$eV. In an optimized setup, we show it is possible to multiplex 32 detectors without significantly degrading the intrinsic detector resolution.

Authors:
J.-P. Porst
J.S. Adams
M. Balvin
S.R. Bandler
J. Beyer
S.E. Busch
D. Drung
G. M. Seidel
S.J. Smith
T.R. Stevenson