Workflow:

Cell reconstructed to SWC file format.

SWC files combined into a “hoc” file for NEURON (V7.3), using nrnpython.

Cells are decorated with ion channels, with the density set according to the morphological identification of each section.

Channels used are: NaV11 (NaV1.1 channel from Varela et al.)

KLT and KHT (from Rothman and Manis, 2003c).

Ih (from Rothman and Manis, 2003c).

Leak (ohmic leak, Erev = -65 mV).

Channel conductances set following Xie and Manis (2013), based in part on Cao and Oertel (2010) for mouse cochlear nucleus.

Somatic conductances scaled as indicated in X&M2013. Dendrites current have have 0.5 gNa and 0.5 gLeak, but full complement of others (this is an area that needs exploration).

Synapses:

Each synapse is a “multisite” synapse, where each site is driven by the presence of a presynaptic spike, but release is stochastic. The time evolution of release probability with input events is governed by the Dittman-Krieger-Regeher (2001) model, which allows us to run simulations with arbitrary input spike patters. However, in the present case, the release probability is held constant (synapses are not depressing). Details are in Xie and Manis, J. Neurosci., 2013.

The postsynaptic AMPA receptors are a 6-state model from Raman and Trussell (1992), with the rates between the last bound open and bound closed states adjusted for mouse kinetics. The conductance of the postsynaptic receptor is set by scaling to the amplitudes of mEPSCs as recorded in CBA mice. Details in X&M 2013.

There are also postsynaptic NMDA receptors (see Cao and Oertel, 2010), using the model of Kampa et al. The conductance is scaled according to the AMPA/NMDA conductance ratio as measured in Cao and Oertel, corrected for the open probabilities of the models.

Auditory nerve input: Computed from Zilany et al model (latest version 2014). Each AN is computed independently. Current model uses spont rate group #2 (medium spontaneous rate). Model has not been corrected for mouse periphery.