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Cryogenic micro-calorimeters as pixelated, high resolution x-ray detectors

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Cryogenic micro-calorimeters are detectors for measuring single particle energies in the XUV to hard x-ray regime. They are operated at very low temperatures (below 100 mK) and work by detecting thermodynamic responses to the energy deposition from incident particles. Because of that, their intrinsic noise level is kept at a minimum and is mostly independent of the detected energy. In particular, metallic magnetic micro-calorimeters combine the advantages of using crystal spectrometers with a very high energy resolution (below 3 eV FWHM) and semiconductor detectors with a wide dynamic range over several magnitudes of particle energies. Recent developments in multipixel calorimeters therefore made these detectors a promising tool for the usage in spectroscopy and imaging applications. However, the utilization of micro-calorimeters is still challenging since they require complex setups and read-out systems. In the frame of this work, a scheme is presented to make the application of micro-calorimeters more feasible by introducing a digital analysis algorithm based on finite response filters. First tests on both simulated and measured data show that these filtering functions have a high performance and produce results comparable with those of more resource intensive procedures which are currently in use.

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