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| **Figure 1.** Simulation for depression synapsis with step-changing long-term plasticity (LTP). In these plots, blue is used to represent the value before step change, and the orange one represents value after change **(A)** Overall cross-correlogram. The red line represents the model cross-correlation. **(B)** Long-term plasticity. **(C)** Synaptic efficacies at different pre-synaptic inter-spike interval (ISI). The dots represent the empirical efficacies, and the lines represent the model efficacies. **(D)** Cross-correlograms before and after step change in LTP. **(E)** Cross-correlograms split by quartiles of ISI, before and after step change in LTP. Only plots with Q1 to Q2, and larger than Q3 of ISI are shown. |

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| **Figure 2.** Simulation (black lines and bars) and model fitting results (red lines) when holding baseline firing rate be constant. **(A)** LTP and modification function for facilitation, depression and non-plasticity STP. The LTP were held as step-changing. **(B)** Cross-correlograms split by quartiles of ISI, to show STP. **(C)** LTP and modification function, when holding STP be depression and let LTP change linearly and sinusoidally. **(D)** Cross-correlograms split by quartiles of T, to show LTP. |

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| **Figure 3.** Influence of baseline post-synaptic firing rate (baseline) change on estimations. The LTP are held as step-change and linear-change. The baselines were changed in linear and sinusoidal. The model fitting results are represented in red. These results show that changing baseline will influence the estimations, but not a lot. **(A)** Baseline change. The logarithm of post-synaptic firing rate is plot against the recording time. **(B)** Long-term plasticity. **(C)** Modification function. **(D)** Cross-correlograms split by quartiles of T, to show LTP and baseline. |

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| **Figure 4.** Influence of pre-synaptic firing rate on estimations. The baseline, LTP and STP were held as constant, step-changing and depression respectively. Here we compare estimations between 5Hz and 10Hz. The model fitting results are show in red. These results show that in acceptable range, larger pre-synaptic firing rate will lead to a more accurate estimations. **(A)** Pre- and post-synaptic firing rate. The blue curves represents the pre-synaptic firing rate, while the black represents the post-synaptic one. **(B)** Baseline. **(C)** Long-term plasticity. **(D)** Modification function. |