Question 1: What type of layer specific excitatory input (i.e. spike patterns and number of synaptic contacts) is required to elicit a spike in IS3 cells?

Question 2: What type of local inhibitory input is required to coordinate IS3 cell activity? (more of a network question to be investigated down the line… potentially in Katie’s self-generating theta models)

Known:

-Current amplitudes of layer-specific synaptic inputs

-Rise times and decay times of synaptic events

-Synaptic conductance: G = I/(Vhold – Vrev), according to Tyan *et al*, 2014 \*\*\*Cannot measure without synaptic reversal potential (might assume that it is zero though)

-In NEURON NETCON synapse equations, G is a function of weight, rise time, decay time and time since synaptic event.

-In OLM cells the reversal potential is -71.9 mV (determined, experimentally using I-V plot in Salesse et al, 2011)

Unknown:

-Number of synaptic inputs from each current source (i.e. schaffer collaterals and perforant path)

-Distributions of synapses from each current source (i.e. with the assumption that they are restricted to a specific CA1 layer, such as SCs in SR and PPs in SLM).

-IS3 synaptic reversal potential

Ideas:

Use “insert extracellular” and then pick the “i\_membrane” variable to record current

**1) Tuning Synaptic Weights to Match EPSC amplitudes**

-How to pick the weights to use? Look at required weight to evoke an EPSC of ~-12.5pA in when synapse is located at different points along the dendritic arbour.

-Record both somatic voltage and current in response to single spikes (i.e. with layer specific synapse parameters and increasing weights – when EPSC is greater than ~-12.5pA, move to next location) along the dendritic arbour, and then analyze peak EPSC amplitudes and number of evoked spikes in MATLAB.

**2) Investigate Bursting Inputs Along Dendritic Arbour**

-Record both somatic voltage and current in response to presynaptic events of increasing frequencies (until a spike is observed at the soma) using the optimal weights along the dendritic arbour found previously. Analyze synaptic summation and number of somatic spikes in response to single presynaptic spikes from low to high frequency bursting inputs.

**3) Investigate Synchronous Uniformly Distributed Inputs Along Dendritic Arbour**

-Record both somatic voltage and current in response to synchronized presynaptic events (1-6 spikes that occur at the same time at different points uniformly along the dendrites, in the SR layer and then the SLM layers) using the optimal weights along the dendritic arbour found previously.