
TES detection-chain operation of the QUBIC instrument dedicated to the CMB observation

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Abstract

Q U Bolometric Interferometer for Cosmology (QUBIC) is a new ground-based experiment aiming to detect the Cosmic Microwave Background (CMB) B modes. QUBIC is based on bolometric interferometry, a new instrument architecture. This allows to combine together the well known control of systematic effects fromn interferometers with the high sensitivity of bolometric detectors. It will observe the polarisation of the CMB, the first light emitted after the Big Bang, in two frequency bands (150 and 220 GHz.)

It uses two focal planes of kilo-pixels arrays of Transition Edge Sensors (TES) in addition with Superconducting QUantum Interference Device (SQUID) used as amplifiers and switches for mltiplexing system, and Application Specific Integrated Circuit (ASIC) at low temperature. Time-domain multiplexing using mainly cryogenic readout devices (TES, SQUID, and ASIC) has been developed for the QUBIC detection chain. The original concept combining SQUID multiplexing and additional multiplexing stage in a cryogenic integrated circuit (ASIC) allows achieving a 128-multiplexing factor.

The full readout system is in operation in the QUBIC cryostat since 2018 and was operated on a partially populated focal plan of 256 NbSi TES. Operations and performance using this readout system will be presented. Aliasing noise and limitation of the multiplexing frequency will also be discussed highlighting possible future improvements of performance.