***The .set file***

For simulating a dataset, first a topology has to be defined. This is done with the .set files.

Within the .set file, the length of the simulated time series has to be set with the variable “**np\_samples**” and the name of the .mat step response file with the variable “**stepresponse**”.

In case that the SNR is to be *the same* for all simulated time series in the dataset, the standard deviation of the simulated noise is to be defined with the variable “**sigma\_noise**”. For simulated datasets containing time series different SNR, see “Simulating datasets with varying SNR”.

Below these variables, a series of matrices for the definition of the topology are listed. Above each matrix its dimensions are defined as (rows columns).

Under “**model parameters K:**”, the transition matrix of the topology is defined. Importantly, transition rates that are to be non-zero (existing connections) need to be defined as an arbitrary number larger than zero within the matrix. By default the transition rates are sampled from the ranges defined in the .ini file (see below). If the transition rates are to be *the same* for all simulated time series in the dataset, they can be set via this matrix and the variable “**randomness of timeseries, 0=kij as in Setfile; 1=randomized accordingly to boundaries for kij as stated above**” (line 99) of the .ini file (see below) should be set to 0.

Next, under “**indices of the parameters in K to be fitted:**”, the list of existing connections has to be stated. The first row again defines the dimensions of the following matrix. The first column states the starting state and the second column the target state.

Under “**initial state distribution (t=0)**”, the starting state distribution is set. This feature is currently disabled and the simulation starts in the leftmost state as defined in “**assignment states <-> output symbols:”** (see below). Nevertheless, the probability of all states need to add up to 1 and the number of states needs to match the number of states in the defined topology.

Under “**assignment states <-> output symbols:**” the current levels of each state are defined. With 2 representing a closed state and 1 an open state.

Under “**output level in DAC units, depending on symbols:**” the current levels are set. The convention of the program is to define the higher current as the closed level. For simulating datasets containing time series different SNR, only the lower level (closed level) is being set via the .set file by the left of the two numbers. In this case, the amplitude of the current is set in the.ini file (see “Simulating datasets with varying SNR”). Otherwise, the right number defines the upper level (open level). Currently, only one conductance level is supported (open and closed state).

The section “**Summe der Wahrscheinlichkeitsdichten aller Kanaele:**” is not relevant and should not be modified.

**Important note:** The overall format of the file should not be changed. This includes empty new lines and spacing. For the definition of topologies with fewer or more states, columns and rows need to be added in the relevant sections above.

***The .ini file***

The remainder of the settings is adjusted via the .ini file. When using the 2D-Fit for simulation of training datasets it should be left largely untouched except for the following variables:

“**2D-Fit K1\_max**” up to “**2D-Fit K10\_max**” (lines 49-68)🡪 definition of the sampling ranges for each transition rate (logarithmic distribution) as defined in the .set file. Important: the enumeration of the transition rates is given by reading the transition matrix row by row as defined in the .set file. If a transition rate is not defined in the .set file the corresponding range will be ignored.

“**2D-Fit sampling frequency**” (line 86)🡪 currently, only a sampling frequency of 100 kHz is supported. Do not change this value.

“**2D-Fit filter frequency**” (line 87)🡪 obsolete: The filter frequency of the applied filter type is indirectly encompassed in the step response of the step response file. This value should not be changed.

“**timeseries**” (line 92) 🡪 the path to the target time series to be fitted when using the 2D-Fit. Important: when simulating datasets the path needs to lead to a dummy time series in binary format (uint 16) with the same length as the simulated time series. The content of the dummy time series is irrelevant in the simulation case.

“**0 = low pass filtered white noise; 1 = noise generated from spectral file; 2 = noise loaded from timeseries**” (line 93) 🡪 select the type of noise generation.

“**file noise series loaded via setfile**” (line 94)🡪 the path that leads to either the noise spectrum (if option 1 is selected above) or noise time series (if option 2 is selected above).

“**setfile**” (line 95)🡪 path to the .set file containing the information about the topology, as detailed above.

“**number of timeseries/2D-histograms to save**” (line 98) 🡪 the number of time series or 2D-histograms to simulate.

***Simulating datasets with varying SNR and current amplitude***

To simulate a dataset containing time series with varying SNR sampled randomly sampled from a uniform distribution, the variable “**2D-Fit Levelfit 0=FALSE; 1=TRUE**” (line 69) in the .ini file needs to be set to 1. Additionally, the variables “**randomness of timeseries, 0=current lvl as in Setfile; 1=randomized accordingly to boundaries for levelfit as stated above, #Levelfit should be equally set to 1**” (line 100) and “**randomness of timeseries, 0=noise lvl as in Setfile; 1=randomized accordingly to boundaries noise as stated above**” (line 101) need both be set to 1. Now, via the variables “**min noise level**” (line 84) and “**max noise level**” (line 85) the range from which the SNR for each simulated time series is sampled (uniformly distributed) needs to be defined. Furthermore, while this option is enabled the current amplitude needs to be defined via the .ini file, with the variables “**2D-Fit Levelfit lvl1\_min, important lvl0=closed;**” (line 70) and “**2D-Fit Levelfit lvl1\_max**” (line 71) by setting the min and max range from which the amplitude is uniformly sampled. If the current amplitude is desired to be constant, both should be set to the same value. Also, while the random SNR option is active, the current level for the upper level (closed) is *ignored* in the .set file and only the current level for the lower level (open) is used that serves as the base line upon which the randomly sampled current amplitude is added.

***Important information***

This documentation is only valid for the uploaded version of the code and is subject to change. For installing the up to date version of the program it is strongly recommended coming in contact with the authors for a comprehensive instruction.