Stochastic diffusions became a classical tool for describing a neuronal activity, either of a one single neuron (Ditlevsen and Samson, 2012, Höpfner et al., 2016, Leonand Samson, 2017), or a large network of neurons (Ditlevsen and Löcherbach, 2017, Ableidinger et al., 2017). However, the techniques which would allow us to establish a rigorous link between a specific model and available neurophysiological data is often missing. The open question is the source of stochasticity in spiking activity.

One point of view is that both the membrane and the ion channels of the neuron cell are affected by noise. Another position is that only the ion channels have a stochastic behaviour and that their concentration in cell explicitly defines the membrane potential. The question is then how to test both hypotheses with extracellular recordings of the membrane potential. For network-scale neuronal models, the estimation of the noise rank is equivalent to estimating a number of populations of different types of neurons in the network. The question boils down to a problem of a covariance matrix rank estimation and constructing a statistical test of the rank. Our aim is to challenge this problem with the help of numerical approximation methods for stochastic diffusions and properties of matrix determinants, following works of Jacod et al. (2008), Jacod and Podolskij (2013).