



Multiplexed readout for 4000-pixel arrays of microwave kinetic inductance detectors

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Microwave Kinetic Inductance Detectors (MKIDs) are very sensitive radiation detectors for sub-mm astronomy as well as for optical/near infrared astronomy. The main interest in MKIDs comes from the fact that they are intrinsically capable of frequency division multiplexing and therefore ideally suited for the construction of large arrays with ultimate sensitivity. We describe a new analog/digital readout operating over a 2 GHz band with an arbitrary center frequency within a 4-8 GHz frequency range. The frequency range is chosen to match the readout frequency of aluminium based MKIDs. This readout system is unique in the fact that it uses a highly integrated design both for the analog as well as for the digital part of the system: The digital part consists of a DAC board and ADC board, both equipped with a Virtex 7 FPGA for carrier generation (DAC) and measurement (ADC). The RF system, which up-converts the signal from the DAC and down-converts it after the cryostat, consists of a single integrated unit that has the dimension of a standard Eurocard PCB (see the image below). The system can read out up to 4000 carriers simultaneously at a data rate of 1 kHz. It achieves a readout noise power spectral density of -93 dBc/Hz while reading 4000 carriers simultaneously. We demonstrate that this is sufficient to read-out 4000 MKID pixels with background-limited sensitivity without any degradation of the MKID performance.

