

Single-trial phase precession in the hippocampus

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During the crossing of a place field in the rat hippocampus, the firing phase of a place cell decreases with respect to the local theta rhythm. This phase precession is usually studied on the basis of trial averages, in which data from many place field traversals are pooled together. Here, we study properties of phase precession in single trials and compare them to the properties of trial-averaged phase precession. We find that single-trial and trial-averaged phase precession are different with respect to three fundamental properties: phase-position correlation, phase-time correlation, and phase range. Comparison with surrogate trials indicates that single trials are not randomly drawn samples from the trial-averages. Thus, an important source of variability of phase precession pooled over trials is the large trial-to-trial variability. Part of this trial-to-trial variability may be explained by running speed and firing rate differences across trials but the larger part of the variability remains to be explained.