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Activation Time of Cardiac Tissue In Response to a Linear Array of Spatial Alternating Bipolar Electrodes[1] DAVID MASHBURN, JOHN WIKSWO, Vanderbilt University — Prevailing theories about the response of the heart to high field shocks predict that local regions of high resistivity distributed throughout the heart create multiple small virtual electrodes that hyperpolarize or depolarize tissue and lead to widespread activation. This resetting of bulk tissue is responsible for the successful functioning of cardiac defibrillators. By activating cardiac tissue with regular linear arrays of spatially alternating bipolar currents, we can simulate these potentials locally. We have studied the activation time due to distributed currents in both a 1D Beeler-Reuter model and on the surface of the whole heart, varying the strength of each source and the separation between them. By comparison with activation time data from actual field shock of a whole heart in a bath, we hope to better understand these transient virtual electrodes. Our work was done on rabbit RV using florescent optical imaging and our Phased Array Stimulator for driving the 16 current sources. Our model shows that for a total absolute current delivered to a region of tissue, the entire region activates faster if above-threshold sources are more distributed.

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