

Model	None	LIF	AdExp	$e$ LIF	mAdExp	HH	HH+Ca
Runtime (s)	0.75	0.8	2.7	2.86 (1.79)	3.52 (2.56)	3.47	4.92

**S1 Table.** Runtime of various models in NEST. A “baseline” run with no neuron (None), compared to runs with one neuron of each of the mentioned models. For the new energy-based models ( $e$ LIF and mAdExp), two runs were performed: one using a naive implementation and another using slightly optimized implementation (numbers in parentheses). Conductance-based models are also included: a standard Hodgkin-Huxley (HH) model which can display regular spiking and a depolarization block, and one with calcium and calcium-gated potassium (HH+Ca) to reproduce bursting dynamics