Temporal Integration model

The models described below can be used to replicate (hopefully) the results presented in an article currently being prepared for submission to JASA.

Auditory nerve first-spike latency and auditory absolute threshold: a computer model. by Ray Meddis.

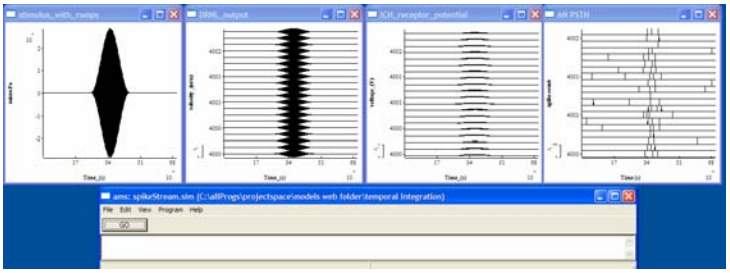
What is written below will make no sense if you have not already perused the article.

The model was created using AMS (Auditory Modelling System). If you wish to run the model you will need to download the appropriate modelling software. The software is evolving all the time but the version to be found here is the version used to evaluate the model as published in the article (version 1.1.7). If there are problems when running the latest version of the software, you might try to go back in time to this version.

If you have problems with these programs or require further clarification, please contact Ray Meddis (rmeddis@essex.ac.uk). If you are having difficulty with program execution, please zip up the folder you are using and attach it to your email. This can save 48 hrs of delay! Do bear in mind that some of the programs are stochastic and will give a different answer each time. hopefully the broad pattern of results will be maintained but the detail will usually be different.

First-spike latency

The basic model is given in a file *spikeStream.sim* which can be run using AMS in stand alone mode. This creates a brief tone and passes it to an auditory nerve model producing a train of spikes in 20 fibers with similar CFs. The screen should look like this.



A second model is given in the file McGregor.sim which takes the output of spikeStream and processes it through a McGregor model simulating a simple neuron. This model is not designed to run in stand alone mode but is called from MATLAB which provides the input and reads the output. The *spikeStream.sim* and *McGregor.sim* models are used to study first-spike latency effects in the model using the MATLAB program *firstSpikeDetector.m*. This program is called using

```
firstSpikeDetector (fibertype, modeltype);
```

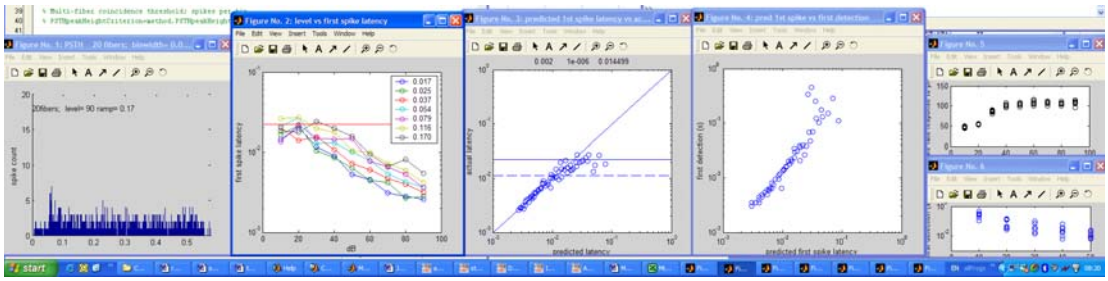
where, modelType= 'Sumner' or 'H&N;

for the Sumner model or the modified model based on calcium dissipation
and fiberType= HSR', 'MSR', LSR'

e.g. `firstSpikeDetector ('HSR', 'H&N');`

producing the following charts:

