



Advanced ACTPol detector-readout interface: High-density superconducting cable fabrication process and array assembly techniques

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Advanced ACTPol is an upcoming Atacama Cosmology Telescope (ACT) receiver upgrade, scheduled to deploy in 2016, that will allow measurement of the CMB polarization and temperature to the highest precision yet with ACT. As part of the receiver upgrade, the current ACTPol detector arrays will be replaced with new 6" wafer detector arrays of multichroic transition-edge sensor (TES) polarimeters read out with a SQUID time-division multiplexing (TDM) system. The Advanced ACTPol increase in sensitivity is partly provided by an increase in the number of TESs per array by a factor of two over the current ACTPol receiver detector arrays. This higher detector density brings new challenges to detector-readout interface design and array assembly. Here, we present the fabrication process for the 70-micron pitch superconducting flexible cables that connect the Advanced ACTPol detector arrays to the first-stage readout electronics. The process significantly improves upon that used for cables in parts of the ACTPol arrays by reducing the process time by 50% and increasing yield consistency. In addition, we discuss the assembly process for the Advanced ACTPol arrays, which is designed to meet the challenges of the large-scale assembly projects the CMB community is moving towards. Our strategy emphasizes automated and hands-free techniques to keep the number of assembly man-hours manageable and to produce consistently robust electrical and mechanical connections over the entire array.