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Increased multiplexing of superconducting microresonator arrays by post-characterization adaptation of the on-chip capacitors

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We present an interdigitated capacitor trimming technique for fine-tuning the resonance frequency of superconducting microresonators and increasing the multiplexing factor. We first measure the optical response of the array with a beam mapping system to link all resonances to their physical resonators. Then a new set of resonance frequencies with uniform spacing and higher multiplexing factor is designed. We use simulations to deduce the lengths that we should trim from the capacitor fingers in order to shift the resonances to the desired frequencies. The sample is then modified using contact lithography and re-measured using the same setup. We demonstrate this technique on a 112-pixel aluminum lumped-element kinetic-inductance detector array for 1mm band. Before trimming, the resonance frequency deviation of this array is investigated. The variation of the inductor width plays the main role for the deviation. After trimming, the mean fractional frequency error for identified resonators is -6.4e-4, with a standard deviation of 1.8e-4. The final optical yield is increased from 70.5% to 96.7% with no observable crosstalk beyond -15 dB during mapping. This technique could be applied to other photon-sensitive superconducting microresonator arrays for increasing the yield and multiplexing factor.

Less than 5 years of experience since completion of Ph.D

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Student (Ph.D., M.Sc. or B.Sc.)

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