An investigation of the longitudinal proximity effect in superconducting and normal metal TES

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As the TES volume and (effective) Tc become very small – for volume < 10 mu m x 10 mu m x 0.5 mu m and Tc < 90 mK – we approach a regime in which the noise equivalent power is dominated by fluctuations in power dissipating from the TES electrons to its phonons. Our ultimate goal is to build a TES bolometer that operates in this regime to be used for far-infrared and sub-mm astronomy. In this study, we characterize the *R* vs *T* behavior of small TES in order to engineer a TES bolometer that has a very low Tc. Sadleir et al [1] found that as the distance *L* between two superconducting leads, with the lead Tc >> the TES Tc, connected at opposite ends of TES approaches zero, superconductivity is induced parallel to the current flow, or longitudinally, and results in a much higher effective TES Tc. Here we present effective Tc measurements of Mo/Au TES bounded by Nb leads as a function of *L* which ranges between 4 and 36 mu m. We observe that the effective Tc is suppressed for current density of order 10^-6 A/mu m^2. We also explore the possibility of using a normal metal TES.

[1] J. E. Sadleir, S. J. Smith, S. R. Bandler, J. A. Chervenak, and J. R. Clem, "Longitudinal Proximity Effects in Superconducting Transition-Edge Sensors," arXiv:0910.2451v1 (2009).