Attention-dependent reductions in response variability in area V4 associated with changes in spike power spectra and burstiness

Jude F. Mitchell, Kristy A. Sundberg & John H. Reynolds

Behavioral Task:

Single Unit Examples:

Reductions in Fano Factor are due to within trial rate fluctuations.

Attention-dependent modulation differs between classes defined by waveform duration and burstiness.

Low frequency fluctuations and burstiness account differently for Fano Factor reductions depending on class.

Methods: for each neuron, random spike trains were generated by two models and tested to determine if they exhibited similar changes in Fano Factor. For an accurate model points would fall along the line of unity above. One model had Poisson spiking with rate matched trial to trial. The second model generated spike trains matched in their spike autocorrelation for attended and unattended conditions.

The distribution of burstiness differs between narrow and broad spiking neuron categories.

1) Within trial rate fluctuations account for attention-dependent reductions in Fano Factor in a sustained attention task.
2) Rate fluctuations can be captured in the spike autocorrelation.
3) Broad spiking neurons exhibit more burstiness in firing.
4) Narrow spiking neurons (putative fast spiking interneurons) show reductions in variability due to reductions in low frequency fluctuations.
5) Burst firing broad spiking neurons show reductions in variability at least partially due to reductions in the burstiness of their firing.

References