SQUID current sensor to read out the TES-bolometers arrays for SAFARI

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***Abstract*— The SpicA FAR-infrared Instrument (SAFARI) will use large-format arrays of bolometers based on transition-edge sensors (TESs). The SAFARI detectors will be operated at a temperature of 50 mK in order to meet the aspired very low noise equivalent power levels of ~2e-19 W/sqrt(Hz). The readout of the TES arrays will make use of SQUID based current sensors in a current-summing frequency division multiplexing configuration. The allowable readout contribution to the total detector noise and to the cross-talk between pixels, the envisaged multiplexing ratio (~160) and the refrigerator setup translate into a set of requirements for the SQUID sensor regarding its coupled energy sensitivity, maximum power dissipation and analog signal bandwidth. Furthermore, the current sensor configuration should ensure sufficient noise margin to a semiconductor amplifier at 135K and address potential electromagnetic interference along a ~6m cryo-harness in between the SQUID output and the amplifier. A concept for the SAFARI current sensor based on a 2-stage SQUID cascade consisting of a front-end operated at 50mK and a signal booster with differential output located at 1.7K has been developed. Single-SQUID front-ends and serial-parallel SQUID arrays as the signal booster stage have been fabricated and tested at their foreseen operational temperatures. Their characteristics support the feasibility of the current sensor concept and allow estimations of the overall noise and dynamic performance that are consistent with the TES array readout requirements.**