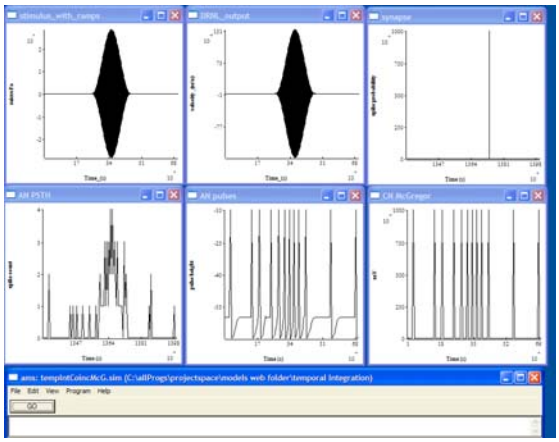
chart no: 1 2 3 4 5/6



1 PSTH for 20 parallel fibers (1 trial per fiber) – changes for each run.
2 1st spike latency as a function of duration and ramp
3 Actual versus predicted AN first-spike latency
4 Actual first-spike latency for CN neuron versus predicted AN latency
5 Rate level function
6 Latency against level

Threshold measurement

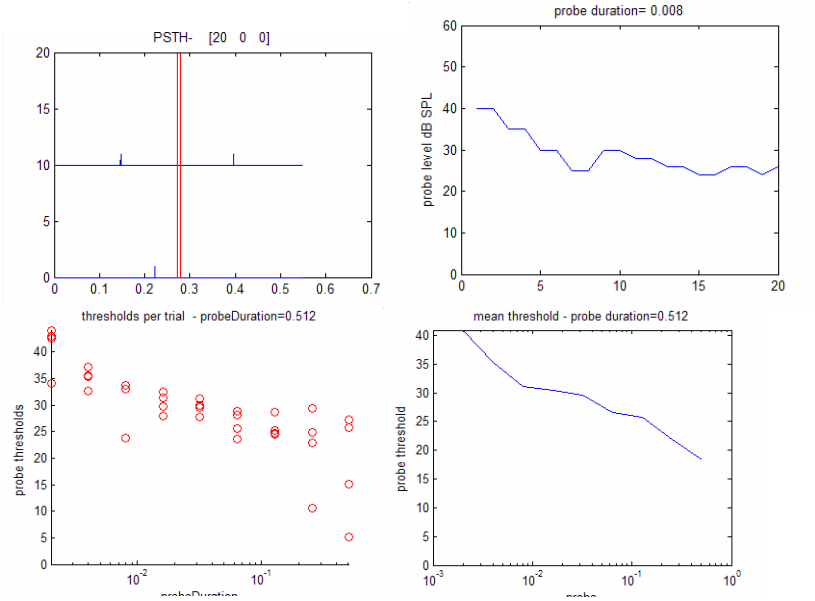
The models used here are tempIntCoinc.sim (for AN response only) and tempIntCoincMcG.sim (for CN unit response). The latter is used in the MATLAB program for measuring temporal integration, can be used in stand-alone mode and should give a screen picture something like this.



The MATLAB controlling program is tempIntCoincMcG.m and is called using
`tempIntCoincMcG(numFiberList, nBlocks, probeDurationList, paradigm)`
where:

< numFiberList> Is a list of counts of HSR, MSR and LSR fibers. For example [20 10 5] requests 20 HSR, 10 MSR and 5 LSR fibers.
< nBlocks > is the number of trials required
<paradigm> is either 'Clock' or 'Florentine'. It determines whether spikes are counted only during the presentation of the probe (Clock) or during the whole observation window (Florentine).

When this is run, you should get screen figures like these



1. CN unit response to current stimulus. The two blue horizontal lines represent the control- no stimulus - (upper track) and the stimulus (lower track). Small vertical blips are spikes. The red vertical line indicates when the stimulus was presented. This changes for each stimulus presentation

2. Levitt track showing the level of the stimulus at successive presentations. This is cumulative across presentations for a single duration.

3. Thresholds measured at each duration. A separate symbol is used for each trial. The chart is cumulative

4. The mean threshold against duration for all trials so far. This is changed at the end of each trial.